EFFECTIVE DATE: (08/22)

LOUISIANA
DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT
SUPPLEMENTAL SPECIFICATIONS

(FOR 2016 STANDARD SPECIFICATIONS)

TABLE OF CONTENTS

PART I – GENERAL PROVISIONS

PART II – EARTHWORK AND SITE PREPARATION

PART III – BASE COURSES

PART IV – SURFACE COURSES

PART V – ASPHALT PAVEMENTS

PART VI – RIGID PAVEMENT

PART VII – INCIDENTAL CONSTRUCTION

PART VIII – STRUCTURES

PART IX – PORTLAND CEMENT CONCRETE

PART X – MATERIALS

LOUISIANA
DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT
SUPPLEMENTAL SPECIFICATIONS

The 2016 Louisiana Standard Specifications for Roads and Bridges and supplemental specifications thereto are amended as follows.

PART I – GENERAL PROVISIONS

SECTION 101 – GENERAL INFORMATION, DEFINITIONS, AND TERMS:

Subsection 101.01 – Voice/Mood and References (03/20), Page 2

101.01 is deleted and replaced with the following:

101.01 VOICE/MOOD AND REFERENCES.

101.01.1 Active Voice/Imperative Mood: This specification book uses the active voice/imperative mood when describing the contractor's responsibility, or the bidder's responsibility prior to award of contract. The subject of a sentence written in the active voice/imperative mood is not explicitly stated. For example: "Provide competent supervision" is taken to mean "the Contractor is required to provide competent supervision."

101.01.2 References: Section and Subsection titles and headings provide reference only, not interpretation.

A cross-reference to a specific Subsection of these specifications includes all general requirements of the Section of which the Subsection is a part.

Unless specified by year or date, cited publications refer to the most recent issue, including interim publications, in effect on the first date of advertisement for bids.

SECTION 105 – CONTROL OF WORK:

Subsection 105.02.1 – Plans (07/19), Page 41

The first paragraph of 105.02.1 is deleted and replaced with the following:

The contractor will be furnished, without charge, a maximum of 5 sets of half-scale plans, and when requested, a maximum of 3 full-scale plans. When plans include standard plans by reference only, copies of standard plans will be furnished, by request, with the same maximums described above without charge.

SECTION 107 – LEGAL RELATIONS AND RESPONSIBILITY TO PUBLIC:

Subsection 107.19 – Contractor's Responsibility for Work (03/18), Page 85

The first sentence of the second paragraph of 107.19 is deleted and replaced with the following:

1. Guard rail, impact attenuators, cable barriers, and other such devices shall be repaired as soon as possible after damage.

PART II – EARTHWORK AND SITE PREPARATION

SECTION 202 – REMOVING OR RELOCATING STRUCTURES AND OBSTRUCTIONS:

Subsection 202.02 – General Construction Requirements (06/19), Pages 116 and 117

202.02 is deleted and replaced with the following:

202.02 GENERAL CONSTRUCTION REQUIREMENTS. Remove and dispose of all portions of structures or obstructions on the right-of-way, except items for which other provisions have been made for removal or relocation. When specified, remove structures and appurtenances that extend beyond the right-of-way or that are entirely on private property. Materials deemed salvageable by the engineer shall be carefully disassembled and care shall be taken to preserve the condition of the salvaged materials before and during transportation to the designated facility. Upon delivery to the designated facility, they shall be unloaded and neatly arranged at specified storage areas as directed by the engineer. When no storage sites are specified, deliver salvaged materials to the nearest DOTD maintenance unit. Dispose of materials not specified to be salvaged off the project right-of-way outside the view of the traveling public with written permission of the property owner on whose property the material is placed. DOTD reserves the right to refuse material prior to delivery for any reason or if not in usable condition upon delivery. Any material refused shall then be deemed unsalvageable and disposed of accordingly. Furnish copies of agreements (including rights of entry, etc.) with property owners to the engineer prior to beginning of work. The agreement must contain language holding the department harmless regarding any liabilities of the contractor or property owners. A certificate of release from the property owner will be required before final acceptance. Fill holes left by structure removal or the removal of materials associated with contaminated soils or sites by blading the area with surrounding soil or backfilling with soil complying with 203.06.1. Compact to a condition similar to the surrounding soils or as directed.

If any fuel storage tanks or other environmentally sensitive or contaminated sites are located during construction, stop construction activity in the immediate vicinity of the environmentally sensitive or contaminated site and notify the project engineer who in turn will notify the Department's Materials and Testing Section immediately for guidance. Testing and clean-up by the contractor shall be coordinated with the Materials and Testing Section.

The Department reserves the right to eliminate work items in accordance with 104.02.4.

SECTION 203 – EXCAVATION AND EMBANKMENT:

Subsection 203.06.7 – Soils for Soil Cement In-Place Cement Stabilization or Treatment (04/18), Page 132

203.06 is amended to include the following:

203.06.7 Soils for Soil Cement In-Place Cement Stabilization or Treatment: Soils to be used for in-place cement stabilization or treatment shall be in accordance with Subsection 302.02.1

PART III – BASE COURSES

SECTION 301 – CLASS I BASE COURSE:

Subsection 301.01 – Description (08/22), Pages 152 and 153

301.01 is deleted and replaced with the following:

301.01 DESCRIPTION. Furnish and place Class I base courses on a subgrade layer conforming to Section 305 in accordance with these specifications and in conformance with the lines, grades, thicknesses, and typical cross sections shown on the plans or established by the engineer. Control the selection, placement, mixing, and compaction of materials so that the completed base course is uniform and conforms to plan dimensions and other acceptance requirements.

Quality assurance requirements shall be as specified in the latest edition of the Department's publication titled *Application of Quality Assurance Specifications for Embankments and Base Course.*

Unless approved otherwise in writing, use the same type of Class I base course throughout the project in accordance with these specifications.

When asphalt concrete or portland cement concrete is specified on the plans, the total thickness of asphalt concrete or portland cement concrete shall be the thickness as indicated on the plans.

When the base course material is not specified on the plans, any of the following types may be used:

1. Soil Cement
2. Crushed Stone
3. Asphalt Concrete on Embankment Layer
4. Recycled Portland Cement Concrete
5. Blended Calcium Sulfate

For Asphalt Concrete on Embankment Layer, the top half of the base course thickness shall be asphalt concrete. The remaining thickness of the base shall be the same type and construction as the top layer of the underlying embankment, treated layer, or subgrade, or in accordance with Section 203 for placement on existing ground. Do not place raw, untreated material between a treated embankment and the asphalt concrete layer.

In areas that are inaccessible for mixing and compacting, such as in turnouts, crossovers, and other isolated or irregular areas, full depth portland cement concrete or full depth asphalt concrete base course may be used in lieu of the specified Class I base course material with approval.

When portland cement concrete is used, unless otherwise specified or approved by the engineer, the minimum thickness shall be 6 inches.

Portland cement concrete shall be in accordance with Section 706 except as follows. Portland cement concrete thickness tolerances shall be in accordance with Section 601 and corrected in accordance with 301.16.2.2. Portland cement concrete width corrections shall be in accordance with 301.16.3.2. Any pay adjustment in portland cement concrete shall be in accordance with Table 901-5.

A bond breaker is required between portland cement concrete base and portland cement concrete pavement. A bond breaker shall consist of a double application of curing compound or 2 layers of polyethylene sheeting. A 3 inch scored joint will be made to control cracking in the concrete base. The scored joints should be placed at the required surface joint locations. No load transfers will be required in the base slab.

Drainage of all existing and constructed pavement structures shall be maintained at all times during construction at no additional cost to the Department. When base course is permeable, provide a base drain outlet consisting of non-plastic embankment (stone) and geotextile fabric, or as specified in the plans, in accordance with 203.09.

Submit a dust control plan to address weather, sight clearance, operational procedures, traffic control, and any other project specific concerns. Failure to maintain sight clearance will result in the engineer stopping contractor operations.

The Department will identify dust-sensitive areas in the plans. In these specific areas, the dust control plan must also include environmental requirements. In order to meet air quality standards, the contractor may be required to use central plant mixing of cement treated mixtures in dust sensitive areas at no direct pay. The contractor may use other types of Class I base course in dust sensitive areas at no direct pay.

Subsection 301.02.4 – Asphalt Concrete Base Course (08/22), Pages 153 and 154

301.02.4 is deleted.

Subsection 301.03.4 – Automatic Finishing Machine (08/22), Page 156

The last sentence of 301.03.4 is deleted and replaced with the following:

The approved automatic finishing machine shall be capable of operating from an erected stringline or Global Positioning System (GPS) and laser system, and be capable of automatically controlling grade and cross slope conforming to 502.09.2.3.

Subsection 301.09 – Grade and Cross-Slope Control (08/22), Page 160

301.09 is deleted and replaced with the following:

301.09 GRADE AND CROSS-SLOPE CONTROL. Unless otherwise specified, construct Class I Base Courses (except asphalt concrete) to the required grade and cross slope, using an automatic finishing machine controlled from an erected stringline or GPS and laser system conforming to 502.09.2.3.

Subsection 301.17 – Measurement (08/22), Pages 167 and 168

301.17 is deleted and replaced with the following:

301.17 MEASUREMENT. The quantities of Class I base course for payment will be the design volumes or areas specified in the plans and adjustments thereto. Design quantities are based on the horizontal dimensions and theoretical compacted thickness of the completed base course shown on the plans. Design quantities will be adjusted if the engineer makes changes to adjust to field conditions, plan errors are proven, or design changes are necessary.

Base drain outlets will be measured for payment per each.

Subsection 301.18 – Payment (08/22), Page 168

301.18 is deleted and replaced with the following:

301.18.PAYMENT. Payment for Class I base course will be made at the contract unit price, adjusted as specified in 301.16 and the following provisions, which include furnishing and placing required base course materials, portland cement, portland-pozzolan cement, water, grade control, asphalt curing membrane, and prime coat.

When the density test value for the section falls below 95.0 percent, a payment adjustment will be applied in accordance with Table 301-1.

Failure to add the specified amount of cement in soil cement will result in a payment adjustment in accordance with Table 301-3 below. For materials other than asphalt concrete, payment adjustments that are made for more than one deficiency shall be cumulative. Any payment adjustment in asphalt concrete shall be in accordance with Section 502 and shall apply to the cubic yard total quantity of base course.

Table 301-3
Payment Adjustment Schedule

	Percent of Contract Unit Price			
	100	90	80	50 or Remove and Replace [1]
Cement content (Percent by dry weight) less than required	0.0 – 0.1	0.2 – 0.4	0.5 – 1.0	more than 1.0

[1.] At the option of the Chief Engineer.

Payment for base drain outlet will be made under the contract unit price per each and include excavation, furnishing and placing non-plastic embankment (stone) material, geotextile fabric, and all incidentals necessary to complete the work.

Payment will be made under:

Item No.	Pay Item	Pay Unit
301-01	Class I Base Course	Cubic Yard
301-02	Class I Base Course ____in Thick	Square Yard
301-03	Class I Base Course for Shoulders	Cubic Yard
301-04	Class I Base Course for Shoulders _____in Thick	Square Yard
301-05	Base Drain Outlet	Each

SECTION 303 – IN-PLACE CEMENT STABILIZED AND TREATED BASE COURSES:

Subsection 303.04 – Preparation of Roadbed (04/20), Page 185

303.04 is amended to include the following sentence between the second and third paragraph:

If only shoulder stabilization has been performed, the paving operation shall commence within 7 calendar days of stabilization.

PART IV – SURFACE COURSES

SECTION 401 – AGGREGATE SURFACE COURSE:

Subsection 401.07.1 – General (12/17), Page 217

401.07.1 is deleted and replaced with the following:

401.07.1 General: Place material and shape by suitable means. Compact with an approved roller. Continue to shape and compact until the surface conforms to the required sections and has a tight, uniform surface free from ruts and waves.

PART V – ASPHALT PAVEMENTS

PART V – ASPHALT PAVEMENTS:

Part V – Asphalt Pavements (11/21), Pages 224 – 305

Part V – Asphalt Pavements is deleted and replaced with the following:

Section 501
Thin Asphalt Concrete Applications

501.01 DESCRIPTION.

501.01.1 General: Furnish and construct a finish course of asphalt concrete mixture in conformance with these specifications and in conformance with the lines, grades, thicknesses, and typical sections shown on the plans or established. A finish course is defined as a 501 thin lift mix placed over a 502 asphaltic concrete pavement or a Portland cement concrete pavement.

Comply with Section 503 and the Application of Quality Assurance Specifications for Asphalt Concrete Mixtures (QA Manual).

Use a DOTD certified laboratory accredited by AMRL, CMEC, or other accreditation agency approved by DOTD.

These specifications apply to all asphalt concrete thin lift mixtures with typical plan thicknesses between ¾ inches and 1½ inches. The following mixtures are further described herein and as shown on the plans:

1. Dense Mix – traffic volumes less than 3,500 ADT.
2. Coarse Mix – all traffic volumes. Can be substituted in place of Dense Mix without change order.
3. Open Graded Friction Course (OGFC) – all traffic volumes, typically specified for use on Interstate Highway System. Can be substituted in place of Coarse Mix or Dense Mix applications without change order.

Use the same mixture type throughout the project length unless approved otherwise by the Project Engineer.

501.01.2 Quality Assurance: Work shall meet the requirements of this section and be subject to acceptance by the Department. Exercise quality control as defined in 101.03. When these specifications are not being met and satisfactory control adjustments are not being made, discontinue operations and notify the Project Engineer immediately until proper adjustments and uniform operations are established. The contractor will have a quality control program independent of the Department's testing and ensure that the requirements of the job mix formula (JMF) are being achieved and that necessary adjustments provide the specified results.

Do not begin daily plant operations unless the contractors' Certified Asphalt Concrete Plant Technician (Level 2 or Level 3) is at the plant. When the plant is in operation, have a Certified Asphalt Concrete Plant Technician at the plant or jobsite.

501.02 MATERIALS. Comply with applicable subsections listed herein. Sample and test in accordance with the Material Sampling Manual and the test procedures described in Table 502-1.

Keep accurate records including proof of deliveries of materials for use in these processes. Ensure that materials comply with the following Sections and Subsections and as specified in this section:

Asphalt Cement	1002
Anti-Strip Additives	1002.02.1
Aggregates	1003.01 & 1003.06
Hydrated Lime	1018.02
Crumb Rubber	1002.02.2
Mix Release Agent	1018.10
Mineral Filler	1003.06.6
Fibers	1002.02.5
Reclaimed Asphalt Pavement (RAP)	1003.01 & 1003.06.5

501.02.1 Tack Coat: Ensure that tack coat meets the requirements of Section 1002. Apply tack coat as described in 501.09.1. Application rates are defined in Table 501-1. Use emulsions listed in the Approved Materials List.

For dense mixtures, apply a NTSS-1HM, CBC-1HT, SS-1H, CSS-1H, CSS-1HP, or a hot applied non-tracking tack (NTHAP).

For coarse and OGFC mixtures, apply a Polymer Emulsion Tack (PET) or hot applied non-tracking tack (NTHAP).

501.02.2 Asphalt Cement: Comply with Table 501-1. If the asphalt cement does not comply with the requirements of Section 1002 notify the Project Engineer and cease mix production until proper asphalt material is supplied. Allow grade substitution as specified for Level 1 wearing course in Section 502. PG76-22rm may also be substituted for PG76-22m.

501.02.3 Additives:

501.02.3.1 Anti-Strip: Use anti-stripping additives from a source listed on the Approved Materials List. Add anti-strip at a minimum rate of 0.6 percent or a rate approved by the District Lab Engineer. Increase the anti-strip additive or change to different additive as needed to meet Loaded Wheel Test (LWT) requirements. Discontinue production until satisfactory adjustments are made when the amount of anti-strip additive is not in accordance with the approved JMF.

501.02.3.2 Hydrated Lime: When used, specify rate of hydrated lime additive on the Job Mix Formula. Add hydrated lime additive at a minimum of 1.5 percent and thoroughly mix with aggregates in conformance with 503.05.5. Hydrated lime may be added as mineral filler in accordance with 503.05.4 and 1003.06.6.

501.02.3.3 Waste Tire Rubber Additive: When used, crumb rubber may be pre-blended or, with approval by the Materials Laboratory, may be blended at the plant. The maximum rubber replacement is 10 percent by weight of asphalt.

When blending crumb rubber at the contractor's plant, add crumb rubber to a PG 67-22 material on the Approved Materials List. Add 30 mesh (or finer) crumb rubber as required to meet grade PG 76-22rm. Comply with 1002.02.2.

501.02.4 Aggregates: Use aggregate from Approved Material List. For Coarse Mix and OGFC, use aggregate with a maximum water absorption of 2 percent as reported on the Approved Material List and verified by the District Lab Engineer. Use aggregate that meets requirements of 1003.06. Submit a Certificate of Analysis with the JMF to the District Laboratory Engineer indicating conformance to Table 501-2.

501.02.5 Mineral Filler: If used, meet the requirements of 1003.06.6.

501.02.6 Fibers: When required to prevent draindown, use cellulose or mineral fiber, meeting the requirements of 1002.02.5. When used, add fibers at a rate sufficient to prevent draindown with a minimum rate of 0.1 percent by weight (mass) of mixture.

501.02.7 Reclaimed Asphalt Pavement (RAP): Keep reclaimed asphalt pavement separate from other materials at the plant in such a manner that will allow for Department inspection and acceptance. Keep stockpiles uniform and free of soil, debris, foreign matter and other contaminants. Allowable RAP percentages are defined in Table 501-1. Screen or crush RAP, prior to use, to pass a 1-inch sieve.

501.02.8 Natural Sand: When used, meet the requirements of Table 501-1 and 1003.06.3.

501.03 DESIGN OF THIN ASPHALT CONCRETE MIXTURES AND JOB MIX FORMULA (JMF) APPROVAL. Submit an aggregate gradation that conforms to Table 501-1 along with the Certificates of Analysis required in 501.02.4. Aggregate friction rating for coarse mix and OGFC will be in accordance with Table 502-3.

Design dense and coarse mixtures to midpoint of voids using the gyratory requirements of Table 501-1. For design of OGFC mixtures, the full range of void requirements is allowed. Report the corresponding asphalt content on the JMF. Design and report mix temperatures between 300^0F and 350^0F on the JMF. At minimum, all design submittals will include the recommended materials proportions, extracted gradation, recommended mix and compaction temperatures, and supporting design data. Submit the recommended JMF electronically through a Department approved data system as designated by the Department for District Laboratory Engineer acceptance. No mixture will be produced until the proposed JMF has been accepted. Prior to JMF approval, present a Certificate of Analysis showing aggregate physical properties conforming to Table 501-2.

Once a plant is producing an acceptable JMF, keep JMF production within the specified tolerances. Changes will be reviewed and accepted by the District Laboratory Engineer as necessary. A change in the asphalt cement source will require testing for Moisture Susceptibility using Loaded Wheel Test (LWT) in accordance DOTD TR 332. An acceptable mix design may not be changed to eliminate or add the use of crumb rubber without submitting a new JMF.

The Project Engineer may require a new mix design when acceptance requirements are not being met or plant quality data indicates non-compliance.

501.04 LOT SIZES. A lot is a segment of continuous production of asphalt concrete mixture from the same JMF produced for the Department at a specific plant, delivered to a specific DOTD project. A lot is defined as 2400 tons of mixture production, a sublot is 800 tons. The final sublot may be increased up to 50 percent of the last sublot with the mutual agreement of the contractor and Project Engineer.

501.05 JOB MIX FORMULA (JMF) VALIDATION AND APPROVAL. The Department and contractor will jointly test plant mix to validate each JMF and accept each JMF whenever a plant begins initial operations for the Department in a specific plant location, or whenever a plant experiences a change in materials or change in source of materials (other than asphalt cement), or when there are significant changes in equipment, such as the introduction of a new crusher, drum mixer, burner, etc. All JMF's shall be re-validated a minimum of every 2 years. Re-validation may consist of reviewing ongoing production data.

Validate the JMF on the first 1200 tons (3-400 ton sublots) of production for a project by meeting the requirements of Table 501-1. With mutual agreement of the contractor and the Department, a fourth sample may be taken during validation. This sample may be used in place of the first validation plant sample for purposes of determining lot averages and establishing JMF targets.

During the validation process or when a new asphalt cement source is used, the Asphalt District Inspector (ADI) will collect a sample of loose mixture and a sample of asphalt cement to send to the central laboratory for GPC testing.

The District Laboratory and Contractor shall jointly test three sublots for theoretical maximum specific gravity (G_{mm}), percent air voids, percent asphalt cement content, and extracted aggregate gradation. The JMF is considered conditionally validated if the following parameter individual test results meet the design specification limits.

1. Theoretical Maximum Specific Gravity (G_{mm}),
2. Percent Air Voids at N_{design},
3. Percent Asphalt Content by Ignition,
4. Extracted Gradation,
5. Percent Draindown (if required)

The production can continue during conditional validation. The JMF is considered validated with passing LWT results. If any failure occurs, adjust mix and revalidate. If second failure occurs, redesign the mix.

Upon validation of the JMF, the average of results for the validation lot will become the JMF target values to be used with production tolerances in Table 501-3.

501.06 PLANT QUALITY CONTROL. Exercise quality control over all materials and their assembly, design, processing, production, hauling, laydown and associated equipment to ensure compliance with Table 501-3 and all other specifications herein. At the end of each production day, notify the District Lab Engineer (DLE) and the DOTD Asphalt District Inspector (ADI) of the next scheduled mix production run and placement. Keep accurate records, including proof of deliveries of all materials used in this process.

For plant quality control, a lot is defined as 2400 tons of continuously produced mixture from one JMF. Obtain a sample of plant mixture and test the mixture once every sublot using a random sampling approach. Minimum quality control testing for each sublot is as follows:

<u>Loose Mix</u>

1. Theoretical Maximum Specific Gravity, G_{mm}
2. % Asphalt Cement Content
3. Extracted Gradation
4. % Crushed
5. Dust to Asphalt Ratio
6. Temperature
7. Draindown (1/lot when required)

<u>Compacted Specimen, N_{design}</u>

1. % Air Voids, V_a

Age all loose mix tested for Gmm or volumetrics for one hour in accordance with AASHTO R30 prior to testing.

For each lot, report all quality control data to the Department's Certified Plant Inspector. Increased quality control sampling or control charts may be requested by the Project Engineer if mixture problems develop.

501.07 PLANT ACCEPTANCE. The Department will perform all plant acceptance and verification testing to meet the Materials Sampling Manual requirements. All Department inspection procedures, including sampling and testing, form the basis for acceptance of asphaltic concrete. Sampling and testing shall be accomplished following a stratified sampling plan in accordance with the Materials Sampling Manual and specified test procedures.

The Department will take samples or perform tests as outlined in these specifications, to ensure that the asphaltic concrete conforms to Department standards, which include job mix limits, material properties, and surface deviations. For plant acceptance, a sublot is defined as 800 tons and a lot is defined as 2400 tons of continuously produced mixture from one JMF. Obtain a sample of plant mixture and test the mixture once every sublot using a random sampling approach. Minimum plant acceptance testing for each sublot is as follows:

Loose Mix

1. Theoretical Maximum Specific Gravity, G_{mm}
2. Extracted Gradation
3. Temperature
4. Draindown (1/lot when required)

Sample and test the mixture for Moisture Susceptibility using LWT every 10,000 tons.

Take corrective action or cease production if the lot average for each test result does not fall within the production tolerances, listed in Table 501-3, when applied to the JMF validated targets or if the LWT results do not meet specifications. The District Laboratory Engineer may require re-validation of the mix when the averages of the acceptance data indicate repeated non-compliance with the specified limits or tolerances.

501.08 ROADWAY OPERATIONS. Meet the requirements of 502.08 except as modified herein.

501.08.1 Weather Limitations: Ensure that Thin Asphalt Concrete complies with the weather limitations of 502.08.1 except that both the surface and ambient temperatures shall be a minimum of 60°F.

Do not place OGFC when ambient temperatures are predicted to drop below freezing, 32°F, within a three-day forecast period by the U.S. National Weather Service (NWS).

501.08.2 Surface Preparation: Protect and cover manhole covers, drains, grates, catch basins and other such utility structures. Cut back all vegetation at the road edge. Sweep the surface clean of dust, dirt, caked clay, and loose foreign material. Remove any existing raised pavement markers prior to asphalt concrete overlay operations. Payment for removal of pavement markings will be included with the applicable asphalt item.

501.09 HAULING, PAVING AND FINISHING. Meet the requirements of 502.09 except as modified herein. Use fully sealed tarps on all loads. Load haul trucks to minimize segregation.

501.09.1 Application of Tack Coat: Before constructing the thin lift, apply an approved asphalt tack coat in accordance with Section 501.02.1. Apply all tack coat emulsions using a spray paver meeting the requirements of 503.15.1, or apply hot applied non-tracking tack (NTHAP) using a power asphalt distributor meeting the requirements of 503.13.1. Spray tack coat uniformly and accurately across the paving width and monitor the rate of spray. Determine the tack coat application rate by road conditions and mix type. Meet the undiluted asphalt emulsion application rate in Table 501-1. Any change to the tack coat application rate (increase or decrease) in Table 501-1 must be approved by the Project Engineer.

501.09.2 Placement: Place mixtures in accordance with processes and equipment described in Section 503. Deliver material to the paver at a uniform rate and in an amount within the capacity of paving and compacting equipment. Adjust the paver speed and number of trucks to maintain continuous paving operations. Keep the height of material in front of the screed at a uniform height.

Ensure the pavers are designed and operated to place mixtures to required line, grade and surface tolerance without resorting to hand finishing.

501.09.3 Paving: Place and compact the mixture to plan thickness. Place a smooth uniform mat over the full lane width.

501.09.4 Compaction: Comply with 502.10 except as modified herein. Compact the mixture applying a minimum of 3 passes over a single point on the road using a double drum steel wheel roller of sufficient weight to properly seat the aggregate without crushing. Roll longitudinal joints directly behind the paving machine. Do not vibrate except at transverse joints. Accomplish final compaction with a second roller. Compact and finish before the mixture temperature falls below 180°F.

501.10 ROADWAY QUALITY ASSURANCE. The Project Engineer will verify that the tack coat application rate meets the requirements of Table 501-1 and check the mixture yield.

Do not place asphalt concrete exhibiting deficiencies before placement such as segregation, contamination, lumps, non-uniform coating, excessive temperature variations, alignment deviations, variations in surface temperature or other deficiencies, apparent on visual inspection.

Poor construction practices such as handwork, improper truck exchanges, improper joint construction, or other deficiencies, apparent on visual inspection, will not be accepted.

501.10.1 Opening to Traffic: Do not open the new pavement to traffic or allow any roller to sit idle on the pavement until the rolling operation is complete and the material has cooled to a temperature where the mat will not be damaged by traffic.

501.10.2 Smoothness: Furnish equipment specified in 502.12.1. Measure IRI in accordance with DOTD TR644 using a DOTD certified inertial profiler before and after placement. Meet Table 501-5 requirements. Ensure a maximum transverse deviation of 1/8 inch and maximum longitudinal deviation of 1/4 inch using a 10 foot metal static straight edge. Correct by grinding at no direct pay at the direction of the Project Engineer.

Perform quality control for surface tolerance as needed. Measure initial and final IRI in the presence of the DOTD certified inspector and submit each data in accordance with 502.12.5 to the DOTD certified inspector at the time of collection.

501.11 MEASUREMENT. Measure the Thin Asphalt Concrete applications by the ton. Measure the tack coat in accordance with Section 504.

501.12 PAYMENT. Payment for Thin Asphalt Concrete mixture will be made at the contract unit price per ton which includes furnishing all required materials, labor, equipment, tools and incidentals necessary for designing and producing the mixtures, preparing the surfaces on which the mixtures are to be placed, hauling the mixtures to the work site, and placing and compacting the mixtures. Production of mix that is not eligible for 100 percent payment will not be allowed on a continuous basis.

Asphalt tack coat will not be a pay item and will be considered incidental to the 501 item. However, if the Project Engineer adjusts the application rate of tack coat from that specified by the contract document, payment for the asphalt mixture will be increased or decreased based on the difference in the applied quantity of asphalt emulsion shown on paid invoices (total of charges). The contractor shall provide copies of paid invoices for this determination. Payment will be subject to the payment adjustment schedules as shown in Table 501-4.

Payment adjustments will be assessed on a per lot basis. The percent payment for the roadway lot will be the lowest value of the payment adjustment parameters for that lot.

A separate payment adjustment for IRI will be applied per travel lane to the theoretical tonnage of each lane for the entire length of the project in accordance with Table 501-5.

Payment for removal of pavement markings will be included with the applicable asphalt item.

Payment will be made at the contract unit price under:

Item No.	Pay Item	Pay Unit
501-01	Thin Asphalt Concrete (Dense Mix)	Ton
501-02	Thin Asphalt Concrete (Coarse Mix)	Ton
501-03	Thin Asphalt Concrete (OGFC)	Ton

Table 501-1
Asphalt Mix Design Requirements

Mix Type	Dense Mix	Coarse Mix	OGFC
Asphalt Cement Grade	PG 70-22	PG 70-22m	PG 76-22m
Gyratory Revolutions, AASHTO T 312	50	75	50
Minimum AC content, %	4.5	4.5	6.5
Air Voids, % [1]	4-6	6-8	18-24[2]
Natural Sands, Max. %	15	0	0
Dust/ Asphalt Ratio	0.6-1.6	---	---
RAP, Max %	10	0	0
LWT rut depth, 12 mm (max) @ no. passes, DOTD TR 332[3]	12,000	20,000	5000
Draindown, % max, ASTM D6390	---	0.15	0.30
Min. Tack Coat Undiluted (or NTHAP) Application Rate, gal/sq.yd. (0.40 gal/sq.yd maximum)	0.08[4]	0.15	0.15
% Passing 3/4 inch	100	100	100
% Passing 1/2 inch	100	75-100	85-100
% Passing 3/8 inch	90–100	—	55-75
% Passing No. 4	—	25-40	10-25
% Passing No. 8	35-70	19-28	5-13
% Passing No. 16	20-50	—	—
% Passing No. 200	2.0-10.0	2.0-5.5	2.0-4.0

[1] Design target voids at mid-point of void requirement. Full range allowed for OGFC.
[2] As computed using the measure of the physical volume (weight of compacted specimen)/ (height of compacted specimen x area of the compacted specimen).
[3] Compact LWT specimen to the mid-point of design void requirement, OGFC to 18% voids.
[4] If bleeding, ponding or slipping are evident, this rate may be reduced to a minimum of 0.04 gallon/square yard with a minimum 0.02 gallon/square yard residual with approval of the Project Engineer.

Table 501-2
Aggregate Physical Properties

Test	Method	Coarse Mix and OGFC	Dense Mix
Micro Deval, % loss max[1]	AASHTO T-327	18	—
Flat and Elongated Ratio; 3:1, % Max.	ASTM D4791	25	—
Coarse Aggregate Angularity, % Crushed, Double Faced, Min.	DOTD TR 306	90	—
Sand Equivalent, Min.	DOTD TR 120	—	40
Fine Aggregate Angularity (FAA), Min.	DOTD TR 121	45	40
Friction Rating		I, II[2]	I, II, III

[1] Micro Deval target applies to each individual aggregate.
[2] See Table 502-3.

Table 501-3
Production Tolerances

Sieve % Passing	Production Tolerances
3/4 inch	±4
1/2 inch	±4
3/8 inch	±4
No. 4	±4
No. 8	±3
No. 16	±2
No. 30	±2
No. 50	±2
No. 200	±1.5
A/C by Ignition, %	±0.2
Mix Temperature, ^{0}F	±25
G_{mm}	±0.015
Air Voids, %	Meet design
Dust/Asphalt Ratio	Meet design

Table 501-4
Payment Adjustment Schedules

Plant:	**Percent of Contract Unit Price per Lot**			
	100%	**90%**	**80%**	**50% or Reapplication[1]**
Theoretical Maximum Specific Gravity (G_{mm}) Average Deviation from Validated JMF Target Value	≤0.015	>0.015 - 0.020	>0.020 - 0.025	>0.025
Limits on Extracted Aggregate, Average Deviation from Table 501-3, JMF Validated Target[2]				
No. 4 Sieve	≤ 4.0	>4.0 - 5.0	> 5.0 - 6.0	> 6.0
No. 200 Sieve[3]	≤ 1.5	>1.5 - 2.0	> 2.0 - 2.5	> 2.5
Roadway:				
Tack Coat Undiluted (or NTHAP) Application Rate, gal/sq.yd. Coarse Mix and OGFC	≥0.15	<0.15 - 0.08	<0.08 - 0.04	< 0.04

[1] Reduced pay or reapplication at the contractor expense shall be As directed by the Chief Engineer.
[2] Gradation pay adjustment applies to coarse and OGFC mixtures only.
[3] For OGFC and Coarse Mix, if the No. 200 sieve is above maximum design limit, apply at 90% adjustment or the computed adjustment from the deviation, whichever is greater.

Table 501-5
Smoothness Payment Adjustment Schedules

Percent of Contract Unit Price per Travel Lane for final IRI			
	100%	**90%**	**50% or Reapplication[1]**
Initial IRI of ≤ 65	≤ 65	>65-73	> 73
Initial IRI > 65 to 81	≤ 65	≤10% greater than initial measure	> 10% greater than initial measure
Initial IRI > 81	≥ 20% reduction from initial measure	<20% reduction from initial measure	greater than initial measure

[1] As directed by the Chief Engineer.

Section 502
Asphalt Concrete Mixtures

502.01 DESCRIPTION.

502.01.1 General: Furnish and construct asphalt concrete mixtures in conformance with these specifications, the lines, grades, thicknesses, and typical sections in the plans.

Comply with Section 503 and the Application of Quality Assurance Specifications for Asphalt Concrete Mixtures (QA Manual).

Use a DOTD certified laboratory accredited by AMRL, CMEC, or other accreditation agency approved by DOTD.

502.01.2 Lift Description and Mixture Types: The wearing course is defined as the final lift placed. The binder course is defined as the lift placed prior to the final lift as defined in the plans. When a Section 501 thin lift mix is used in conjunction with construction of 502 mixtures, it is a finish course.

Mainline mixtures include wearing, binder, and base courses for travel lane, ramps and turnouts greater than 300 feet, interstate acceleration/deceleration lanes, turn lanes, and the two center lanes for airports.

Minor mixes include mixture used for bike paths, crossovers, curbs, detour roads, driveways, guardrail widening, islands, joint repair, leveling, medians, parking lots, shoulders, turnouts, ramps less than or equal to 300 feet, patching, widening, miscellaneous handwork, and any other mixture that is not mainline.

Stone Matrix Asphalt (SMA) is a plant produced hot mix asphalt concrete wearing course for high traffic applications that is a rut resistant hot mix design with stone on stone contact.

502.02 MATERIALS. Comply with applicable Part X subsections listed herein. Sample in accordance with the Materials Sampling Manual and ensure testing in accordance with the procedures listed in Part X and Table 502-1. Keep accurate records, including proof of deliveries of all materials used in asphalt concrete mixtures. Furnish copies of these records to the Project Engineer upon request.

Aggregates	1003.01 & 1003.06
Anti-Strip Additives	1002.02.1
Asphalt Cement	1002
Crumb Rubber	1002.02.2
Hydrated Lime	1018.02
Fibers	1002.02.5
Mineral Filler	1003.06.6
Mix Release Agent	1018.10
Reclaimed Asphalt Pavement (RAP)	1003.01 & 1003.06.5
Warm Mix Additives	1002.02.4

Table 502-1
Test Procedures for Asphalt Concrete

Description	Test Method
Specific Gravity and Density of Compressed Asphalt Mixtures	DOTD TR 304
Theoretical Maximum Specific Gravity, G_{mm}	DOTD TR 327
Asphalt Cement Content, P_b	DOTD TR 323
Mechanical Analysis of Extracted Aggregate	DOTD TR 309
Moisture Content of Loose HMA	DOTD TR 319
Degree of Particle Coating (plant requirement)	AASHTO T-195
Bulk Specific Gravity and Absorption	AASHTO T 84, T 85
Coarse Aggregate Angularity, % Crushed (Double Faced)	DOTD TR 306
Fine Aggregate Angularity	DOTD TR 121
Flat and Elongated Particles	ASTM D 4791
Sand Equivalent	DOTD TR 120
Mixture Conditioning (Aging) of HMA Mixtures	AASHTO R 30
Superpave Volumetric Mix Design	AASHTO M 323
Preparing Gyratory Samples	AASHTO T 312
Asphalt Cement Draindown	ASTM D 6390
Longitudinal Profile Using Automated Profilers	DOTD TR 644
Thickness and Width of Base and Subbase	DOTD TR 602
Loaded Wheel Tester (LWT)	DOTD TR 332
Semi-circular Bend Test (SCB)	TR 330

502.02.1 Asphalt Cement: Comply with Table 502-2. If the asphalt cement does not comply with the requirements of Section 1002, notify the Project Engineer and cease mix production until proper asphalt material is supplied.

Table 502-2
Asphalt Cement Usage

Location	Mix Level	Asphalt Grade Required[1]	Substitutions Allowed[2]	
			Lower Grade	Higher Grade
Mainline Wearing & Binder	1	PG 70-22m	PG 67-22 with traffic volume < 3500 ADT	PG 76-22rm, PG 76-22m
Mainline Wearing & Binder	2 and SMA[3]	PG 76-22m PG 76-22rm	PG 70-22m with Hydrated Lime	
Base	1	PG 67-22	PG 58-28[4]	PG 76-22rm, PG 76-22m, PG 70-22m
Minor Mixes including Leveling	ALL	PG 67-22		PG 76-22rm, PG 76-22m, PG 70-22m

[1] For single lift overlay, match grade of overlay.
[2] Asphaltic mixtures using substitutions are required to meet all design requirements for the original design level in Table 502-6 or Table 502-6b.
[3] Only PG76-22m and PG76-22rm are allowed for SMA.
[4] When more than 25% RAP is used, PG 58-28 is required.

502.02.2 Additives:

502.02.2.1 Anti-Strip: Add anti-strip additive at the minimum rate of 0.6 percent by weight of asphalt cement or a rate approved by the District Lab Engineer. Anti-strip will be thoroughly mixed in-line with the virgin asphalt cement at the plant. Increase the anti-strip additive or change to different additive as needed to meet Loaded Wheel Test, LWT, requirements. Discontinue production until satisfactory adjustments are made when the amount of anti-strip additive is not in accordance with the approved JMF.

502.02.2.2 Hydrated Lime: When used, specify rate of hydrated lime additive on the Job Mix Formula. Add hydrated lime additive at a minimum of 1.5 percent and thoroughly mix with aggregates in conformance with 503.05.5 as required to meet LWT requirements.

502.02.2.3 Waste Tire Rubber Additive: When used, crumb rubber may be pre-blended or, with approval by the Materials Laboratory, may be blended at the plant. The maximum rubber replacement is 10 percent by weight of asphalt.

When blending crumb rubber at the contractor's plant, add crumb rubber to a PG 67-22 material on the Approved Materials List. Add 30 mesh (or finer) crumb rubber as required to meet grade PG 76-22rm. Comply with 1002.02.2

502.02.2.4 Latex Additive: When added at the contractor's plant, blend a minimum of 1.0 percent residual latex by weight of asphalt cement to a PG 67-22 material on the Approved Material List, and in accordance with Section 503. Meet PG 70-22m requirement using pre-qualified asphalt material and latex.

502.02.2.5 Warm Mix Asphalt Additives: When used, add only approved warm mix chemical additives. Foaming with water is allowed.

502.02.3 Aggregates: Use aggregates from Approved Material List. Blend aggregates to meet Section 502 and Section 1003.

502.02.3.1 Friction Ratings: Friction ratings for aggregates are determined in accordance with 1003.01.2.4. Table 502-3 describes the friction ratings and corresponding usage allowed for the current average daily traffic (ADT) shown on the plans. Friction rating requirements apply to the mainline wearing course only, unless a finish course is applied. If a finish course is applied, then the friction rating requirements do not apply to wearing course.

Table 502-3
Aggregate Friction Rating

Friction Rating	Allowable Usage[1,2]
I	All mixtures
II	All mixtures
III	All mixtures, except mainline wearing courses with current plan Average Daily Traffic (ADT) greater than 7000
IV	All mixtures, except mainline wearing courses

[1] When ADT is greater than 7000, blending of Friction Rating III aggregates and Friction Rating I and/or II aggregates will be allowed for travel lane wearing courses at the following percentages. At least 30 percent by weight (mass) of the total aggregates shall have a Friction Rating of I, or at least 50 percent by weight (mass) of the total aggregate shall have a Friction Rating of II. The Friction Rating I and Friction Rating II aggregates used to obtain the required percentages shall not have more than 10 percent passing the No. 8 (2.36 mm) sieve.

[2] When the average daily traffic (ADT) is less than 2500, blending of Friction Rating IV aggregates with Friction Rating I and/or II aggregates will be allowed for travel lane wearing courses at the following percentages. At least 50 percent by weight (mass) of the total aggregate in the mixture shall have a Friction Rating of I or II. The Friction Rating I and Friction Rating II aggregates used to obtain the required percentages shall not have more than 10 percent passing the No. 8 (2.36 mm) sieve.

502.02.3.2 Reclaimed Asphalt Pavement (RAP): Keep reclaimed asphalt pavement separate from other materials at the plant in such a manner that will allow for Department inspection and acceptance. Keep stockpiles uniform and free of soil, debris, foreign matter and other contaminants. Allowable RAP percentages are defined in Table 502-6 (or Table 502-6b for ADT $\leq$ 1000). Screen or crush RAP, prior to use, to pass the 1-inch sieve. RAP is not allowed in Airport or SMA.

502.02.3.3 Mineral Filler: When used, comply with the requirements of 1003.06.6. May be used to control draindown.

502.02.3.4 Natural Sand: When used, meet the requirements of Table 502-6 (or Table 502-6b for ADT $\leq$ 1000) and 1003.06.3.

502.02.3.5 Fibers: When required to prevent draindown, use cellulose or mineral fiber, meeting the requirements of 1002.02.5. When used, add fibers at a rate sufficient to prevent draindown with a minimum rate of 0.1 percent by weight (mass) of mixture.

502.02.3.6 SMA Aggregate: Aggregates for SMA are to be clean durable crushed stone with a minimum of 50 percent of the coarse aggregate having a friction rating of I with the remaining percentage meeting friction rating II or III. Alternately, 100 percent of the coarse aggregate will meet a friction rating of II. Fine aggregate for SMA will be 100 crushed manufactured sand.

All materials used for SMA production are to be on the Approved Materials List.

502.03 DESIGN OF ASPHALT MIXTURES AND JOB MIX FORMULA (JMF) APPROVAL. Design all asphalt mixtures for optimum asphalt content in compliance with the mix design in accordance with DOTD Quality Assurance Manual, AASHTO M323, AASHTO M325 for SMA, and the requirements of Table 502-6 (or Table 502-6b for ADT ≤ 1000).

At minimum, all design submittals must include the recommended materials proportions, extracted gradation, recommended mix and compaction temperatures, and supporting design data. Submit the proposed JMF electronically through a Department approved data system, at least 7 days prior to use, as designated by the Department for District Laboratory Engineer acceptance. No mixture shall be produced until the proposed JMF has been accepted.

Indicate the optimum mixing and compaction temperatures as suggested by the asphalt binder supplier on the JMF. Mix temperatures are recommended by the asphalt supplier as determined by rotational viscosity or other means. Warm Mix Asphalt technology may be used to reduce this temperature and must be noted on the JMF. Warm mix asphalt may be substituted with a minimum production temperature of 275°F.

Once a plant is producing an acceptable JMF, keep JMF production within the specified tolerances. Changes will be reviewed and accepted by the District Laboratory Engineer as necessary. An acceptable mix design may not be changed to eliminate or add the use of crumb rubber without submitting a new JMF.

The Project Engineer may require a new mix design when roadway acceptance requirements are not being met or plant quality data indicates non-compliance.

502.03.1 Mixtures Design Substitutions: Changes in design level will not be allowed on the roadway.

The 3/4-inch Nominal Maximum Size (NMS) wearing course may be substituted for binder course but not substituted for base course. The 1-inch NMS binder course may be substituted for base course.

The 1/2-inch NMS wearing course may be substituted for incidental paving, Level A. Shoulders may be any mixture type shown in Table 502-4 regardless of design level except that shoulder wearing must be a 1/2-inch or 3/4-inch NMS mixture.

Apply all specification requirements for the substituted mixture with the following exceptions: When wearing course is substituted for binder course, Table 502-3 does not apply. The amount of RAP allowed is in accordance with the originally specified mixture.

Frictional aggregate requirements apply to final surface only. RAP is allowed in accordance with the original mixture specified, not the substituted mixture. When a 501 finish course and a 502 wearing course are required on a project, allowable RAP percentage for wearing may be increased by 5 percent.

502.04 LOT SIZES. A lot is a segment of continuous production of asphalt concrete mixture from the same JMF produced for the Department at a specific plant, delivered to a specific DOTD project. A lot is defined as 5000 tons of mixture production, a sublot is 1000 tons. The final lot size may be extended one sublot with the mutual agreement of the contractor and Project Engineer.

A lot may be terminated prior to 5000 tons with the mutual agreement of the contractor and Project Engineer for any of the following reasons:

1. The interval between continuous production exceeds 7 calendar days
2. A new job mix formula is accepted
3. The final lot is less than 5,000 tons
4. The total project quantity is less than 5,000 tons
5. A payment adjustment will be applied to the portion of the lot already produced, provided adjustments have been made to bring the asphaltic concrete into compliance with specifications.

502.04.1 Mainline Mix Type Uses: Mainline mixture uses include wearing, binder, and base courses for travel lane, ramps and turnouts greater than 300 feet, interstate acceleration/deceleration lanes, turn lanes, and the two center lanes for airports.

502.04.2 Minor Mix Type Uses with Density Requirement: Minor mixture uses requiring density include bike paths, crossovers, parking lots, patching, widening greater than 2.5 feet, uniform leveling thicker than 1.5 inches, tapers, and shoulders.

502.04.3 Minor Mix Type Uses without Density Requirement: Minor mixture uses not requiring density include curbs, detour roads, driveways, guardrail widening, islands, joint repair, spot leveling, medians, turnouts less than 300 feet, and mix uses not listed above. Make compaction effort to the satisfaction of the Project Engineer.

502.05 JOB MIX FORMULA VALIDATION AND APPROVAL. The Department and contractor will jointly test plant mix to validate each JMF. A JMF for mainline mixture will be validated whenever a plant begins initial operations for the Department in a specific plant location, whenever a plant experiences a change in materials or change in source of materials (other than asphalt cement), or when there are significant changes in equipment, such as the introduction of a new crusher, drum mixer, burner, foaming device, etc. Meet all applicable requirements of Table 502-6 (or Table 502-6b for ADT $\leq$ 1000). All JMF's will be re-validated a minimum of every 2 years. Re-validation may consist of reviewing ongoing production data.

For all mixes, a change in the asphalt cement grade or asphalt cement source does not require re-validation, but will meet all applicable requirements of Table 502-6 (or Table 502-6b for ADT $\leq$ 1000).

JMF's for minor mixtures do not require validation; however, use the first five quality control sublots to establish targets for production tolerances. The District Lab Engineer may reestablish targets for minor mixtures using production data.

The validation lot will be the first portion of production of a new JMF between 1000 and a maximum of 2000 tons of mixture produced. Divide the validation lot quantity into five sublots (typically 400 tons each) and sample using a random sampling approach. Obtain one sample of plant mixture for each sublot. With mutual agreement of the contractor and the Department, an sixth sample may be taken during validation. This sample may be used in place of the first validation plant sample for purposes of determining lot averages and establishing JMF targets.

During the validation process or when a new asphalt cement source is used, the Asphalt District Inspector (ADI) will collect a sample of loose mixture and a sample of asphalt cement to send to the central laboratory for GPC testing.

Report the mean, standard deviation, Quality Index and percent within limits (PWL) of the test results in accordance with the QA manual. The JMF is considered conditionally validated if the following parameters are 71 percent within limits of the JMF and meet the specifications.

1. Theoretical Maximum Specific Gravity (G_{mm}),
2. Percent G_{mm} at $N_{initial,}$
3. Percent passing the No. 8 and No. 200 sieves,
4. Percent Air Voids at $N_{design,}$ and
5. VFA.

The averages of all other validation tests shall meet the specifications limits in Table 502-4 and Table 502-6 (or Table 502-6b for ADT $\leq$ 1000). The production can continue during conditional validation. The JMF is considered validated with passing LWT results.

If any parameter falls below 71 PWL or the validation average falls outside of specifications, adjust mix and revalidate. If the second attempt does not meet specifications, redesign the mix. Upon validation of the JMF, the average of results for the validation lot will become the JMF target values to be used with production tolerances in Table 502-4.

502.05.1 Payment for Validation Lot: A validation lot is represented as an individual lot; the density requirement in Table 502-5 will still apply to any validation lot that fails to validate. Perform roadway acceptance in accordance with 502.11, except only one acceptance core is required per sublot, and pay in accordance with 502.15.

502.06 QUALITY CONTROL AND PLANT ACCEPTANCE. All quality control information, plant records, etc. will be considered part of the Department's acceptance decision. Exercise quality control over all materials and their assembly, design, processing, production, hauling, laydown and associated equipment to ensure compliance with Table 502-4 and all other specifications herein. At the end of each production day, notify the District Lab Engineer (DLE) and the DOTD Asphalt District Inspector (ADI) of the next scheduled mix production run and placement. All testing data will be entered into the DOTD data management software by the end of the work shift that it was performed.

For plant quality control, a sublot is defined as 1000 tons and a lot is defined as 5000 tons of produced mixture from one JMF that is consecutively sent to a single project (this tonnage may or may not be continuous at the plant). Obtain a sample of plant mixture and test the mixture once every sublot using a random sampling approach. Minimum quality control testing for each sublot is as follows:

Loose Mix

1. Theoretical Maximum Specific Gravity, G_{mm}
2. % Asphalt Cement Content
3. Gradation
4. % Crushed
5. Temperature, and
6. % Moisture content (1 per day per JMF)

Compacted Specimen, N_{design}

1. % G_{mm} at $N_{initial}$
2. % Air Voids, Va
3. % VMA
4. % VFA, and
5. % G_{mm} at N_{max} (1 per 5 sublots)

Age all loose mix tested for G_{mm} or volumetrics for one hour in accordance with AASHTO R30 prior to testing. Age all warm mix for two hours.

Determine the G_{mm} for each sublot. The plant sublot G_{mm} will be utilized in the determination of the plant air voids and the density of the corresponding roadway sublot.

Determine the rolling five test results average and standard deviation for aggregate gradation, asphalt content, air voids, VFA, VMA, and G_{mm}. Take corrective action or cease production when the latest rolling five test results show:

1. Air voids or G_{mm} fall below 71 PWL; or
2. Average VMA, VFA, average asphalt content, or average gradation for the No. 8 or No. 200 sieve is outside of specification limits

The full range of gradation mix tolerances applied to the validated JMF will be allowed even if they fall outside the control points. The District Laboratory Engineer may require termination or re-validation of the JMF when the average of the Quality Control data indicates non-compliance with the specified limits or tolerances.

Measure the moisture content of the cold feed aggregates daily in accordance with DOTD TR 403. The moisture content of the final mixture, measured daily, shall not exceed 0.3 percent by weight (mass) when tested in accordance with DOTD TR 319.

502.07 PLANT INSPECTION AND AUDITS. All Department inspection procedures, including sampling and testing, and the contractor's quality control data form the basis for acceptance of the asphalt mixture. The Department's Certified Asphalt Plant Inspector will randomly visit and inspect asphalt plants, sample and test material, and review documentation to ensure conformance to specification requirements. In particular, the inspector will take a minimum of the following samples which may be tested for verification:

Loose Mix

1. Theoretical Maximum Specific Gravity, G_{mm},
2. % Asphalt Cement Content,
3. Gradation, and
4. % Crushed

Compacted Specimen, N_{design} (Using contractor's equipment)

1. % G_{mm} at Ninitial,
2. % Air Voids, Va,
3. % VMA,
4. % VFA, and
5. Loaded Wheel Testing (LWT) every 20,000 tons of production per JMF.

The inspector will review contractor data and documentation. The inspector will check the plant equipment, lab equipment and plant operations. The inspector will sample asphalt cement working tank and or transport during random plant visits and will obtain random asphalt cement transport samples as requested by the Materials Lab.

Failure to maintain production tolerances listed in Table 502-4 and specification limits listed in Table 502-6 (or Table 502-6b for ADT $\leq$ 1000) for five sublots may result in increased sampling, reduced pay, or removal and replacement of the asphalt mixture, decertification of the technician, and/or decertification of the plant. Correct deficiencies or cease operations.

502.08 ROADWAY OPERATIONS.

502.08.1 Weather Limitations: Apply asphalt concrete mixtures on a dry surface when the ambient temperature is above 50°F for wearing courses and 40°F for base and binder courses. Material in transit, or a maximum of 100 tons in a surge bin or silo used as a surge bin, at the time plant operation is discontinued may be placed. All mixture placed is expected to perform satisfactorily and meet specification requirements. Inclement weather will be sufficient reason to terminate or not begin production.

When base course mixtures are placed in plan thicknesses of 2 3/4 inches or greater, disregard temperature limitations provided all other specification requirements are met. When a wearing course is substituted for a binder course mixture, apply the temperature limitation for binder course.

502.08.2 Surface Preparation: Maintain the surface being covered. Acceptance is required for each surface prior to placement of subsequent surface.

Roadway slope shall be established at the base course level unless otherwise authorized by the Project Engineer. The absolute minimum lift thickness placed shall be 1/4 inch greater than the nominal maximum aggregate size as shown on Table 502-6 (or Table 502-6b for ADT ≤ 1000). Failure to meet minimum thickness is subject to removal.

502.08.2.1 Cleaning: Sweep the surface to be covered clean of dust, dirt, caked clay, caked material, vegetation, and loose material by revolving brooms or other mechanical sweepers supplemented with hand equipment as directed. Remove excess joint filler from the surface by an approved method when mixtures are to be placed on portland cement concrete pavement or previously overlaid portland cement concrete. Remove any existing raised pavement markers prior to asphalt concrete overlay or SMA operations. Payment for removal of pavement markings will be included with the applicable asphalt item.

Wash the surface with water in addition to brooming, when brooming alone does not adequately clean the surface.

When tack coat is exposed to traffic for more than one (1) calendar day, becomes contaminated, or degrades due to inclement weather, reapply the tack coat at the initial recommended rate at no direct pay.

502.08.2.2 Applying Tack Coat:

502.08.2.2.1 Existing Pavement Surfaces: Before constructing each course, apply an approved asphalt tack coat in accordance with Section 504. Protect the tack coat and spot patch as required.

502.08.2.2.2 Raw Aggregate Base Course and Raw Embankment Surfaces: Apply an approved asphalt prime coat to unprimed surfaces, or protect in-place prime coat and spot apply prime coat as required, in accordance with Section 505.

502.08.2.2.3 Cement and Lime Stabilized or Treated Embankment and Base Course Surfaces: Apply an approved asphalt curing membrane when none is in place, or protect the in-place curing membrane and spot apply, as required, with asphalt material in accordance with Section 506.

502.08.2.2.4 Other Surfaces: Cover contact surfaces of curbs, gutters, manholes, edges of longitudinal and transverse joints, and other structures with a uniform coating of an approved asphalt tack coat complying with Section 504 before placing asphalt mixtures.

502.08.3 Joint Construction:

502.08.3.1 Longitudinal Joints: When constructing longitudinal joints, set the screed to allow approximately 2 inches onto the adjacent pass. Use approved 10-foot static straight edge to maintain no greater than 1/8-inch deviation in grade. Make necessary correction in joint before continuing operations. Offset longitudinal joints in one layer over those in the layer below by a minimum of 3 inches; however, keep the top layer joint 6 inches to 9 inches from the centerline of two lane highways. Offset 6 inches to 9 inches from lane lines when the roadway is more than two lanes. Construct the narrow strip first.

502.08.3.2 Transverse Joints: Construct transverse joints by milling or hand forming paper butt joints. Use an approved 10-foot static straightedge to identify the location to be cut back to maintain no greater than a 1/8-inch deviation in grade. Lightly tack the cut face of the previously placed mat before fresh material is placed. Rest the screed on shims that are approximately 25 percent of lift thickness placed on the compacted mat. Provide an adequate crew to form transverse joints. Additionally, meet the transverse joint surface tolerance requirements of Table 502-5. Make necessary corrections to the joint before continuing placement operations.

Offset transverse joints in succeeding lifts by at least 3 feet.

502.09 HAULING, PAVING AND FINISHING. Transport mixtures from the plant and deliver to the paver at a temperature no cooler than 25°F below the lower limit of the approved job mix formula. The minimum temperature for WMA going through the paver is 245°F. Send no loads so late in the day that completion of spreading and compaction of the mixture cannot be completed during daylight, unless artificial lighting has been approved and is on site.

Load haul trucks to minimize segregation.

Place each course of asphalt mixture in accordance with the specified lift thickness shown in Table 502-6 (or Table 502-6b for ADT ≤ 1000).

With the Project Engineer's approval, motor patrols may be used to level isolated depressions in the initial layer, provided this construction does not result in unsatisfactory subsequent lifts.

502.09.1 Coordination of Production: Coordinate and manage plant production, transportation of mix and placement operations to achieve a high quality pavement. Provide sufficient hauling vehicles to ensure continuous plant and roadway operations. The Project Engineer will order a halt to operations when sufficient hauling vehicles are not available.

On final wearing course construction under traffic with pavement layers of 2 inches compacted thickness or less, the contractor will be permitted to pave one travel lane for a full day and the adjacent travel lane the next work day. When the adjacent travel lane is not paved the next work day and the longitudinal joint is exposed to traffic for more than 3 calendar days, and it has been determined that the roadway edge is not true to line and grade as previously constructed, cut back the entire length of exposed longitudinal joint to lift thickness to a vertical edge and heavily tack unless a notch wedge device is used. When pavement layers are greater than 2 inches compacted thickness, place approximately 1/2 of each day's production in one lane and the remainder in the adjacent lane unless an approved notched wedge device is used.

Protect pavement from traffic until it has sufficiently hardened to the extent the surface is not damaged.

502.09.2 Paving Operations: When placing the final two lifts of asphalt concrete on the roadway travel lanes, use a material transfer vehicle (MTV) as described in 503.14. During continuous paving, maintain temperature of the mixture constant. At no time shall there be more than 50°F difference in temperature as measured in 300 linear feet of paving or 25°F across the full paved width. All mixtures shall flow through the paver hopper. Lift into the hopper any mixture dropped in front of the paver or reject such material and cast it aside. Deliver material to the paver at a uniform rate and in an amount within the capacity of paving and compacting equipment. Adjust the paver speed and number of trucks to maintain one truck waiting in addition to the one at the paver in order to maintain continuous paving operations. Maintain a uniform height of material in front of the screed.

Keep the paver steady and in constant alignment during mix transfer. Maintain a level of mix higher than the paver hopper feed slats at all times.

Use pavers and operators capable of placing mixtures to required line, grade and surface tolerance without resorting to hand finishing.

Construct longitudinal joints and edges along established lines. Utilize some form of longitudinal control for the paver to follow, preferably a string line. Position and operate the paver to closely follow the established line. Correct irregularities in alignment by trimming or filling directly behind the paver. Check the texture for uniformity after each load of material has been placed. Check the adjustment of screed, feed screws, hopper feed, etc., frequently and adjust as required to assure uniform spreading of the mix to proper line and grade and adequate compaction. When segregation of materials or other deficiencies occur, suspend paving operations until the cause is determined and corrected.

Correct surface irregularities directly behind the paver. Hand placement will be allowed in accordance with 502.09.3 for surface repair, taking care never to cast material over the fresh surface.

Discontinue paving operations when any screed control device malfunctions during binder or wearing course placement operations. When malfunctions occur, limit material through the paver to that which is in transit. Assume responsibility of meeting all specifications and yield requirements, and bear the cost of any overrun during malfunctions. Do not resume paving operations until the malfunction is fixed.

When paving operations are interrupted, remove and replace at no direct pay, mixture that has cooled below the point that it cannot be finished, or compacted to meet specifications. When additional mix is required to increase superelevation in curves, the use of automatic slope control is optional. However, ensure slope by measuring with a slope board. Allow the Project Engineer use of the slope board upon request.

Use the traveling reference plane method of construction for airport runways unless designated otherwise on the plans. Unless the erected string line is required or directed, use the 27-foot (minimum) traveling reference plane method of construction for roadway travel lanes. The requirements of 502.09.2.1, 502.09.2.2, and 502.09.2.3 shall apply for mechanical pavers.

502.09.2.1 Additional Requirements for SMA: Mixture temperature upon entry into the MTV will not be below 300°F. Paver speed is to be constant and not exceed 25 feet per minute or as directed by the Project Engineer.

502.09.2.2 Traveling Reference Plane: Obtain approval of the traveling reference plane method before use. After the initial paving strip of each lift is finished and compacted, place adjacent paving strips to the grade of the initial paving strip using the traveling reference plane or shoe device to control grade and a slope control device to control cross slope.

On multilane pavements, the initial paving strip and the sequence of lane construction will be subject to approval.

When both outside edges of the paving strip being placed are flush with previously placed material, do not use the slope control device. A grade sensor is required for each side of the paver.

In superelevated curves, the cross slope shall be changed from that specified for tangents to that specified for superelevation in gradual increments while the paver is in motion so a smooth transition in grade is obtained. This change in cross slope shall be accomplished within the transition distance specified.

This is the minimum acceptable method and the contractor must meet or exceed current surface tolerance specifications.

502.09.2.3 Erected Stringline: Use the erected stringline method in isolated areas as directed by the Project Engineer. This method may be used on the first lift of asphalt when the underlying new or reconstructed bases do not have grade control requirements. Equip pavers for roadway travel lanes with automatic screed and slope control devices when used with an erected stringline.

An erected stringline shall consist of a piano wire or approved equal stretched between stakes set at no greater than 25-foot intervals. Tension the stringline between supports so that there is less than 1/8-inch variance between supports when the sensor is in place. If required, place the initial paving strip of the first lift constructed using an erected stringline referenced to established grade. When permitted, mixtures required to level isolated depressions may be placed without automatic screed control. Subsequent lifts may be constructed by use of the traveling reference plane, provided surface and grade tolerances are met on the previous lift.

Only one grade sensor and the slope control device are necessary for roadways with a normal crown on tangent alignment. Superelevated curves will require the use of two grade sensors and two erected stringlines to obtain proper grade and slope; however, when the automatic screed control device is equipped with a dial or other device which can be conveniently used to change the cross slope in small increments, superelevated curves may be constructed using this device and one erected stringline.

After the initial paving strip of the first lift is finished and compacted, lay adjacent paving strips using an approved traveling reference plane.

502.09.2.4 Without Automatic Screed Control: When permitted, pavers without automatic screed control may be used for pavement patching, pavement widening, paved drives and turnouts.

502.09.3 Hand Placement: When the use of mechanical finishing equipment is not practical, the mix may be placed and finished by hand to the satisfaction of the Project Engineer. During paving operations, material shall be thoroughly loosened and uniformly distributed. Material that has formed into lumps and does not break down readily will be rejected. Check the surface before rolling and correct irregularities.

502.10 ROLLING AND COMPACTION.

502.10.1 General: After placement, uniformly compact mixture by rolling while still hot, to a density that complies with Table 502-5. If continuous roller operation is discontinued, move rollers to cooler areas of the mat where they will not leave surface indentations. The use of steel wheel rollers in the vibratory mode, which result in excessive crushing of aggregate, will not be permitted.

Utilize experienced operators when rolling the mixture using consistent rolling sequences and uniform methods to achieve specified density and smoothness. Uniformly overlap preceding passes of individual roller passes to ensure complete coverage of the paving area. Do not tear or crack the mat by varying the roller speed, amplitude, vibration frequency or other roller operation. Operate non-vibrating steel wheel rollers with drive wheels toward the paver. Correct any operation causing displacement, tearing or cracking of the mat.

Prohibit use of equipment, which leaves tracks or indented areas that cannot be corrected in normal operations or fails to produce a satisfactory surface. Stop use of equipment resulting in accumulation of material and subsequent shedding of accumulated material into the mixture or onto the mat.

Keep rollers of steel wheel rollers properly moistened without excess water to prevent adhesion of mixture to rollers.

Maintain adequate heat for pneumatic tire rollers to prevent mix from adhering to tires. Operate the pneumatic tire roller at a contact pressure which will result in a uniform, tightly knit surface. Keep the pneumatic tire roller approximately 6 inches from unsupported edges of the paving strip; however, when an adjacent paving strip is down, overlap the adjacent paving strip approximately 6 inches.

Vibratory rollers may be used provided they do not impair the stability of the pavement structure or underlying layers. Vibratory rollers shall not be used on the first lift of asphalt concrete placed over the asphalt treated drainage blanket. When mix is placed on newly constructed cement or lime stabilized or treated layers, do not use vibratory rollers until base is approved by the Project Engineer and not for at least 5 days after such stabilization or treatment.

It is the responsibility of the contractor to determine the number, size, and type of rollers to sufficiently compact the mixture to the specified density and surface smoothness. Ensure that the rolling equipment is capable of maintaining the pace of the paver and conforms to 503.16.

The surface of mixtures after compaction shall be smooth and true to cross slope and grade within the tolerances specified. Remove mixtures that become loose, broken, contaminated or otherwise defective and replace with fresh hot mixture compacted to conform to the surrounding mixture.

Excessive rippling of the mat surface will not be accepted. Ripples are small bumps in the pavement surface which usually appear in groups in a frequent and regular manner. No more than 12 ripples or peaks will be allowed in any 100-foot section. Rippling indicates a problem with the paving operation or mix that requires immediate corrective action by the contractor; otherwise cease operations. Correct unacceptable areas at no direct pay.

After rolling, ensure that newly finished pavements have a uniform, tightly knit surface free of cracks, tears, roller marks or other deficiencies. Correct deficiencies at no direct pay and adjust operations to correct the problem. This may require the contractor to adjust the mix or furnish additional or different equipment.

502.10.2 SMA Compaction: SMA mixture is to be rolled immediately after placement by two steel wheel breakdown rollers capable of rolling the entire width of the mat in one pass. The rollers are to have a minimum weight of 10 tons. Rollers are to use high frequency and low amplitude. The mastic is not allowed to migrate to the surface. Rolling will continue until all roller marks are eliminated and the minimum density is obtained. Rolling operations will cease when the mat has cooled to 220°F and traffic will not be allowed on the roadway until the mix has cooled to 140°F or less.

502.10.3 Hand Compaction: Along forms, curbs, headers, walls and at other places inaccessible to rollers, compact the mixture uniformly to the satisfaction of the Project Engineer with approved hand tampers or mechanical tampers, conforming to 503.17.

502.11 ROADWAY ACCEPTANCE. Acceptance testing for pavement density and dimensional tolerances will be conducted on that portion of the lot placed on each contract. Acceptance testing for surface tolerance will be conducted upon completion of mainline paving.

Do not place asphalt concrete mixture exhibiting deficiencies such as segregation, contamination, lumps, non-uniform coating, excessive temperature variations, or other deficiencies apparent on visual inspection.

Correct and/or replace at no direct pay any asphalt concrete mix exhibiting deficiencies, such as segregation, contamination, alignment deviations, variations in surface texture and appearance or other deficiencies, apparent on visual inspection. Poor construction practices such as handwork, improper truck exchanges, improper joint construction, or other deficiencies, apparent on visual inspection, will be corrected at no direct pay.

502.11.1 Density by Pavement Cores: Obtain pavement samples from each sublot within 24 hours after placement. When this falls on a day the contractor is not working, sampling will be done within 3 calendar days. Sample at locations determined by the Project Engineer using random number tables shown in DOTD S605.

When the sampling location determined by random sampling falls within areas that are to be replaced or within 18 inches of the unsupported pavement edge, another random sampling location will be used.

Take cores, approximately 6 inches in diameter, with an approved core drill. Furnish samples cut from the completed work. Replace removed pavement with hot or cold mixture and refinish during the work day coring is performed at no additional pay. Sample in the presence of the Project Engineer's representative. Do not use cores less than 1 3/8 inches thick upon extrusion for payment determination. For transport by parties other than DOTD representatives, ensure that the acceptance cores are transported in accordance with the quality assurance manual. Any evidence of tampering with the acceptance cores during transport by contractor or third party will result in the cores being rejected and additional pavement samples being required.

The Project Engineer or his representative will transport cores in approved transport containers. When allowed, the contractor or third party will transport in an approved, tamper proof transport container.

There are typically five sublots for each lot. Mainline and minor mixes may be in the same lot/ sublot. Divide each of the sublots into two segments of approximately equal tonnage. For each sublot segment, the Department will determine sample locations using random sampling approach. Obtain one acceptance core at the designated sample location, obtain one quality control core approximately 12 inches in the direction of travel from the acceptance core. If the sublot segment has mainline mix uses, the acceptance cores will be taken from the mainline portion. A typical lot will have 10 acceptance cores and 10 quality control cores. Record the location and mix use of each core taken.

If a sublot has both mainline and minor uses, at least one acceptance core is required to represent the minor mix type. If the lot has any mixture used for mainline, a minimum of three cores is required to represent the mainline portion. Take additional acceptance cores randomly from the respective portions as needed to meet these requirements. Take additional quality control cores approximately 12 inches in the direction of travel from the any additional acceptance core collected.

In the presence of the Department roadway inspector, the contractor will perform the following: cutting, extracting, trimming, and cleaning the roadway cores. The Department roadway inspector will immediately take possession of the acceptance core. The contractor may transport the acceptance cores to the District Laboratory provided that the acceptance cores are transported in accordance with the quality assurance manual.

For projects with less than 250 tons, the job mix formula, materials, and plant and paving operations shall be satisfactory to the Project Engineer. Sampling and testing requirements may be modified by the Project Engineer and payment adjustment for deviations waived.

502.11.1.1 Testing of Roadway Cores: The District Laboratory will calculate the density of each acceptance roadway core using the bulk specific gravity (Gmb) of the core and the maximum specific gravity (Gmm) of the corresponding plant sublot. The percent density requirement for each mix use is shown in Table 502-5.

The contractor will calculate the density of each quality control core using bulk specific gravity (G_{mb}) of the core and the maximum specific gravity (G_{mm}) of the corresponding plant sublot.

All roadway acceptance and quality control core results will be submitted using the approved DOTD software. All core result determination shall be completed within 3 calendar days of the cores being extracted and placed in DOTD custody. The only exception is if the 3 calendar days fall on a weekend or legal holiday.

502.11.1.2 Verification of G_{mm}: Within two calendar days after the contractor timeframe to dispute roadway core densities (24 hours after the completion and reporting of all roadway core data) or after a roadway core density dispute is settled, one acceptance core tested by the Department will be randomly selected for verification of the theoretical maximum specific gravity, Gmm. If the verification Gmm is not within ± 0.024 of the average plant Gmm reported for the lot, notify the contractor and randomly select one core from each of the other sublots for verification. If the average verification Gmm is not within ± 0.024 of the average plant Gmm reported for the lot, notify the District Laboratory Engineer and the average Gmm determined by verification for the lot will be used to calculate percent density for all sublots in the lot.

A sample of a core broken down for G_{mm} verification will be sent to the DOTD Central Materials Laboratory for GPC testing at a rate of one per project or every 20,000 tons of a JMF.

Cores will be retained for a period of 10 days after density is reported.

502.11.1.3 Contractor Dispute: The contractor may dispute the results of acceptance core (Gmb) tests or verification of Gmm tests performed in a District laboratory. If the contractor believes that a District laboratory test result is in error, the contractor will substantiate the reason for the belief that the test result is in error and document the reasons in writing. The contractor will submit the written dispute to the Project Engineer and the DOTD Asphalt Technology Lab (ATL) manager. If the Project Engineer and DOTD ATL manager agree that there is sufficient reason to question the test result, the acceptance samples will be taken for testing by the DOTD ATL.

The contractor may dispute acceptance core (G_{mb}) test results within one business day of notification of the final acceptance core (G_{mb}) test result. A representative of the DOTD ATL will take possession of the acceptance cores of any disputed sublot. A DOTD ATL representative independent of the project may test the cores at any laboratory that is AASHTO R18 accredited.

The contractor may dispute verification of G_{mm} test results, within one business day of notification of the average G_{mm} verification test result. A representative of the DOTD ATL laboratory will take possession of the remaining acceptance cores from the District laboratory. A DOTD ATL representative independent of the project may perform G_{mm} testing at any laboratory that is AASHTO R18 accredited.

If the original District laboratory test results are found to have been accurate, the contractor shall bear a cost of $1,000 per sublot disputed for the additional core (G_{mb}) testing and evaluation or $1,000 for G_{mm} verification testing and evaluation. Such costs shall be deducted from any monies owed to the Contractor.

If the original District laboratory test results are found to be in error, the ADI and District Laboratory Engineer will investigate the cause of the error.

502.11.1.4 Minor Mix without Density: This minor mix shall have a neat, uniform appearance and be compacted by methods to the satisfaction of the Project Engineer. Plant quality control data will be submitted using the approved DOTD software. Any mixture placed while quality control data indicates the mixture is out of specification is subject to removal at the option of the Project Engineer.

502.11.2 Density by Non-Destructive Technologies (NDT): In addition to all required quality control testing, contractors may submit quality control density measurements collected using DOTD approved non-destructive technologies (NDT) in accordance with the quality assurance manual. Density measurements reported by NDT devices will be for informational purposes only, such as, to provide supporting documentation for a dispute claim. Density measurements reported by NDT devices will not be used in place of any required quality control or quality assurance testing.

502.11.2.1 Equipment and Operation: Use a non-destructive technologies (NDT) device meeting requirements of AASHTO T-343 or AASHTO T-355.

When performing NDT tests, set the device in the single reading and shallow penetration modes. A density measurement will consist of the average of five readings taken in accordance with the reading pattern described by the manufacturers procedure manual. Take readings where the pavement surface is flat and no surface moisture is evident. Use brush to clear loose particles from contact area.

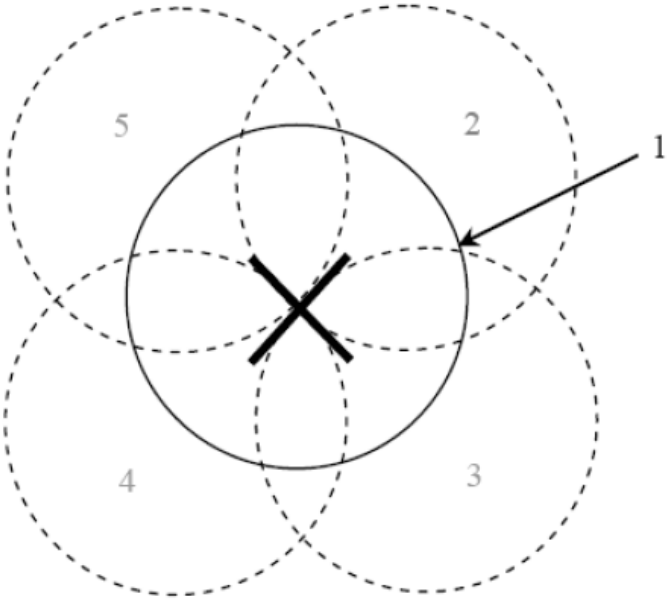
Verify the NDT device operation daily using the standardization plate issued with the gauge. Follow the Manufacturer's instructions for performing the standardization. Ensure each day's standardization result is within the limits established by the manufacture.

502.11.2.2 NDT Device Off-set Procedures: Prior to using NDT device measurements, an offset will be determined for each JMF, for each project. This offset will be established during mixture validation in the presence of DOTD personnel. On days when a control strip is being placed, the DOTD personnel must witness the contractor's personnel standard count procedure. The NDT device will be used to determine an average density from random locations determined by the DOTD personnel. The frequency of testing will be 20 locations within the validation lot. The center location of the device readings will be marked. Core specimens will be extruded from marked location after all NDT reading are conducted at that location. The device readings will be compared with the core densities in order to establish a working offset. The offset will be specific to that device, for that JMF, for that project. In the event that the JMF changes, or a new device is used, a new offset must be established.

Off-set procedures should be followed as listed below:

1. Contractor and DOTD technicians should jointly verify all NDT parameters for each device:
    a. Successful self-test at start up
    b. JMF G_{mm}
    c. Lift thickness
    d. Test mode
    e. Target density
    f. Correct any issue(s) prior to proceeding with field confirmation

2. DOTD personnel will select a random site on the mat:
    a. Location of random spots will be recorded
3. NDT readings should be taken in single mode and reading pattern should follow the 5-point star



method as seen below.

4. The QA gauge operator will conduct 50 NDT density tests, 5 readings at each of the 10 random core locations within the validation lot. The 5 readings from each location will be averaged into a single density measurement for that location.
5. Density gauge readings will be recorded on paper and in the density gauge if possible.
6. Follow core sampling, trimming, handling and transport procedures outlined in section 502.11.1.
7. The off-set will be determined by subtracting the device density from the core density. An average offset is determined using the 10 locations. The off-set will be applied on subsequent lots of the same JMF, with the same device, during the construction of the project.

502.11.2.3 Roadway Testing Procedures: There are typically five sublots for each lot. Mainline and minor mixes may be in the same lot/ sublot. Divide each of the sublots into two segments of approximately equal tonnage each. For each sublot segment, the Department will determine sample locations using random sampling approach. The department will obtain one acceptance device density reading (average of 5 spot readings) at the designated sample location. The contractor will obtain one quality control device density reading (average of 5 spot readings) approximately 12 inches in the direction of travel from the acceptance reading. If the sublot segment has mainline mix uses, the acceptance reading will be taken from the mainline portion. A typical lot will have 25 acceptance readings and 25 quality control readings. Record the location and mix use of each reading taken.

The NDT density readings will be entered into an approved DOTD software. The off-set value determined during validation will be applied in the software and reported. All result determination shall be completed within 1 calendar day. Differences between the Contractor's quality control and the Department's quality assurance density results will be considered acceptable if within ± 1.3%.

One destructive field core will be cut from the roadway every lot for offset verification. The location will be determined randomly by DOTD.

502.11.2.4 Disputed NDT Device Readings: In the event of a questionable NDT device reading, a core will be extracted from the center location of the 5 readings. The core density will replace that NDT device reading for determination of pay. If the core density is found to be unacceptable, the roadway inspector will isolate the questionable section with the NDT device. Corrective action or reduction in pay may be associated with the section.

502.12 SURFACE TOLERANCE EQUIPMENT, QUALITY CONTROL, ACCEPTANCE, MEASUREMENT AND PAYMENT ADJUSTMENT. Measure the top two lifts of the mainline travel lanes with an DOTD certified inertial profiler. Maintain record of intermediate measures of smoothness quality as described herein. Final acceptance will be based on the last measurement taken on the final wearing course of the travel lanes. Measurement of the center two lanes will be required for airports. Constantly monitor equipment, materials, and processes to ensure that surface tolerance requirements are met.

502.12.1 Equipment: For longitudinal surface tolerance quality control testing and acceptance testing on mainline wearing and binder courses, furnish and use a DOTD certified inertial profiler. DOTD certified profilers will have a DOTD decal indicating the date of certification and profiler system parameter settings. Measure longitudinal surface profile in inches per mile in accordance with DOTD TR 644 and report as the International Roughness Index (IRI).

Verify the profiler system parameter settings before each run. Demonstrate the daily set up procedure and pre-operation tests in accordance with the manufacturer's procedures and DOTD TR 644. Ensure that a copy of the manufacturer's setup, pre-operation, and general operating procedures for measuring surface tolerance are available at all times during measurement.

For transverse smoothness, cross slope, and grade testing, furnish a 10-foot metal static straightedge and electronic or static level for quality control and for Department use. The straightedge and level will also be used for longitudinal quality control testing for mainline wearing course, mainline binder course, and minor wearing course (bike paths, detour roads, parking lots, and shoulders).

502.12.2 Longitudinal Surface Tolerance Quality Control: Within 7 calendar days of placement, for mainline wearing and binder courses, run the certified profiler. View the raw data with ProVAL to determine IRI for each wheelpath. Make corrections to operation and/or mixture to ensure that the overall ride and individual bump requirements are met. Ensure that the following quality requirements are met:

1. Produce IRI which meets the requirements for 100 percent pay in accordance with Table 502-8. Continued surface tolerance penalties are not allowed.
2. Correct all individual bumps which are more than longitudinal value specified in Table 502-5 when tested with a 10-foot metal static straightedge. The Rolling Straightedge Simulation in ProVAL may be used to help identify these bumps.
3. Correct ripples to the satisfaction of the Project Engineer. Report the Rolling Straightedge Simulation for areas with 12 or more small, regular (less than 1/4 inch) bumps in a 100-foot section or for any areas in question.

Minor mixes shall comply with Table 502-5. For minor mixes, use the 10-foot metal static straightedge to check for conformance to specifications.

502.12.3 Transverse Smoothness, Cross Slope, and Grade: The Department will test the surface of the binder and wearing courses at selected locations for conformance to the surface tolerance requirements of this subsection and Table 502-5.

502.12.3.1 Transverse Smoothness: Areas with surface deviations in excess of specification limits shall be isolated and corrected in accordance with 502.12.4. Control the transverse surface finish.

502.12.3.2 Cross Slope: When the plans require the section to be constructed to a specified cross slope, take measurements at selected locations using a stringline, a slope board, an electronic or static level mounted on a 10-foot metal static straightedge, or other comparable device. Control the cross slope for each lane to comply with the tolerances shown in Table 502-5. Make corrections in accordance with 502.12.4.

502.12.3.3 Grade: When the plans require the pavement to be constructed to a specified profile grade, test for conformance at selected locations, using a stringline or other comparable device. Control grade variations so that the tolerances shown in Table 502-5 are not exceeded. Grade tolerances shall apply to only one longitudinal line, such as the centerline or outside edge of pavement. Make corrections in accordance with 502.12.4.

502.12.4 Correction of Deficient Areas: Correct areas as required in 502.12.2 and 502.12.3 and those not meeting Table 502-5. Correct wearing and binder courses as defined in this subsection at no direct pay. In lieu of grinding, the Project Engineer may penalize the contractor $1000 per individual bump specified in Table 502-5 or per "Ripple" as defined in 502.12.2.

502.12.4.1 Deficiencies in Mainline Wearing Course: Correct deficiencies in the final wearing course by:

1. by diamond grinding and applying a light tack coat; or
2. by furnishing and placing a supplemental layer of wearing course mixture at least 1½ inches compacted thickness for the full width of the roadway meeting specification requirements; or
3. by removing and replacing mixture.

If the supplemental layer does not meet specification requirements of Table 502-5, remove and replace or correct it by other methods approved by the Project Engineer.

For areas that will not be improved by grinding such as minor dips, extreme vertical curves, or other areas that are not exempt as measured with a 10 feet metal static straight edge, the Project Engineer may waive the requirement to grind as specified in 502.12.4.

502.12.4.2 Deficiencies in Mainline Binder Courses: Correct deficiencies in binder course: longitudinal, transverse, cross slope, and grade to meet specification requirements by diamond grinding, by milling, or by removing and replacing mixture. Make corrections before subsequent courses are constructed.

502.12.4.3 Deficiencies in Minor Mixes: Correct deficiencies in minor mixes by diamond grinding or approved method at the Project Engineer's direction.

502.12.5 Longitudinal Surface Tolerance Acceptance: Measure the top two lifts of the mainline travel lanes with a DOTD certified inertial profiler. Final acceptance will be based on the last measurement taken on the final wearing course of the travel lanes. Measurement of the center two lanes will be required for airports.

Measure surface tolerance at the completion of the project, or an approved portion of the project in accordance with 105.17.1, and after all corrections have been made in accordance with 502.12.2. Measure the mainline wearing course continuously from start to finish in the direction of travel. The measurement shall be performed by the contractor in the presence of the DOTD certified inspector. The measurement may also be made by the Materials and Testing Section or by a private company approved by the Department. Report one IRI measurement in inches per mile for the entire project or an approved portion of the project. Although grinding may be waived by the Project Engineer, the measured roughness will still contribute to the total IRI for the project. A stand-alone pay adjustment factor will be determined in accordance with 502.15.

Place a start and stop mark at the beginning and end of each travel lane so that measurements can be rerun by the Department if needed. To ensure that the contractor has corrected deficiencies, the Department may spot check for 1/4 inch bumps in accordance with 502.12.2. Partial acceptance due to phasing, sequence of construction, or unavoidable lengthy delay may not exceed 100 percent pay. However, payment exceeding 100 percent for this section of roadway will only be allowed if the smoothness re-measured at the completion of the project meets the requirements of Table 502-8.

For mainline category D measure and submit IRI data to the DOTD certified inspector before starting paving operations.

The DOTD certified inspector will be present for acceptance IRI measurements and will immediately receive a copy of the raw data, the ".erd file" and any files with information about the project, the operator, the equipment, the settings, daily pre-operation results, and a copy of the IRI results via USB flash drive provided by the contractor. In addition to the data transferred by USB storage device, provide to the DOTD certified inspector a paper copy of the IRI report. Acceptance for the project will be in accordance with Tables 502-8, based on the data. The Department may elect to perform and utilize independent ride quality measurements for acceptance at any time.

502.12.5.1 Exclusions: Acceptance IRI measurements shall be taken in its entirety, without exclusions. The Department will then review the profile report obtained for each lane of the mainline wearing course. In special cases or extenuating circumstances, the Project Engineer may isolate or exclude sections of the profile. These include the following:

1. Bridge ends, and sections that are within 150 feet of bridge ends;
2. Outside wheelpath of curb and gutter sections that require adjustment in order to maintain adequate drainage;
3. Manholes, catch basins, valve and junction boxes;
4. Street intersections or rail road crossings of a different grade;
5. Structures located in the roadway which cause abrupt deviations in the profile;
6. Transitions to and from ramps and turn lanes and sections within 200ft of the limits of the project if the limits begin or end at an intersection;
7. Sections where the Project Engineer determines that attaining smoothness is beyond the contractor's reasonable control.

Exclusions will not be used to simply isolate sections of road that are in poor condition when the project is let. The roughness in excluded areas will not be included in the total IRI used for payment purposes. All bumps shall be corrected in the excluded areas to meet the requirements of 502.12.2. The quantity of asphalt represented by the length excluded will not receive a pay adjustment for surface tolerance.

502.12.6 Surface Tolerance Measurement: Measure and report the average IRI of mainlines lane prorated for the entire project.

502.13 DIMENSIONAL REQUIREMENTS. Ensure that mixtures conform to the following dimensional requirements only. No other acceptance tests will be required for these mixtures. Over-thickness and over-width will be accepted at no direct pay.

502.13.1 Thickness: For mixture specified for payment on cubic yard or square yard basis, thickness of mixtures will be determined by the Department in accordance with DOTD TR 602. Under-thickness shall not exceed 1/4 inch.

Correct area under-thickness in excess of 1/4 inch to plan thickness at no direct pay. Furnishing and placing additional mixture in accordance with 502.12.4.1. Correct excesses of 1/2 inch for category D, Table 502-8. When grade adjustments do not permit placing additional mixture, remove the deficient under-thickness area and replace at no additional pay.

For mixtures specified for payment on a per ton basis, thickness of mixtures will be determined by the plans, Table 502-6 (or Table 502-6b for ADT ≤ 1000), and that agreed to with the Project Engineer. Under thickness shall not exceed 1/2 inch. Removal and replacement of deficient under-thickness area(s) or other approved remediation agreed to by the Project Engineer will be at no direct pay.

502.13.2 Width: The width of completed courses will be determined in accordance with DOTD TR 602. Correct under-widths by furnishing and placing additional mixture to a minimum width of 1 foot and plan thickness at no direct pay.

502.14 MEASUREMENT. Measure asphalt concrete by the ton of 2,000 pounds from printed weights as provided in Section 503. Provide stamped printer tickets with each truckload of material delivered denoting JMF number and plant tonnage. Material lost, wasted, rejected or applied contrary to specifications will not be measured for payment.

Any NDT performed shall not be measured for payment.

Removal of pavement markings will be considered incidental to the associated asphalt pay item and will not be measured for pay.

Estimated quantities of asphalt concrete shown on the plans are based on 110 lb/sq yd/inch thickness. The measured quantity of asphalt mixtures will be multiplied by the following adjustment factors to obtain the pay quantity.

Theoretical Maximum Specific Gravity, (G_{mm}) (DOTD TR 327)	**Adjustment Factor**
2.340 - 2.360	1.02
2.361 - 2.399	1.01
2.400 - 2.540	1.00
2.541 - 2.570	0.99
2.571 - 2.590	0.98

The adjustment factor for mixtures with theoretical maximum specific gravities less than 2.340 or more than 2.590 will be determined by the following formulas:

Theoretical maximum specific gravity less than 2.340:

$$F = \frac{2.400}{S}$$

Theoretical maximum specific gravity more than 2.590:

$$F = \frac{2.540}{S}$$

where,

F = quantity adjustment factor

S = theoretical maximum specific gravity of mixture from approved job mix formula

502.14.1 Volume or Area Measurement: The quantities for payment will be the design quantities specified in the plans and adjustments thereto. Design quantities will be adjusted when the Project Engineer makes changes to adjust the field conditions or when design changes are necessary. Design quantities are based on the horizontal dimensions and compacted thickness of the completed course shown on the plans.

502.15 PAYMENT.

502.15.1 Payment General: Payment for all mixes will be at the contract unit price of asphalt mixture accepted on the roadway. Payment for asphalt concrete will include furnishing all required materials, producing the mixtures, preparing the surfaces on which the mixtures are placed, hauling the mixtures to the work site, and placing and compacting the mixtures. Any NDT performed will be considered incidental to the associated asphalt pay item. When the mix does not meet requirements, payment adjustments shall be assessed. Production of mix that is not eligible for 100 percent payment will not be allowed on a continuous basis. When test results demonstrate that payment adjustments are necessary, satisfactory mixture and compaction adjustments shall be made, or production shall be discontinued. All calculations for percent payment adjustments will be rounded to the nearest one (1) percent. Payment for removal of pavement markings will be considered incidental to the associated asphalt pay item. Payment adjustments will be cumulative and determined in accordance with 502.14 and the QA Manual.

502.15.2 Payment for Mixture with Density Requirements:

502.15.2.1 Mainline Mixtures: For all mainline mixtures, adjustments in contract unit price for roadway density as required by Table 502-5 and will be based on PWL using Table 502-9 and Table 502-10 for all acceptance cores with mainline uses in the lot. This payment adjustment will be applied to the mainline tonnage and contract unit price.

In addition, for mainline wearing course, a separate pay adjustment for surface tolerance based on Table 502-8 shall apply for all travel lanes based on the theoretical mainline lane quantity and contract unit price.

The theoretical quantity is computed by using the plan width, the plan thickness, and the total length of travel lanes, without exclusion areas.

502.15.2.2 Mainline Mixtures (≤1000 ADT): Pay for Mainline mixtures with ADT ≤ 1000 may, at the contractor's request at the preconstruction conference, be determined using the average method. Otherwise, pay will be determined as per Section 502.15.2.1. When the average method is being used, the average of the acceptance cores for mainline use for each sublot will be used to determine the sublot pay adjustment using Table 502-7 and the density requirement in Table 502-5. The final pay adjustment for the lot will be determined using a weighted average on tonnage. When using the average method for pay of mainline mixtures, each individual mainline core density must be equal to 90.5 percent density or greater. Segments not meeting the individual core minimum density criteria will have additional cores taken at the direction of the Project Engineer to identify the localized deficient area. The localized deficient area will incur a 50 percent pay adjustment or be subject to removal and replacement at no direct cost to the Department at the discretion of the Chief Engineer.

502.15.2.3 Minor Mixtures: Pay will be determined on the average of acceptance cores for minor use per sublot and the pay of all sublots in the lot will then be averaged to determine the final pay for each lot. Adjustments in contract unit price for roadway density as required by Table 502-5 and will be based on sublot average for minor uses using Table 502-7.

502.15.2.4 Lots with Mainline and Minor: Determine pay using 502.15.2.1 and 502.15.2.2 for the respective uses. Compute the final lot pay percentage for percent density using a weighted average by mix use for the tonnage of the lot. Tonnage representing minor mixture without density requirements is treated as 100 percent pay for purposes of the weighted average.

502.15.3 Payment for Tack: Tack coat as required in 502.08.2.2 "Applying Tack Coat" will be considered incidental to the 502 item. If the Project Engineer adjusts the application rate of tack coat from that specified by the contract document, payment for the asphalt mixture will be increased or decreased based on the difference in the applied quantity of asphalt emulsion shown on paid invoices (total of charges). The contractor shall provide copies of paid invoices for this determination.

502.15.4 Payment Adjustment for Asphalt Cement: A payment adjustment of 50 percent of the 502 item will apply to areas of mixture placed that do not meet specification but are within one asphalt grade of the specification. Mixture placed that exceeds one lower grade difference in specification will be subject to removal and replacement at no direct cost to the Department at the discretion of the Chief Engineer.

The DOTD Central Materials Laboratory and the DOTD Asphalt Technology Laboratory will evaluate the roadway and the contractor's documentation to isolate the area of mixture placed with the lower asphalt grade.

502.15.5 Payment Adjustment for Surface Tolerance: For mainline wearing course, apply a percent payment adjustment as described in Table 502-8 for the total theoretical quantity of tons represented in each lane of the mainline wearing course. Apply the adjustment to the total theoretical quantity and contract unit price.

The total theoretical quantity is computed by using the total length of lanes, the plan thickness, and the plan width, excluding shoulders, minor mixes, and excluded areas as described in 502.12.5.1.

This pay adjustment is in addition to the pay adjustments for density as described in 502.15.2.

502.15.6 Payment for Erected Stringline: When the use of an erected stringline is not specified, but directed by the Project Engineer, an additional payment of $3500 per contract plus $0.25 per linear foot will be made for mixtures placed by the erected stringline method. When the use of an erected stringline is specified, no additional payment will be made.

Payment will be made under:

Item No.	Pay Item	Pay Unit
502-01	Asphalt Concrete	Ton
502-02	Asphalt Concrete	Cubic Yard
502-03	Asphalt Concrete, (Inches Thick)	Square Yard
502-04	Asphalt Concrete (SMA) Wearing Course	Ton

Table 502-4
Plant Produced Asphalt Mixture Requirements and Tolerances

	REQUIREMENTS FOR EXTRACTED ASPHALT CEMENT AND AGGREGATE GRADATION						
U.S. (Metric) Sieve % Passing	½ inch SMA	3/8 inch Nominal	½ inch Nominal	¾ inch Nominal	1 inch Nominal	1.5 inch Nominal	Production Tolerances
2 inch	–	–	–	–	–	100	± 4
1 ½ inch	–	–	–	–	100	90 – 100	± 4
1 inch	–	–	–	100	90 – 100	89 Max.	± 4
¾ inch	100	–	100	90 – 100	89 Max.	–	± 4
½ inch	90 – 100	100	90 – 100	89 Max.	–	–	± 4
3/8 inch	75 Max.	90 – 100	89 Max.	–	–	–	± 4
No. 4	24 – 34	89 Max.	–	–	–	–	± 4
No. 8	16 – 28	32 – 67	29 – 58	26 – 49	23 – 45	19 – 41	± 3
No. 16	–	–	–	–	–	–	± 2
No. 30	12 – 25	–	–	–	–	–	± 2
No. 50	11 – 22	–	–	–	–	–	± 2
No. 100	–	–	–	–	–	–	± 2
No. 200	7 – 13	4.0 – 10.0	4.0 – 10.0	3.0 – 8.0	2.0 – 7.0	1.0 – 6.0	± 0.7
Extracted Asphalt, %	6.0 Min.	–	–	–	–	–	± 0.2
Mix Temperature	–	–	–	–	–	–	± 25˚F

Table 502-5
Asphalt Pavement Requirements

Density, Minimum Percent of Theoretical Maximum Specific Gravity (%Gmm), AASHTO T209 Method C				
Mainline, SMA	93.5			
Mainline	92.0			
Minor with density	90.0			
Surface Tolerance Variation[1]	Longitudinal[2] inches	Transverse[2] inches	Cross Slope[2] inches [%]	Grade[3] inches
Mainline Wearing Courses, Category A, B	1/4	1/8	3/8 [0.3]	1/2
Mainline Wearing Courses, Category C	1/4	1/4	1/2 [0.4]	1/2
Mainline Wearing Courses, Category D	1/2	1/2	3/4 [0.6]	3/4
Mainline Binder Courses	1/4	1/2	3/4 [0.6]	3/4
Minor Mixes[4]	3/8	3/8	3/4 [0.6]	3/4
Bike Paths, Detour Roads and Parking Lots	1/2			
Shoulder, Ramps < 300’	1/2			

[1]Mainline categories based on Table 502-8.
[2]Based on 10 feet, using 10-foot static straightedge and static or electronic level.
[3]Applicable only when profile grade is specified.
[4]Except bike paths, detour roads, parking lots, shoulders, and ramps less than 300 feet.

Table 502-6
Asphalt Concrete General Criteria

Nominal Max., Size Agg.	0.5 inch (12.5 mm)			0.75 inch (19 mm)			1.0 inch (25 mm)				1.5 inch (37.5 mm)	SMA
Type of Mix	Incidental Paving[1]	Wearing Course		Wearing Course	Binder Course		Binder Course		Base Course	ATB[7]	Base Course	Wearing
Level[2]	A	1	2	2	1	2	1	2	1	1	1	2
Coarse Agg. Angularity, % Crushed, (Double Faced), Min. %	55	75	95	95	75	95	75	95	75	75	75	98
Fine Agg. Angularity, Min. %	40	40	44	44	40	44	40	44	40	40	40	45
Flat and Elongated Particles (5:1), Max. %	10											5[9]
Sand Equivalent, Min. %	40	40	45	45	40	45	40	45	40	40	40	NA
Natural Sand - Max. %	---	15		15			15			25	25	0
Asphalt Binder		Table 502-2, (3% minimum for Asphalt Treated base (ATB), 6% min for SMA)										
RAP, Max. % of Mix[3]	25	20	20	20	25	25	25	25	35	35	35	0
	Compacted Mix Volumetrics											
VMA @ N_{design}, Min. %	13.5	13.5	13.5	12.5	12.5	12.5	11.5	11.5	11.5	n/a	10.5	16.0
Air Voids @ N_{design}, %[4]		(2.5-4.5); (no limit for ATB)										
VFA @ N_{design}, %[5]		(69-80); no limit for ATB; no maximum for SMA										
$N_{initial}$ 90% max.[6] (Gyrations)	7	7	7	7	7	7	7	7	7	n/a	7	7
N_{design} 96.5±1 % (Gyrations)	55	55	65	65	55	65	55	65	55	30	55	65
N_{max} 98 % max. (Gyrations)	90	90	105	105	90	105	90	105	90	n/a	90	65
LWT, max. rut-design, mm @ # passes, @ 50^0C	10 @ 10,000	10 @ 20,000	6 @ 20,000	6 @ 20,000	10 @ 20,000	6 @ 20,000	10 @ 20,000	6 @ 20,000	12 @ 20,000	10 @10,000	12 @ 20,000	6 @ 20,000
Dust/Effective Asphalt Ratio, %	0.6 – 1.6											
SCB, min, Jc, KJ/m^2 @ 25^0C	---	0.5	0.6	0.6	0.5	0.6	0.5	0.6	---	---	---	0.6
Design Lift Thickness, inch[8]	≤2.0	1.5–2.0		1.5–2.0	2.0–3.0		2.5–4.0		≥2.5	≥3.0	≥4.0	1.5-2.0

[1]May be used for minor mix uses (except patching and widening), airports, and other incidental items approved by the Project Engineer. (May be used as a standard roadway mix for local governments.)
[2]Mixtures designated at Level 1F and 2F shall meet the requirements of Level 1 and 2, respectively. Additionally, Level 1F and 2F shall meet the friction rating requirements in Table 502-3 for travel lane wearing courses.
[3]RAP is not be allowed for airports or SMA.
[4]Air voids mix design target is a 3.5 percent.
[5]Mix design minimum VFA is 72.0%, Mix design minimum VFA for PG76-22rm is 75.0%, and 71% for 25 mm NMS mixtures.
[6]For Level 1 mixtures, $N_{initial}$ shall be 91.0% max. For Level A mixes, $N_{initial}$ shall be 92.0% max.
[7]Asphalt Treated Base (ATB) may be used for patching of base material, for shoulder <3500 ADT and maintenance widening; when used achieve average density of 90% of G_{mm} as measured per minor mix table.
[8]Absolute minimum of lift thickness across width equal to 1/2 inch lower than minimum lift thickness.
[9]Also must meet a maximum of 25 percent at a 3:1 ratio.

Table 502-6b
Asphalt Concrete General Criteria (<1000 ADT)

Nominal Max., Size Agg.	0.375 inch (9.5 mm)		0. 5 inch (12.5 mm)	
Type of Mix	Incidental Paving[1]	Wearing Course	Incidental Paving[1]	Wearing Course
Coarse Agg. Angularity, % Crushed, (Double Faced), Min. %	55	75	55	75
Fine Agg. Angularity, Min. %	40	40	40	40
Flat and Elongated Particles (5:1), Max. %	10			
Sand Equivalent, Min. %	40	40	40	40
Natural Sand - Max. %	---	20	---	15
Asphalt Binder		Table 502-2		Table 502-2
RAP, Max. % of Mix[2]	25	20		20
	Compacted Mix Volumetrics			
VMA @ N_{design}, Min. %	15.0	15.0	14.0	14.0
Air Voids @ N_{design}, %[3]		2.5-4.5		2.5-4.5
VFA @ N_{design}, %[4]		72-80		72-80
N_{design} 96.5±1 % (Gyrations)	40			
N_{max} 98 % max. (Gyrations)	40			
LWT, max. rut-design, mm @ # passes, @ 50^{0}C	10 @ 10,000	10 @ 15,000	10 @ 10,000	10 @ 15,000
Dust/Effective Asphalt Ratio, %	0.6 – 1.6			
SCB, min, Jc, KJ/m^2 @ 25^{0}C	---	SCB, min, Jc, KJ/m^2 @ 25^{0}C	---	SCB, min, Jc, KJ/m^2 @ 25^{0}C
Design Lift Thickness, inch[5]	≤2.0	Design Lift Thickness, inch[5]	≤2.0	Design Lift Thickness, inch[5]

[1]May be used for minor mix uses (except patching and widening), airports, and other incidental items approved by the Project Engineer. (May be used as a standard roadway mix for local governments.)

[2]RAP is not be allowed for airports or SMA.

[3]Air voids mix design target is a 3.5 percent.

[4]Mix design minimum VFA is 72.0%, Mix design minimum VFA for PG76-22rm is 75.0%

[5]Absolute minimum of lift thickness across width equal to 1/2 inch lower than minimum lift thickness.

Table 502-7
Payment Adjustment Schedule for Minor Mixture and Low (≤1000) ADT Mainline Mixture

Parameter	Percent of Contract Unit Price per Lot		
	100	90	50 or Remove[1]
Average Roadway Density of Lot, % G_{mm}	≥ Lower Limit	-0.1 to -0.9 below lower limit	-1.0 or greater below lower limit

[1]At the option of the Chief Engineer

Table 502-8
Payment Adjustment Schedules for Longitudinal Surface Tolerance, Maximum International Roughness Index, Inches per Mile

Percent of Contract Unit Price per Travel Lane	**102%**	**100%**	**98%**	**80%**	**50% or Remove[1]**
Category A [2] All Interstate and Three or More Lift Construction	<45	<65	65-85	86-105	>105
Category B[2] Two Lift Overlays Over Milled Surface and Two Lift Overlay Over Improved Base	<55	<75	75-95	95-115	>115
Category C Two lift Overlay Over Existing Surface, Single-Lift Overlays with Surface Prep., and Single Lift Overlays Over Milled Surfaces or Improved Base	<55	<85	85-110	111-130	>130
Category D Single-Lift Overlays Over Unimproved Surfaces[3,4]	N/A	20% Reduction	0% - 19% Reduction	N/A	IRI Increase

[1] At the option of the Chief Engineer
[2] Remove and replace any individual 0.05-mile segment having an average greater than 150 in/mile. Removal and replacement will be at the direction of the Chief Engineer. This note does not apply to excluded areas.
[3] A project with an unimproved surface has no surface preparation item.
[4] IRI measurements taken before and after construction.

Table 502-9
Quality Index Values for Estimating Percent Within Limits (PWL)[1,2]

PWL	n = 3	n = 4	n = 5 - 6	n = 7 - 9	n = 10 - 12	n = 13 -15 or greater
99	1.16	1.47	1.68	1.89	2.04	2.14
98	1.15	1.44	1.61	1.77	1.86	1.93
97	1.15	1.41	1.55	1.67	1.74	1.80
96	1.15	1.38	1.49	1.59	1.64	1.69
95	1.14	1.35	1.45	1.52	1.56	1.59
94	1.13	1.32	1.40	1.46	1.49	1.51
93	1.12	1.29	1.36	1.40	1.43	1.44
92	1.11	1.26	1.31	1.35	1.37	1.38
91	1.10	1.23	1.27	1.30	1.32	1.32
90	1.09	1.20	1.23	1.25	1.26	1.27
89	1.08	1.17	1.20	1.21	1.21	1.22
88	1.07	1.14	1.16	1.17	1.17	1.17
87	1.06	1.11	1.12	1.12	1.13	1.13
86	1.05	1.08	1.08	1.08	1.08	1.08
85	1.03	1.05	1.05	1.05	1.04	1.04
84	1.02	1.02	1.02	1.01	1.00	1.00
83	1.00	0.99	0.98	0.97	0.96	0.96
82	0.98	0.96	0.95	0.94	0.93	0.92
81	0.96	0.93	0.92	0.90	0.89	0.89
80	0.94	0.90	0.88	0.87	0.85	0.85
79	0.92	0.87	0.85	0.83	0.82	0.82
78	0.89	0.84	0.82	0.80	0.79	0.78
77	0.87	0.81	0.79	0.77	0.76	0.75
76	0.84	0.78	0.76	0.74	0.72	0.72
75	0.82	0.75	0.73	0.71	0.69	0.69
74	0.79	0.72	0.70	0.67	0.66	0.66
73	0.77	0.69	0.67	0.64	0.63	0.62
72	0.74	0.66	0.64	0.61	0.60	0.59
71	0.71	0.63	0.60	0.58	0.57	0.56
70	0.68	0.60	0.58	0.55	0.54	0.54
69	0.65	0.57	0.55	0.53	0.51	0.51
68	0.62	0.54	0.52	0.50	0.48	0.48
67	0.59	0.51	0.49	0.47	0.46	0.45
66	0.56	0.48	0.46	0.44	0.43	0.42
65	0.53	0.45	0.43	0.41	0.40	0.40
64	0.49	0.42	0.40	0.38	0.37	0.37
63	0.46	0.39	0.37	0.35	0.35	0.34
62	0.43	0.36	0.34	0.33	0.32	0.31
61	0.39	0.33	0.31	0.30	0.30	0.29
60	0.36	0.30	0.28	0.27	0.26	0.26
59	0.32	0.27	0.25	0.24	0.24	0.23
58	0.29	0.24	0.23	0.21	0.21	0.21
57	0.25	0.21	0.20	0.19	0.18	0.18
56	0.22	0.18	0.17	0.16	0.16	0.15
55	0.18	0.15	0.14	0.13	0.13	0.13
54	0.14	0.12	0.11	0.11	0.10	0.10
53	0.11	0.09	0.08	0.08	0.08	0.08
52	0.07	0.06	0.06	0.05	0.05	0.05
51	0.03	0.03	0.03	0.03	0.03	0.03
50	0.00	0.00	0.00	0.00	0.00	0.00

[1] For negative values of Qu or QL. PWLU or PWLL is equal to 100 minus the tabular PWLU or PWLL.
[2] If the value of QU or QL does not correspond exactly to a value in the table, use the next higher value.

Table 502-10
Payment Adjustment for Mainline Pavement Density (PWL)

Roadway Density PWL	Percent Payment
81-100	100
71-80	98
61-70	90
51-60	80
≤50	50 or remove

Section 503
Asphalt Concrete Equipment and Processes

503.01 DESCRIPTION. This section specifies requirements for the certification of asphalt concrete plants and paving equipment. It includes methods and equipment for handling and storing materials, producing asphalt concrete, and transporting and placing asphalt concrete at the job site.

The Department's publication entitled "Application of Quality Assurance Specifications for Asphalt Concrete Mixtures" is hereby made a part of this specification by reference.

503.02 PLANT EQUIPMENT.

503.02.1 General: Provide equipment and processes to proportion aggregates, additives and asphalt cement in accordance with the approved Job Mix Formula (JMF). When the automatic adjustments or other critical control and shutoff devices are not functioning, do not operate the plant. Operate the plant with clean, easily accessible, and accurate thermometers, scales and meters. Immediately repair, replace, or recalibrate equipment when faulty operation is detected.

Provide a system with positive weight control of cold aggregates fed by a belt scale or other device interlocked with the asphalt measuring system to maintain required proportions of combined aggregates and asphalt cement. Heat, dry and mix aggregates with asphalt cement to produce a homogeneous mixture in which all aggregate particles are uniformly coated. Use approved methods to discard the first and last output of the plant after each interruption. Place discarded material in a separate dedicated area.

Digitally display the total quantities and the rates of production of every material used on a DOTD project.

503.02.2 Certification and Calibrations: The Department will certify plants furnishing asphalt mixtures every two years with current Departmental procedures or when any major component is repaired, replaced or upgraded. The plant owner is required to report any major component upgrades to the District Laboratory Engineer. Forward all documentation available upon request by the Department. All plant components and processes are subject at any time to inspection and approval by the District Laboratory Engineer. The plant owner is required every 90 days to have the laboratory gram scales, ignition oven scales, truck platform scales, and weight batchers tested, inspected, and calibrated by a qualified independent scale service or the Weights and Measures Division, Louisiana Department of Agriculture and Forestry.

Within 10 working days of the 90 days plant scale recalibration, the Certified Asphalt Concrete Plant Technician, in accordance with 503.09, will verify calibration of the plant's cold feed bins, RAP feed bins, weight bridges, asphalt pump, and additives measuring devices to stated DOTD standards. The Certified Asphalt Concrete Plant Technician shall notify the DOTD certifying District Laboratory two days prior to plant calibration.

Provide a plant site laboratory conforming to 722.02 as a part of the plant facilities at no direct pay, except as modified herein. Each plant laboratory shall have a minimum floor space of 400 square feet. Laboratories are to be provided for all Quality Assurance testing. Calibrate, verify and document all laboratory equipment according to the procedures, test methods, and frequency in accordance with the current "LADOTD Laboratory Equipment Manual."

503.03 AGGREGATES.

503.03.1 Stockpiles: Store aggregates at the plant site so that no intermixing, segregation, pooling of water or contamination will occur. Ensure that gradation and other properties of aggregate in stockpiles are combined in proper proportions so that the resulting combined gradation will meet the requirements of the approved JMF.

503.03.2 Cold Feed Bins: Blend and proportion all aggregates in cold feed bins.

Provide cold aggregate bins of sufficient size to store the amount of aggregates required for continuous plant operation. Provide a cold bin feed system capable of uniformly delivering the maximum number of required aggregate sizes in their proper proportion. Extend partitions between bins a minimum of 1 foot above the top of bins sufficient to prevent intermixing of aggregate sizes. Do not use the partition as part of the bin.

Calibrate the cold feed system based on the weight of bin material. Feed material from a bin through the individual orifice and bypass to a container to be weighed, or over the calibrated weigh bridge. Calibrate material from each bin separately. Calibrate with manufacturer's recommended procedures and keep records on file. The calibration process shall be part of the contractor's quality control.

Provide an automatic plant no flow alarm and shutoff to cease operations when any aggregate bin becomes empty or flow is interrupted for 20 seconds. If repeated no flow indications are evident, cease operations until continuous flow can be maintained. Provide belt scales for conveyor systems and calibrate accordingly.

When more than one cold bin feeder is used, operate each as a separate unit. Integrate the individual controls with a master control for all materials.

503.03.3 Moisture: Make provisions for introducing the latest moisture content of the cold feed aggregates into the belt weighing system, thereby correcting the conversion of wet aggregate weight to dry aggregate weight. Digitally display dry weight of the aggregate flow in appropriate units.

503.03.4 Screens: Provide a static screen system on top of the fine sand cold feed bin system and the RAP bin system, to ensure removal of objectionable material.

When a belt scale is used, provide a vibrating scalping screen between the cold bin system discharge and the belt scale. Size the screens to remove all oversize aggregate and other objectionable material.

503.03.5 Reclaimed Asphalt Pavement (RAP): If RAP is used, provide a separate cold feed system. Include a scalping screen, bin, feeder belt, and weigh bridge which is fully integrated with the cold feed system and asphalt cement supply system. Calibrate this system in accordance with 503.02.2 and 503.03.2. Add RAP to the dryer in a location as recommended by the manufacturer so that it does not expose the material to direct flame.

503.04 ASPHALT CEMENT.

503.04.1 Working Tank: Provide an asphalt cement working tank capable of uniformly heating the material, under positive control, to the required temperature as recommended by the supplier by methods approved by the District Laboratory Engineer. Provide an asphalt circulating system of adequate size to ensure proper and continuous circulation (except while asphalt is being measured). Equip new tanks with paddle-type mixers or agitators which keep the material in motion and minimize prolonged exposure to the heating source. Maintain the proper mixing temperature of the asphalt. Heat and insulate pipelines and fittings. Provide a sampling spigot in each tank and/or the supply line. Place strainers or screens between the working tank and mixing unit to filter undesirable material. Fix a thermometer graduated in 5°F increments and having an accuracy of ±5°F in the asphalt feed line at an approved location near the discharge valve at the mixer unit to indicate the temperature of asphalt from storage.

503.04.2 Measurement: Measure the asphalt cement either by weight or volume. Ensure that all scales and meters are calibrated and accurate to 0.5 percent. Display by percent the rate of flow of asphalt cement and the total quantity used.

503.04.2.1 Weight Measurement: Provide scales reading to the nearest pound.

503.04.2.2 Volume Measurement: Measure the asphalt cement by volume using a positive displacement pump and record in digital form to the nearest gallon. Periodically check by weight the quantity of asphalt cement delivered. Continuously display in digital form the corrected rate of asphalt cement delivery and the total quantity delivered. Ensure measurement during production is accurate to within 1.0 percent.

503.05 ADDITIVES. When additives are used, digitally display the rate of flow and the total quantity used for each. Provide meters accurate to 0.5 percent.

503.05.1 Anti-Strip: Provide a recirculation anti-strip additive storage tank producing uniform heat with an indicating thermometer at an approved location near the tank discharge point. Place a thermometer graduated in 5°F increments and having an accuracy of ±5°F at an approved point near the anti-stripping tank discharge point before the meter. Disperse anti-strip additive directly into the asphalt feed line at a location between the asphalt control valve and the end of the asphalt discharge line. Ensure that the anti-strip delivery system continuously delivers the proper amount of material and in correct proportion to the asphalt cement. This system must be equipped with a no-flow indicator, which triggers a light or alarm in the control room and an alarm in the plant lab when the anti-strip material is not flowing. If the anti-strip flow is stopped or interrupted for more than 5 minutes, discontinue production until the system is repaired. The equipment shall include a positive displacement accumulating meter which accumulates and displays materials used, and reads to the nearest 0.25 gallon. Additionally, provide a measuring dip stick and a chart correlating tank quantity with the height of anti-strip liquid.

503.05.2 Plant Blending: Equipment required to introduce crumb rubber modifier, latex, or warm mix additives is described herein. Submit a proposed plant equipment diagram to the District Laboratory Engineer for review and forward a copy to the Materials Engineer. Provide written confirmation from the equipment manufacturer that the quantity and type of mixers are appropriate for the proposed materials and flow rates. When modifying asphalt liquid binder at the contractor's plant to meet a new grade of asphalt, provide a Dynamic Shear Rheometer (DSR) for on-site quality control testing.

The District Laboratory Engineer will inspect the plant facilities.

503.05.2.1 In-Line Blending: Provide a sampling spigot in line after the point of mixing and prior to anti-stripping introduction. When modifying the binder with additives, use a totalizing meter to measure the quantity of additive in a similar manner as anti-strip.

503.05.2.2 Single Tank Batch Blending: A single tank system consists of a single blending tank used to blend crumb rubber modifiers. Provide a 20,000-gallon capacity tank or greater, which serves as both a mixing liquid tank and working liquid tank. Continuously mix the liquid and crumb rubber or other additive with paddle type mixers, auger type mixers, or shear mills to properly blend and maintain suspension. Provide a safe and easily accessible sampling spigot.

503.05.2.3 Multiple Tank System: A multiple tank system consists of a blending tank feeding into a working tank used to blend crumb rubber modifiers. The blending tank may be batch or continuous with metered feed controls to accurately maintain proper ratios of crumb rubber or other additive to neat asphalt binder liquid. Properly agitate the mixture in the working tank with paddle type mixers or auger type mixers to maintain suspension of the modified liquid. Provide a safe and easily accessible sampling spigot.

503.05.3 Warm Mix Additives: Provide necessary equipment in accordance with the manufacturer's recommendations and submit a proposed plant equipment diagram to the District Laboratory Engineer for review. Forward a copy to the Materials Engineer.

503.05.3.1 Foaming Using Water Injection: Provide an approved foamed asphalt injection system flow diagram upon request. Provide a control room indicator when using the water injection system.

503.05.3.2 Chemical Additives: Chemical additives are supplied by the liquid supplier, by mixing in the working tank, by in-line blending, or by introducing as an anti-strip. Provide a system that continuously records the quantity of additive used.

503.05.4 Mineral Filler: Proportion mineral filler separately from a bin equipped with an adjustable feed in accordance with Subsection 503.03.2, which can be accurately and conveniently calibrated and be interlocked with the aggregate. The feeder shall accurately proportion the mineral filler and provide a constant flow of material. For continuous drum mixer plants introduce the mineral filler, if used, to the mix at an approved location sufficiently in advance of the addition of the asphalt cement.

503.05.5 Hydrated Lime: When hydrated lime additive is mixed with aggregate on the belt feed, interlock and synchronize the hydrated lime additive equipment with cold feed controls. Equip the system with an automatic no flow indicator that will automatically shut the plant down when a malfunction causes an improper supply of additive or water. Equip the hydrated lime additive system with the following:

1. A separate bulk storage bin with a vane feeder or other approved feeding system that can be readily calibrated. The system shall provide for easy sampling of additive and verification of the quantity dispensed by weight (mass). Ensure the feeder system continuously records the total amount of additive dispensed.
2. An approved spray bar, capable of spraying the composite aggregate with potable water before the addition of hydrated lime additive, when the moisture content of the composite aggregate falls below 3 percent. Ensure the approved equipment and methods consistently maintain the aggregates in a uniform, surface wet condition.
3. An approved pug mill after the cold feed system and before the belt scale.

Dispense the hydrated lime additive directly into the pug mill and composite aggregate. Uniformly blend the additive with the composited aggregate before exiting the pug mill. Obtain the District Laboratory Engineer's review of the process and equipment used for mixing the lime additive and aggregate. Ensure that no less than the required amount of additive is continuously blended with the aggregate.

503.05.6 Fibers: Use a separate feed system to accurately proportion and uniformly distribute the required quantity of mineral fibers into the mixture. Interlock the proportioning device with the aggregate feed or weigh system to maintain the correct proportions for all rates of production. Control the fiber proportion to within ±10 percent of the amount of fibers required. Equip the system with an automatic no flow indicator that will automatically shut the plant down when a malfunction causes an improper supply of fiber. For drum plants, add the fiber adjacent to the asphalt cement discharge location.

503.06 DRUM. Equip the drum with automatic burner controls that continuously agitate aggregates during heating and drying. Provide equipment capable of heating and drying aggregates to meet specifications in the necessary quantities to supply the mixing unit continuously at its operating capacity and at a specified temperature and acceptable moisture content. Slope the drum and maintain flights in accordance with manufacturer's recommendations.

Produce a uniform blend at the specified production rate, with rapid and complete asphalt coating of aggregate. As a minimum, completely coat 95 percent of the coarse aggregate particles retained on the No. 4 sieve when tested in accordance with AASHTO T195.

Process the mixture at the temperature specified on the approved JMF and within ±25°F of the optimum mixing temperature at the discharge. Equip the drum with a thermometer or other temperature device to monitor the discharge temperature of the mix. Use temperature recording device or thermometers graduated in maximum 10°F increments with an accuracy of ±5°F and a sensitivity capable of detecting a change of at least 10°F per minute.

503.07 DUST COLLECTION SYSTEM. Return the fines from the dust collection system at a uniform and regulated rate near the asphalt cement discharge.

503.08 STORAGE AND LOADING OF ASPHALT CONCRETE MIXTURES.

503.08.1 Mix Conveyors: Transport the mix directly from plant to the storage silos or surge bin system by means of an enclosed continuous type conveyor system designed to prevent spillage and match the production rate of the plant. Deliver the mixture to the storage silo or surge bin within ±15°F of plant discharge temperature.

503.08.2 Storage Silos and Surge Bins: Use approved storage silos or surge bins for storing asphalt concrete mixtures.

Ensure that the use of storage silos or surge bins conform to the limitations on retention time, type of mixture, heater operation, bin atmosphere, bin level or other characteristics set forth in these specifications and other requirements stated in granting approval of these facilities. Affix an indicator device to each bin, visible to the loading operator, which is activated when material in the bin drops below the top of the sloped portion. Maintain mixtures above this level during production, except when the plant is not in operation.

When the mixture is placed into a silo or bins through a surge device, provide an automatic warning system to audibly warn the operator of a gate malfunction. Ensure silo or bin unloading gates are either clam shell gates operating under gravity feed or other approved gates that will not cause segregation or be detrimental to the mix.

503.08.2.1 Storage Silos: Maintain a uniform mixture temperature without localized heating. Maximum allowable overnight storage time is 18 hours, provided the silo has an oil sealed discharge gate. The Department may approve additional storage time provided test results and other data indicate that the additional storage time is not detrimental to the mix.

503.08.2.2 Surge Bins: Maintain the mixture at a temperature not less than 25°F below the optimum mixing temperature on the JMF. Do not store the mixture over night.

503.08.2.3 Loading and Sampling: Use haul trucks conforming to 503.11.

Provide a sturdy secured metal sampling platform, with protective rails, at least 30 square feet in area, and set at the proper height to easily obtain a sample. Protect the sampling platform from loaded trucks with barrier rail.

Equip the plant with an approved pressurized system capable of spraying a uniform coating of an approved asphalt mix release agent into the haul unit bed prior to loading. Do not use diesel as a mix release agent.

503.09 SCALES AND METERS.

503.09.1 Scales: Provide scales and meters accurate to ±0.5 percent of the indicated load. Design, construct and install scales and meters so that operations do not affect their accuracy. Calibrate in accordance with 503.02.2. Measure all asphalt concrete mixtures by weigh hoppers or truck platform scales to determine weight for pay.

503.09.2 Weigh Hoppers: Provide weigh hoppers to weigh the mixture or individual material components. Provide hoppers that do not leak or cause segregation. Suspend weigh hoppers from calibrated springless dial scales or load cell scales. Equip the weigh hopper with an approved automatic printer system that will print the certified tare weight of the truck, each batch weight, and total weight of mixture loaded into the truck.

503.09.3 Platform Scales: Provide truck platform scales of sufficient length to weigh the entire unit transporting the mix. Weigh the truck empty to determine tare weight prior to mixture loading. Equip scales with an approved automatic printer system that will print the tare weight as well as the total weight of the unit and the mix.

503.09.4 Printers: Inform the Department in the event of a breakdown of the printing mechanism. Discontinue operations until the printer is repaired or replaced.

503.10 PAVING EQUIPMENT. The Department will inspect primary roadway equipment, including Material Transfer Vehicle (MTV), asphalt distributors, pavers, and rollers, at the start of each project.

503.11 HAUL TRUCKS. The Department will certify haul truck and trailers with a maximum of three trailer combinations for legal payload and volume. Comply with load restrictions in accordance with 105.14. Use trucks having tight, clean, and smooth beds. Spray beds daily or as often as directed with an approved asphalt mix release agent.

Provide a canvas or vinyl cover large enough to completely cover the top and extend over the sides of the bed to protect the mixture from the weather or loss of heat. Use sufficient tie-downs to hold the cover.

Discharge the mixture in a continuous manner so the spreader apron of the paver or MTV will not be overloaded. If the truck or paver is causing surface tolerance penalties or excessive bumps, discontinue its use.

Change equipment or operations when size, speed and condition of trucks interfere with orderly paving operations.

Equip haul trucks used for asphalt surface treatments with a mechanism to provide a positive connection to the aggregate spreader.

503.12 ASPHALT MILLING MACHINE. Use an approved self-propelled milling machine or grinder equipment for milling asphalt surfacing. Provide equipment with sufficient power, traction and stability to remove the thickness of asphalt concrete necessary to provide profile grade and cross slope uniformly across the surface. Provide milling equipment capable of controlling grade or cross-slope from an erected stringline, shoe device or approved traveling reference plane that will accurately reflect the average grade of the surface on which it is to be operated and have an automatic system for controlling cross slope at a given rate. The drum shall be round and true with sufficient number of teeth to yield a uniform and fine textured surface. Equip the milling machine with means to control dust created by the cutting action. Provide adequate loading equipment to immediately remove materials cut from the surface and discharge the cuttings into a truck or on the shoulder as specified or directed.

503.13 ASPHALT DISTRIBUTORS. Provide equipment that ensures even distribution of the asphalt or asphalt emulsion across the entire pavement area at the specified rate as measured per ASTM D2995.

503.13.1 Distributors: The asphalt cement distributor shall be capable of maintaining the allowable variation from any specified rate within ±0.02 gallons per square yard. Equip the distributor with a height adjustable spray bar with spray nozzles recommended by the manufacturer. Assure that the end nozzle over the roadway edge provides a sharp line of asphalt material parallel to the direction of travel. Ensure nozzles remain clean and free from blockage.

Provide means for an accurate and rapid determination of the control and amount of asphalt materials being applied per square yard of surface. Equip the distributor with thermometers to indicate the temperature of the material in the tank. Equip the distributor with a hand-held spray attachment for applying asphalt materials to areas inaccessible with the spray bar.

Within 12 months prior to use, calibrate the asphalt distributor in accordance with ASTM D 2995. Provide the ASTM calibration and furnish the Project Engineer an accurate and satisfactory calibration record prior to beginning the work. The Project Engineer may at any time require verification of calibration accuracy of the asphalt distributor in accordance with ASTM D 2995.

503.14 MATERIAL TRANSFER VEHICLE (MTV). When placing the final two lifts of asphalt concrete on the roadway travel lanes, use a material transfer vehicle (MTV) or lightweight MTV to deliver mixtures from the hauling equipment to the paving equipment, and to minimize thermal and material segregation of the hot mix asphalt concrete.

Ensure that the MTV provides additional mixing of the asphalt concrete mixtures and then deposits the mixture into the paving equipment hopper to reduce segregation and facilitate continuous production. At a minimum, provide an MTV with a high capacity truck unloading system, which will receive mixtures from the hauling equipment; a 20-ton storage bin in the MTV to continuously mix the mixture prior to discharge to a conveyor system; a discharge conveyor, with the ability to swivel, delivering the mixture to a paving equipment hopper while allowing the MTV to operate from an adjacent lane. If the weight of the MTV is determined by the Project Engineer to cause settlement or movement in the base or sub-base, discontinue use. When a malfunction occurs in the MTV during lay-down operations, immediately discontinue plant operations and do not resume until the MTV malfunctions have been remedied. Mixtures in the silo (≤ 100 tons) or materials in transit may be placed.

Due to the weight of the loaded MTV, apply the following restrictions at bridge crossings:

1. Abide by posted weight limits.
2. Prior to crossing a bridge, be as near empty as possible.
3. Do not move across a bridge with any other vehicles being on the bridge.
4. Move on a bridge only within the limits of the travel lanes and do not move on the shoulders of the bridge.
5. Move at a speed no greater than 5 miles per hour when crossing a bridge.

503.14.1 Lightweight MTV: The lightweight MTV has a smaller capacity, is more fuel efficient and may be used in lieu of the MTV. Lightweight MTV's must meet all requirements of the 503.14 MTV and as modified herein. Use a Thermal Profile System in accordance with section 503.14.3 at all times when a lightweight MTV is used in lieu of the MTV. Discontinue use of lightweight MTV when thermal segregation is observed.

The requirement of the 20-ton storage hopper is waived for all lightweight MTVs. The approved remixing methods for lightweight MTV's are:

1. Counter rotating augers,
2. Offset gravity transfer conveyor chute, or
3. Twin interlaced augers.

A tracked or high flotation tires are required for the undercarriage of the MTV to facilitate low ground pressure (< 55 psi).

503.14.2 Windrow Paving: Windrow paving is allowed with the use of an MTV and Thermal Profile System. Equip the MTV with a windrow head attachment capable of removing 95 percent of the mixture off the pavement. Use a Thermal Profile System meeting 503.14.3.

503.14.3 Thermal Profile System: The Thermal Profile System may be used on all projects. The Thermal Profile System is a device capable of continuously recording the temperature of the full width of pavement as the mixture exits the paver with constant record of the GPS location and distance traveled. The system requirements include the capability to provide the Project Engineer with the thermal profile of every roadway sublot and roadway lot.

Mount the system with a recording device to the back of the paver. Provide capability of instant review of data on project site at any time keeping permanent record of all temperature and location data daily.

503.15 PAVERS. Use pavers with an automatic grade control device (dual grade may be required) and slope control devices for use with an approved traveling reference plane or erected stringline, as directed.

Use pavers capable of placing mixtures within specified tolerances. Use a screed or strike-off assembly to distribute the mixture over the entire paving strip. The width of the paving strip must be acceptable to the Project Engineer. Use screed, including screed extensions, to place mixtures that are uniform in appearance and quality. Adjust the screed assembly to provide the required cross section. Equip the screed (including screed extensions) with a heater and a vibrator.

Use a paver insert hopper, in conjunction with the MTV, with a minimum capacity of 5 tons (5 Mg).

Equip pavers with hoppers adequately designed and maintained to prevent spillage. Equip pavers with augers to place the mix evenly in front of the screed, including extensions. Equip pavers with a quick and efficient steering device capable of traveling both forward and in reverse. Provide pavers capable of spreading mixes to required thickness without segregation or tearing.

For shoulder construction or other incidental applications, use modified pavers or widening machines when permitted.

Use auger assembly extensions when screed extensions in excess of 2 feet on a side are to be continuously used in the pavement operation. Extend such auger extensions to within 2 feet of the end of the screed. With approval, the use of an auger extension with screed extensions in excess of 2 feet on one side may be waived for transitions, taper sections and similar short sections.

Do not use a strike-off assembly or boxed extension for paving within the traveled way, except when approved for short irregular sections or non-typical sections.

Ensure that the vibratory screed crowns the pavement with adjustable extensions to accommodate the desired pavement profile.

503.15.1 Spray Paver: Spray pavers are designed to distribute the tack coat immediately before placing the asphalt mixture. Comply with 503.13.1 and ensure that spray pavers evenly distribute the tack coat and apply and level thin asphalt concrete concurrently at a rate of 30 to 92 feet per minute. Do not allow a wheel or other part of the paving machine to come in contact with the tack coat before the hot mix asphalt concrete wearing course is applied. Equip the spray paver to include a receiving hopper, feed system, insulated storage chamber for the tack coat, spray bar, tanks with calibrated load cells, and a variable width heated screed unit.

503.16 COMPACTION EQUIPMENT.

503.16.1 General: Provide self-propelled compaction equipment capable of reversing without backlash. Establish a rolling pattern and provide the number, type and size of rollers sufficient to compact the mixture to the specified density and surface smoothness.

503.16.2 Steel Wheel Rollers: Use either vibratory or non-vibratory steel wheel rollers. Equip the roller with wheels that are true to round and equipped with suitable scrapers and watering devices. Design vibratory rollers for asphalt concrete compaction having separate controls for frequency, amplitude and propulsion.

503.16.3 Pneumatic Tire Rollers: Use treadless tires that are the same size and ply rating, and inflated to a uniform pressure not varying more than ±5 psi between tires. Equip tires with scrapers to prevent adhesion of mixture. The Project Engineer may require additional cleaning and water apparatus on tires if material adhesion is detrimental to the mat.

503.16.4 Equipment for Asphalt Surface Treatments (AST):

503.16.4.1 Pneumatic Tire Rollers for AST: Use a minimum of two self-propelled rollers, weighing at least 12 tons each. Tires shall be smooth tread, of the same size and ply rating. Inflate to a minimum uniform tire pressure of 60 psi, unless damage occurs. The Project Engineer may require a reduction in roller pressure to prevent damage to the aggregate or underlying base course. Wheels shall not wobble and shall be aligned so that the gaps between tires on one axle are covered by tires of the other axle.

503.16.4.2 Power Broom or Blower for AST: Use a power revolving broom or power blower to clean the surface of dust, dirt, mud, and loose or excess material.

503.16.4.3 Aggregate Spreader for AST: Use a self-propelled, pneumatic tire power spreader designed, equipped, and operated to spread aggregate uniformly at the designated rate within the limits of the desired roadway width. The aggregate spreader shall be capable of maintaining an allowable variation from the specified rate within ±0.5 pounds per square yard or ±0.25 pounds per square yard for expanded clay.

Calibrate the aggregate spreader in accordance with ASTM D 5624.

503.16.4.4 Vacuum-Sweeper for AST: Provide a vacuum-sweeper when there is a dusting problem, as determined by the Project Engineer.

503.17 MISCELLANEOUS EQUIPMENT AND HAND TOOLS. Provide power revolving brooms or power blowers that are maintained and in satisfactory working condition.

In areas that are inaccessible to conventional rollers, use satisfactory mechanical compaction equipment, or hot hand tampers. Tamping tools may be used for compacting edges.

Section 504
Asphalt Tack Coat

504.01 DESCRIPTION. Prepare and treat existing asphalt or portland cement concrete pavement surfaces with asphalt material in accordance with these specifications and in conformity with the lines and grades shown on the plans or established.

504.02 ASPHALT MATERIALS. Use an undiluted asphalt emulsion Grade NTSS-1HM, CBC-1HT, CRS-2P, CSS-1H, SS-1H or PET or a hot applied non-tracking tack (NTHAP) as required by Section 501, Section 502, Section 507, and as listed on the Approved Materials List and comply with Section 1002.

504.03 WEATHER LIMITATIONS. Do not apply asphalt tack coat on a wet surface or when the ambient air temperature is below 40°F. For full depth patching, do not place asphalt tack coat when ambient air temperature is below 35°F.

504.04 EQUIPMENT. Provide equipment for applying asphalt material and prepare the surface to be tacked. Apply with equipment conforming to 503.13.1 and 503.15.1. A hand-held pressure nozzle may be used for tack coat application in lieu of the spray bar/tachometer combination for irregular sections or short sections of 1500 feet or less.

504.05 SURFACE PREPARATION. Clean the pavement surface by sweeping or other approved methods. Satisfactorily clean edges of existing pavements that will form joints with new pavement before tack coat is applied.

504.06 APPLICATION. Uniformly apply asphalt tack coat to a clean dry surface with no bare areas, streaks or puddles with an asphalt distributor at a rate in accordance with Table 504-1. If bleeding, ponding, or slipping are evident, these rates may be reduced to a minimum of 0.04 gallon/square yard with a minimum 0.02 gal/sq yd residual with approval of the Project Engineer.

Table 504-1
Section 502 Asphalt Tack Coats

Surface Type	Rate[1,3]; Gal/Sq yd
Existing Surface Treatment[2]	0.12
New Hot Mix	0.06
Existing Hot Mix	0.09
Portland Cement Concrete	0.09
Milled	0.08

[1]Rates are minimum rates of undiluted asphalt emulsion.
[2]Section 507 Asphalt Surface Treatment Type E Interlayer does not require a tack coat.
[3]Minimum rate for hot applied non-tracking tack (NTHAP) is 0.08 gal/sq yd for all surface types in Table 504-1.

The minimum application temperature of the emulsified asphalt Grades NTSS-1HM, CBC-1HT, CRS-2P and Polymer Emulsion Tack (PET) is 160°F and Grades CSS-1H and SS-1H, is 70°F, or as recommended by the manufacturer. For hot applied non-tracking tack (NTHAP) the minimum application temperature is as recommended by the manufacturer.

Apply tack coat in such manner as to cause the least inconvenience to traffic. Traffic is not permitted on tacked surfaces prior to application of the mixture placement. The contractor will be permitted to apply the tack coat one calendar day prior to the mixture laydown for non-traffic areas. However, when tack coat has been damaged or contaminated by dirt, dust or mud, clean the surface and apply tack coat again prior to the mixture laydown at no direct pay. Reapply tack coat to previously tacked surfaces exposed to damage or due to inclement weather at no direct pay.

504.07 MEASUREMENT. Asphalt tack coat will not be measured for payment and is considered incidental to the associated asphalt concrete pay item; however, it will be measured by the gallon in-place using a calibrated stick and/or charts on level ground at the application temperature described in 504.06 for specification compliance.

504.08 PAYMENT. Payment of asphalt tack coat will not be made; however, the associated asphalt pay items will be subject to the payment adjustment provisions of Section 1002 for specification deviations of the asphalt materials.

Section 505
Asphalt Prime Coat

505.01 DESCRIPTION. An asphalt prime coat is used to seal newly constructed unbound and/or un-stabilized base courses. Prepare and treat a surface with asphalt material in conformance with these specifications and in conformity with lines shown on the plans or established.

505.02 ASPHALT MATERIALS. Prime coat shall be cutback asphalt Grade MC-30, MC-70, or AEP Emulsified Asphalt complying with Section 1002.

505.03 WEATHER LIMITATIONS. Do not apply MC-30 and MC-70 materials on a wet surface. Do not apply asphalt prime coat when ambient air temperature is less than 35°F in the shade.

505.04 EQUIPMENT. Provide the necessary equipment for proper construction of the work. Apply with equipment conforming to 503.13.1. A hand-held pressure nozzle may be used for prime coat application in lieu of the spray bar/tachometer combination for irregular sections or short sections of 1500 feet or less.

505.05 SURFACE PREPARATION. Shape the surface to be coated to required grade and section. Assure that the surface is free from ruts, corrugations, segregated material or other irregularities, and compact to required density. Delays in priming may necessitate reprocessing or reshaping to provide a smooth, compacted surface.

505.06 APPLICATION. Extend prime coat 6 inches beyond the width of surfacing shown on the plans. Do not apply the prime coat until the surface has been satisfactorily prepared.

Apply prime coat at the rates and temperatures shown in Table 505-1.

Table 505-1
Prime Coats

Asphalt Grade	Application Rate Gal/Sq Yd		Application Temperature °F	
	Min.	Max.	Min.	Max
MC-30	0.25	0.30	60	120
MC-70	0.25	0.30	100	180
AEP	0.25	0.30	60	120

505.07 PROTECTION. After prime coat has been applied, cure for a minimum of 24 hours before placing the mixture. Keep traffic off the surface until the prime coat has properly cured, unless otherwise permitted by the Project Engineer.

If traffic is permitted, spread approved granular material, as directed by the Project Engineer, over the prime coat at no direct pay.

Maintain the prime coat intact. When required, thoroughly clean the primed surface prior to the placement of mixture.

Where the prime coat has failed, clean the failed area and reapply prime coat to the unbound surface at no direct pay. When the prime coat is generally unsatisfactory, reapply prime coat to the unsatisfactory surface at no direct pay.

505.08 MEASUREMENT AND PAYMENT. Asphalt prime coat will not be measured for payment; however, the associated asphalt pay items' payment under the contract will be subject to the payment adjustment provisions of Section 1002 for specification deviations of the asphalt materials. The Materials and Testing Section will provide the payment adjustment percentage for asphalt materials. Payment for surface preparation will be made under other items.

Section 506
Asphalt Curing Membrane

506.01 DESCRIPTION. The Asphalt Curing Membrane is used to cure treated or stabilized base/subgrade layers. Apply and maintain an asphalt curing membrane to the surface of cement or lime treated or stabilized materials in compliance with these specifications or as directed.

506.02 MATERIALS. Asphalt for curing membrane shall be an emulsified asphalt or an emulsified petroleum resin (EPR-1) complying with Section 1002. Water shall comply with 1018.01.

506.03 WEATHER LIMITATIONS. Do not apply asphalt curing membrane when the temperature is below 35°F, unless otherwise permitted by the Project Engineer.

506.04 EQUIPMENT. Provide and maintain the necessary equipment for proper construction of this work. Apply with equipment conforming to 503.13.1. A hand-held pressure nozzle may be used for application in lieu of the spray bar/tachometer combination for irregular sections or short sections of 1500 feet or less. A gravity flow distribution system will be allowed.

506.05 SURFACE PREPARATION. Assure that the surface to which curing membrane is to be applied is free from ruts, corrugations, loose material or other irregularities.

506.06 APPLICATION. Apply the asphalt curing membrane immediately upon completion of final finishing of the final lift of the surface. Uniformly apply the emulsified asphalt curing membrane in accordance with Table 506-1. Emulsified asphalt may be further diluted with water, to a maximum of 1 part water to 1 part undiluted asphalt emulsion, and applied in multiple passes of the distributor. The total amount of asphalt material applied such that the residual amount of asphalt material equals a minimum of 0.10 gallon per square yard. Remove extraneous material which has collected on the base before additional application of asphalt curing membrane. Maintain and repair the surface before additional applications.

Table 506-1
Asphalt Curing Membrane

Curing Membrane Type	Application Rate[1] Gal/Sq Yd	Application Temperature[2] °F
	Min.	Min.
EPR-1[3]	0.20	70
Emulsified Asphalt[4]	0.10	70

[1]Rates are minimum rates of undiluted asphalt emulsion.
[2]Minimum application temperature or as recommended by the manufacturer.
[3]Undiluted EPR shall consist of 5 parts water and 1 part resin concentrate and comply with Section 1002.
[4]Shall comply with Section 1002.

506.07 PROTECTION. After the curing membrane has been applied, keep public and construction traffic off the surface until the curing membrane has properly cured, unless otherwise directed by the Project Engineer. Maintain the curing membrane at no direct pay until the mixture has been placed. When traffic is permitted, apply additional curing membrane at intervals to protect and cure the surface at no direct pay.

506.08 MEASUREMENT AND PAYMENT. Asphalt curing membrane will not be measured for payment; however, the associated asphalt pay items' payment under the contract will be subject to the payment adjustment provisions of Section 1002 for specification deviations of the asphalt materials. The Materials and Testing Section will provide the payment adjustment percentage for asphalt materials. Water will not be measured for payment.

Section 507
Asphalt Surface Treatment

507.01 DESCRIPTION. This work consists of furnishing properly distributed asphalt material followed by a uniform application of aggregate for building a riding surface, improving the surface friction of a roadway, sealing cracks in the roadway, reducing the rate of oxidation of a surface mixture, or as an interlayer to delay or reduce the occurrence of reflective cracking.

Asphalt Surface Treatment (AST), sometimes referred to as "chip seal," consists of a specified emulsion applied "cold" or polymer modified asphalt material applied "hot," at the temperature range specified in Table 507-1 for cold applications or Table 507-2 for hot applications, respectively. The application rates of asphalt material and aggregates will vary with aggregate size and existing roadway conditions but, for bid purposes only, shall meet the requirements of Table 507-1 or Table 507-2. The Project Engineer will review the actual application rates.

507.02 MATERIALS.

507.02.1 Asphalt: Use asphalt materials complying with Section 1002 that are Approved Material List products. Comply with Table 507-1 or 507-2.

Take samples of asphalt material in the presence of the Project Engineer's representative. The Project Engineer's representative will immediately take possession of the samples.

507.02.2 Aggregates: Aggregates shall comply with 1003.07 and Table 1003-15. Use Approved Material List aggregates shown herein or as designated on the plans.

For hot applications, pre-coat aggregates with a paving grade asphalt cement or a cationic emulsion. For pre-coated aggregates, the residual asphalt content shall be a minimum of 1.4 percent by weight of the aggregate for high absorption aggregates and 0.5 percent minimum by weight for low absorption aggregates as defined in AASHTO T84. The pre-coat applicator shall certify the quantities of pre-coat used in the process. Ensure that the pre-coated aggregate flows freely. The gradation requirements apply to the aggregate after pre-coating. Submit a gradation Certificate of Analysis with each aggregate shipment of 1000 cubic yards or each project, whichever is less. If an emulsion is used for pre-coating, cure the stockpiled pre-coated aggregate prior to use.

507.03 EQUIPMENT. Provide asphalt distributors, pneumatic tire rollers, power brooms or blowers, aggregate spreaders, and vacuum sweepers in accordance with Section 503. Calibrate and maintain the necessary equipment for proper construction.

Keep storage tanks, piping, booster tanks, distributors, and all other equipment used in delivering, storing, or handling asphalt materials clean and in good operating condition.

507.03.1 Power Asphalt Distributor: Provide a computer operated asphalt distributor in accordance with 503.13.1.

507.03.2 Pneumatic-tire Rollers: Use self-propelled rollers, weighing at least 12 tons each in accordance with 503.16.4.1.

507.03.3 Power Broom or Blower: Use a power revolving broom or power blower in accordance with 503.16.4.2.

507.03.4 Aggregate Spreader: Use a self-propelled, pneumatic tire power spreader in accordance with 503.16.4.3.

507.03.5 Vacuum-Sweeper: Provide a vacuum-sweeper when there is a dusting problem in accordance with 503.16.4.4.

507.03.6 Haul Trucks: Provide haul trucks in accordance with 503.11.

507.04 WEATHER LIMITATIONS. Do not apply AST if any of the following conditions occur:

1. Wet or moist surface. Consider the pavement to be excessively moist when it is visibly wet or when a one square foot piece of polyethylene film condenses moisture after being tightly placed on the pavement surface for 15 minutes;
2. Rain has occurred within 24 hours (for hot applied AST only);
3. The air temperature or pavement surface temperature in the shade is less than 60°F; or
4. The air temperature is predicted by the National Weather Service to fall below 60°F within 24 hours after placement.

507.05 PREPARATION OF EXISTING SURFACE. Potholes and surface depressions will be repaired by the Department prior to the asphalt surface treatment work unless shown otherwise on the plans.

Prepare existing surface at no direct pay unless otherwise specified on the plans. Immediately prior to application of the asphalt material, clean and de-grass existing pavements over the full width to be treated. Remove any existing raised pavement markers prior to asphalt concrete overlay operations. Payment for removal of raised pavement markers will be included with the applicable asphalt item. Sweep the pavement with a power broom or blower to remove all loose material. Clean areas not reached by the power broom or blower by hand brooming or blowing.

If used, ensure that the prime coat or curing membrane, is satisfactorily cured and maintained in accordance with Section 505 and Section 506 prior to application of AST.

Obtain the Project Engineer's acceptance of the surface prior to application of AST.

507.06 APPLICATION. After the existing surface has been properly prepared, apply asphalt material and aggregates in the amounts determined by the contractor and accepted by the Project Engineer, and in the sequence specified herein.

Apply and spread asphalt surfacing at the temperatures and sequences given in Table 507-1 or 507-2. The quantities of material given in Table 507-1 or 507-2 may be adjusted by the Project Engineer as field conditions warrant. The type and condition of the surface being covered will affect the required application rate of asphalt material. Use the quantities as recommended by the contractor and accepted by the Project Engineer. Establish the actual rates during the first asphalt and aggregate application.

Before the asphalt surface treatment operation begins, calibrate and set the flow rates of the distributor and spray bar along with the aggregate spreader at a remote location offsite in a manner acceptable to the Project Engineer. Aggregate spread rates may be adjusted by the Project Engineer. It should be noted that after the aggregate spreader passes, the aggregate should never cover 100 percent of the roadway surface. The asphalt coated surface should be visible between the aggregates. Strike off aggregate trucks at the loading area for proper material yield measurements.

The aggregate spreader shall follow immediately behind the asphalt distributor. Make the initial pass with the rollers immediately following the aggregate spreader before the emulsion breaks.

507.06.1 Asphalt Material: In general, the rate of asphalt is increased if the road is absorbent, badly cracked, or coarse, and is decreased if the road is smooth and flushed with asphalt. Guidelines for adjusting the rate of asphalt emulsion in gallons per square yards are shown in Table 507-3.

Do not allow the length of spread of asphalt material to exceed that which can be covered by aggregate within approximately one minute.

Apply asphalt material at a uniform rate for the full width of treatment unless otherwise directed by the Project Engineer. Keep the application of asphalt material consistently within ±0.02 gallons per square yard, otherwise stop construction and recalibrate the distributor to the satisfaction of the Project Engineer.

Adjust the height of the spray bar and the angle of the nozzles so that individual spray fans do not interfere with each other and uniform double or triple coverage is achieved. Maintain a minimum of 100 gallons of asphalt material in the distributor during operation.

Adjust and maintain one of the special spray nozzles at the ends of the spray bar to provide a sharp edge for the asphalt material on the edge of the roadway surface being covered. When the application is less in width than the length of the spray bar, move these special nozzles to provide the specified edge lines.

When any nozzle becomes blocked during application of asphalt material, immediately stop the flow of material and clean the nozzles. When the Project Engineer directs that application be made over less than the full width of the roadway at a time, slightly overlap adjacent treatments longitudinally. Operate the distributor along a marked edge to keep the surface treatment in proper alignment.

To secure uniform distribution at the transverse junction of two treatments, stop the distributor promptly before the flow decreases. Place building paper or other suitable material over the end of the previous application. Start the joining application on the building paper. Satisfactorily remove and dispose building paper in accordance with Section 202 or as directed. Do not burn building papers.

During application of asphalt material, do not splatter adjacent pavements, structures, and trees with asphalt material. Do not clean or discharge the distributor into ditches, borrow pits, on shoulders or along the right-of-way.

Remove excess asphalt material at the junction between distributor loads or correct satisfactorily. Areas of the surface to be treated, which are not covered with asphalt material directly from the distributor shall be covered by means of a hand-held spray attachment equipped with nozzles.

507.06.2 Aggregates: Begin aggregate spreading operations immediately after the application of the asphalt materials. Place all aggregates for hot applications in a surface dry condition. Apply aggregate material within approximately one minute after application of the asphalt material.

Uniformly spread aggregate over the full width of asphalt material with one pass of the spreading equipment and with the application being sharply defined at edges. Do not drive equipment on uncovered asphalt material. When necessary to obtain uniform coverage, hand broom the surface.

Hand spreading will be permitted in conjunction with self-propelled spreaders over areas inaccessible to spreaders. Cover asphalt material with the appropriate rate of aggregate before rolling.

507.06.3 Multiple Applications: When multiple applications are to be placed, allow a minimum of 48 hours to elapse between each successive application of emulsions. Successive hot applications can be placed without delay.

507.06.4 Interlayers: An interlayer shall be Type E as specified herein and may be placed on raw or stabilized base, on a milled surface, between lifts of asphalt, or over existing portland cement concrete pavement which will be overlaid with asphalt. Use a liquid application rate that corresponds to the proper aggregate size given in Table 507-1 or 507-2 as adjusted by the Project Engineer to meet existing conditions. Do not place asphalt concrete on an emulsion surface treatment for a minimum of five days after application. Hot applied interlayers may be overlaid immediately.

507.07 ROLLING AND BROOMING AGGREGATE MATERIAL. Roll the surface immediately after spreading the aggregate material using a minimum of three pneumatic tire rollers. Make the first pass within approximately one minute of spreading the aggregate. Proceed rolling in a longitudinal direction, beginning at the outer edges of the application.

Make a minimum of three (3) passes over a single point. Complete all rolling within 1/2 hour after aggregate material has been spread. Immediately correct any deficiencies or damage in the aggregate material detected during rolling and reroll as directed. Continue rolling aggregate material until uniform coverage has been obtained. Roll the remaining applications as specified for the first application. Do not use a steel wheel roller.

Lightly broom or blow the surface to remove loose material. Completely remove all loose material from all roadway surfaces, including paved shoulders. If the Project Engineer determines the amount of loose material is excessive, pick it up and remove from the project instead of brooming onto the adjacent slopes.

507.08 PROTECTION. Traffic shall not be allowed on the surface until the aggregate has been placed, rolled, and, if necessary, lightly broomed or blown. For cold applications, lightly broom or blow each treatment beginning the next morning, and continue removing loose aggregate up to final acceptance of the project, if necessary.

Distribute aggregate material over the surface to absorb any free asphalt, covering any area deficient with aggregate material, and roll as directed at no direct pay. Do not displace embedded material during maintenance. When placing lightweight aggregate and a dusting problem occurs, use a vacuum sweeper without the sweeper engaged to remove loose aggregate. Loose aggregate material will not be permitted on the surface and shall be promptly removed.

507.09 MEASUREMENT. The quantities of asphalt material and aggregate incorporated into the completed and accepted asphalt surface treatment will be measured separately. Design quantities are based on horizontal dimensions. Design quantities will be adjusted when the Project Engineer makes changes to adjust to field conditions. Each size aggregate will be measured by the square yard per application. Asphalt material will be measured in the distributor by the gallon at application temperatures.

507.10 PAYMENT. Payment for placement and maintenance of asphalt materials and aggregates will be made at the contract unit prices, subject to the payment adjustment provisions of Section 1002 for specification deviations of asphalt materials. The Materials and Testing Section will provide the payment adjustment percentage for asphalt materials. Payment for removal of pavement markings will be included in this pay item.

Payment will be made under:

Item No.	Pay Item	Pay Unit
507-01	Asphalt Material (type)	Gallon
507-02	Aggregate (size)	Square Yard

Table 507-1

Asphalt Surface Treatment (AST) Requirements (Cold Application)

	Course No.	AST TYPE A		AST TYPE B		AST TYPE C	AST TYPE D			AST TYPE E (Interlayer)
Aggregate		Lightweight, Crushed Stone		Lightweight, Crushed Stone		Lightweight, Crushed Stone	Lightweight, Crushed Stone, Crushed Gravel			Crushed Stone, Crushed Gravel
Agg. Friction Rating		I, II		I, II, III		I, II, III	I, II, III, IV			I, II, III, IV
Asphalt Emulsion		CRS-2P		CRS-2P		CRS-2P	CRS-2P			CRS-2P
Application Temp. Minimum		160˚F		160˚F		160˚F	160˚F			160˚F
Application Temp. Maximum		175˚F		175˚F		175˚F	175˚F			175˚F
Number of Applications		2	1	2	1	1	3	2	1	2
Asphalt Emulsion[1] Application Rates Per Course	1	0.39	0.41	0.39	0.31	0.41	0.46	0.39	0.31	0.39
	2	0.29	–	0.29	–	–	0.36	0.29	–	0.29
	3	–	–	–	–	–	0.26	–	–	–
Aggregate Size and Application Rates Per Course[2]	1	S2-0.0111	S2-0.0111	S2-0.0111	S3-0.0075	S2-0.0111	S1-0.0200	S2-0.0111	S3-0.0075	S2-0.0111
	2	S3-0.0075	–	S3-0.0075	–	–	S2-0.0111	S3-0.0075	–	S3-0.0075
	3	–	–	–	–	–	S3-0.0075	–	–	–

[1]Application rates are in gallons of asphalt emulsion per square yard of AST.

[2] Size aggregate and application rates. For example, S2 is Size 2 aggregate and 0.0111 is the application rate in cubic yards of aggregate per square yard of AST. S1A may be used in lieu of S1. Aggregate sizes for AST are shown in Table 1003-15.

Table 507-2

Asphalt Surface Treatment (AST) Requirements (Hot Application)

	Course No.	AST TYPE A		AST TYPE B		AST TYPE C	AST TYPE D			AST TYPE E (Interlayer)
Aggregate		Lightweight, Crushed Stone		Lightweight, Crushed Stone		Lightweight, Crushed Stone	Lightweight, Crushed Stone, Crushed Gravel			Crushed Stone, Crushed Gravel
Agg. Friction Rating		I, II		I, II, III		I, II, III	I, II, III, IV			I, II, III, IV
Asphalt Cement[1]		PAC-15		PAC-15		PAC-15	PAC-15			PAC-15
Application Temp. Minimum		300˚F		300˚F		300˚F	300˚F			300˚F
Application Temp. Maximum		360˚F		360˚F		360˚F	360˚F			360˚F
Number of Applications		2	1	2	1	1	3	2	1	2
Asphalt Cement[2] Application Rates Per Course	1	0.30	0.31	0.30	0.24	0.31	0.36	0.30	0.24	0.30
	2	0.23	–	0.23	–	–	0.28	0.23	–	0.23
	3	–	–	–	–	–	0.20	–	–	–
Aggregate Size and Application Rates Per Course[3]	1	S2-0.0111	S2-0.0111	S2-0.0111	S3-0.0075	S2-0.0111	S1-0.0200	S2-0.0111	S3-0.0075	S2-0.0111
	2	S3-0.0075	–	S3-0.0075	–	–	S2-0.0111	S3-0.0075	–	S3-0.0075
	3	–	–	–	–	–	S3-0.0075	–	–	–

[1]See Table 1002-11.
[2]Application rates are in gallons of asphalt cement per square yard of AST.
[3]Size aggregate and application rates. For example, S2 is Size 2 aggregate and 0.0111 is the application rate in cubic yards of aggregate per square yard of AST. S1A may be used in lieu of S1. Aggregate sizes for AST are shown in Table 1003-15.

Table 507-3
Asphalt Emulsion Adjustment Rate

Existing Surface Condition	**Adjustment rate in Gallons/Sq Yd**
Black, flushed asphalt	-0.10 to -0.06
Smooth, non-porous	0.00
Absorbent, porous, oxidized	0.03 to 0.09

Section 508
Vacant

Section 509
Milling Asphalt Pavement

509.01 DESCRIPTION. Remove asphalt concrete surfacing by milling in accordance with these specifications and in conformity with the average depth, width, grade, cross-slope and typical sections shown on the plans or as established.

509.02 EQUIPMENT. Use an approved self-propelled milling machine or grinder for milling asphalt surfacing in accordance with 503.12.

509.03 CONSTRUCTION REQUIREMENTS. Prior to milling, pavement surface shall be clean, free of debris, properly de-grassed, and swept if necessary.

Pavement surfaces resulting from milling operations shall be of uniform texture, grade and cross slope and free from loose material. Re-mill surfaces not meeting these requirements at no direct pay. Uneven, undulating surfaces will not be accepted. If ridges are excessive, the Project Engineer may require additional milling, replacement of milling machine teeth, or other corrective action. Limit the maximum depth of milling to 2 inches per day when traffic is being maintained. Maintain a maximum 2-inch depth at milling edge of embankment at all times

Use a minimum length 25-foot traveling reference plane on the first pass of the milling machine. A shoe device may be used on adjacent passes.

When the entire roadway width has not been milled to a flush surface by the end of a work period, resulting in a vertical or near vertical longitudinal face exceeding 2 inches in height, slope this longitudinal face as directed. Place smooth transitions at transverse joints prior to restoring to traffic by milling or by using an asphalt concrete mix. Do not use RAP. Transitions shall be a minimum length of one linear foot per 1/4 inch of the milled depth. Make provisions at drives and turnouts to maintain local traffic.

Remove asphalt concrete next to structures or in small irregular areas that cannot be removed by the milling machine by other acceptable methods.

Provide drainage of milled areas, as necessary, by cutting through the shoulder to the ditch on the same day that adjacent milling is performed. After the roadway is completed, but prior to any required shoulder overlay, restore areas where drainage cuts are made in-kind, in accordance with Section 203, 401, 510, or 602.

The milling operation shall not precede the subsequent paving operation by more than 5 calendar days. Delay in starting the paving operations that causes a further degradation in the milled surface shall be corrected by the contractor by additional milling or providing leveling at no additional pay.

Severe raveling or degradation of the milled surface that occurs shall be reported to the Project Engineer in writing with station locations identified. The Project Engineer will direct corrective action.

Place temporary pavement markings prior to opening the roadway to traffic in accordance with Section 713.

Immediately haul, or as agreed upon by the Engineer, all reclaimed asphalt pavement (RAP) material to be retained by the Department for its recycling program, or by other government entities to the storage facility indicated on the plans and stockpile as directed. The contractor may also be required to retain a specified percentage or quantity of the RAP generated by the project.

Make required joint repairs prior to milling. Complete pavement patching before milling, unless additional areas requiring patching are exposed by the milling. Perform pavement patching and joint repair in accordance with Section 510. The initial face of a butt joint can match the radius of the cold planing milling drum. No true vertical face is required.

509.04 MEASUREMENT. The Department will measure milling by the square yard of asphalt concrete surfacing satisfactorily removed. No additional measurement will be made for multiple passes required to achieve total milling depth shown on the plans. Measurement of contractor retained RAP will be by the cubic yard, theoretical in-place plan quantity, and will be credited to the Department by treating it as a negative quantity in the Schedule of Pay Items.

Should the project generate more RAP than the original bid quantity; either by error in original quantity, extending the project limits, or any other reason; the contractor will receive the extra RAP generated at the original ratio of contractor retained bid quantity to DOTD retained RAP.

Should the project generate less RAP than the original quantity; either by error in original quantity, reducing the limits of the project, or any other reason; the contractor will receive the full amount of the original RAP quantity that was bid on or the full quantity of the RAP generated, whichever is less.

509.05 PAYMENT. Payment for milling of asphalt pavement will be made at the contract unit price per square yard, which includes the costs for removing, hauling and stockpiling of RAP material. The value of the RAP material retained by the contractor will be credited to the Department at the contract unit price for the retained material. The Department makes no assurances regarding the quality of existing asphalt pavement to be milled. No adjustment in payment related to quality of existing pavement to be milled will be made to either the contractor or the Department.

Drainage cuts placed through the shoulders, drop off transitions and transitions at transverse joints will be at no additional pay. Restore areas where drainage cuts are made in-kind, in accordance with Section 203, 401, 510, or 602, at no additional pay.

Payment for temporary pavement markings will be included under appropriate pay items.

Payment will be made under:

Item No.	Pay Item	Pay Unit
509-01	Milling Asphalt Pavement	Square Yard
509-02	Contractor Retained Reclaimed Asphalt Pavement	Cubic Yard

Section 510
Asphalt Concrete Pavement Patching, Widening, and Joint Repair

510.01 DESCRIPTION. Use asphalt concrete to patch, widen and repair joints of existing concrete pavements, asphalt concrete pavements, and composite pavements in accordance with these specifications and in conformity with the lines, grades and typical sections shown on the plans or as directed.

510.02 MATERIALS. Use any type of asphalt concrete mixture for patching and widening listed in Section 502, other than 1/2 inch nominal maximum size mixtures. For joint repair, use Incidental Paving Asphalt Concrete (Level A) complying with Section 502. Use asphalt tack coat complying with Section 504.

510.03 EQUIPMENT. Furnish equipment that meets the specification requirements in Section 503 for the types of material used.

510.04 GENERAL CONSTRUCTION REQUIREMENTS. Remove existing surfacing and base materials by sawcutting and perform all required excavation for patching and widening. Sawcuts shall be for the full depth of the pavement along the perimeter of the pavement to be removed as marked by the Project Engineer. Sawcuts shall be made with a diamond bladed concrete concrete saw for the full depth of patch if patching is performed on the final riding surface. Patching performed on underlying surface can be full depth sawed with a rock saw or milled out with a roto-mill or stabilizer, unless otherwise specified in plans. When through traffic is maintained, place the pavement widening material, or fill and compact open areas or trenches at the end of each day's operations. Under-thickness in excess of 1/2 inch will be corrected at no direct pay.

Excavate and dispose of the excess material beyond the right-of-way in accordance with Section 202 at no direct pay. Uniformly compact the subgrade.

For joint repair, clean contact surfaces of existing pavement and apply a thin, uniform layer of approved asphalt tack coat prior to placing asphalt mixture in the joint.

Patch and widen with asphalt concrete conforming to Section 502 except that priming of the subgrade will not be required. Clean contact surfaces of pavement and apply a uniform layer of approved asphalt tack coat before placement of asphalt concrete. Do not overlay patches for a minimum of 5 calendar days.

Spread, finish, and compact the asphalt concrete leaving the surface smooth and slightly above the edge of existing pavement. To provide lateral support, the contractor may construct temporary berms of excavated material against the outside edge of widening strips prior to rolling. If outside edges of widening strips are not edged up by the end of the work day, place super cones or drums on a maximum of 100-feet centers at no direct pay.

510.05 MEASUREMENT.

510.05.1 Patching: The Department will measure patching of pavement by the square yard or ton of existing pavement designated to be removed and replaced. Saw-cutting, removal of existing surfacing, base course, required excavation, and application of tack coat will not be measured for payment.

510.05.2 Widening: The quantities of widening for payment will be the design areas in square yards or ton as shown on the plans and adjustments thereto. Adjust design quantities if the Project Engineer makes changes to adjust to field conditions. Design quantities are based on the horizontal dimensions shown on the plans. No measurement for payment will be made for widening placed outside the dimensions shown on the plans unless dimensional requirements were re-established by the Project Engineer due to field conditions. Required excavation, removal of existing pavement and base course, asphalt tack coat and disposal of removed material will not be measured for payment. Measure the thickness and width in accordance with DOTD TR 602.

510.05.3 Joint Repair: The Department will measure joint repair by the ton of asphalt concrete used to fill the joint. Measurement will be made in accordance with 502.14.

510.06 PAYMENT.

510.06.1 Patching: Payment for pavement patching will be made at the contract unit prices per square yard or ton, subject to the following provisions:

Payment adjustments for deficiencies in asphalt concrete and asphalt materials will be applied at 1/2 the contract unit price for pavement patching. Asphalt concrete will be subject to the payment adjustment provisions of Section 502, Table 502-7 with 4-inch cores allowed.

When the Project Engineer orders additional thickness of patching in excess of plan thickness, payment for the additional thickness will be made as follows. When patching is on a square yard basis, the value per inch thickness will be calculated by dividing the contract unit price per square yard by the plan thickness. Thickness of patches will be measured from the surface that exists at the time of patching. Payment for the additional thickness will be made at 50 percent of the value per inch thus determined.

When the Project Engineer approves of an under-thickness of patching less than plan thickness, a deduction in payment will be made. The value per inch will be calculated by dividing the contract unit price per square yard by the plan thickness. This deduction per inch of under-thickness will be made at 50 percent of the value per inch.

When payment for patching is made per ton, no adjustment in unit price will be made for additional thickness or under-thickness. Any patching that develops or is required between the time of initial patching operations and the placement of the first lift of asphalt concrete will be paid for at the contract unit price. Any patching required due to base failure after placement of the first lift of asphalt concrete will be paid for at twice the contract unit price.

510.06.2 Widening: Payment for pavement widening will be made at the contract unit price per square yard or ton. Over-widths will be accepted at no additional pay. Correct under-widths by furnishing and placing additional asphalt concrete to a minimum width of 1 foot and plan thickness at no direct pay. Payment adjustments for deficiencies in asphalt concrete and asphalt materials will be applied at 1/2 the contract unit price for pavement widening. Asphalt concrete will be subject to the payment adjustment provisions of Section 502.

510.06.3 Joint Repair: Payment for pavement joint repair will be made at the contract unit price per ton.

Payment will be made under:

Item No.	Pay Item	Pay Unit
510-01	Pavement Patching	Square Yard
510-02	Pavement Widening	Square Yard
510-03	Pavement Joint Repair	Ton
510-04	Pavement Patching	Ton
510-05	Pavement Widening	Ton

PART VI – RIGID PAVEMENT

SECTION 601 – PORTLAND CEMENT CONCRETE PAVEMENT:

Subsection 601.03.8.7 – Dowel Bars (10/18), Pages 314 and 315

601.03.8.7 is deleted and replaced with the following:

601.03.8.7 Dowel Bars: Dowel bars shall have a uniformly round cross section and shall be saw-cut, smooth, and free of burrs, projections, and deformations. Dowel bars shall be coated in accordance with 1009.03.

Place dowel bars in approved basket assemblies or by an approved mechanical device that is capable of accurately placing the dowels to the proper depth and alignment. Position dowel bars parallel to the pavement centerline, and parallel to the surface without any skew of individual bars.

Carefully and thoroughly consolidate the concrete around the dowel bars. When using a mechanical insertion device for placement, firmly hold dowel bars in position during the consolidation process so that the bars do not move when released in the concrete by the mechanical insertion device.

Accurately and securely, mark the transverse centerline of the in-place dowel bars prior to sawing the transverse contraction joint over the dowels.

Provide an approved expansion tube on each bar used in expansion joints. The tube shall fit the dowel bar tightly and the closed end shall be watertight. Locate dowel bar placement as shown on the plans.

For plastic coated dowel bars, with the approval of the engineer, repair all slightly damaged coatings of dowel bars by lightly oiling or greasing; otherwise replace.

SECTION 602 – PORTLAND CEMENT CONCRETE PAVEMENT REHABILITATION:

Subsection 602.09 – High Early Strength (HES) Concrete Pavement Full and Partial Depth Patching (07/19), Pages 334 and 335

602.09 is deleted and replaced with the following:

602.09 HIGH EARLY STRENGTH (HES) CONCRETE PAVEMENT FULL AND PARTIAL DEPTH PATCHING. When specified or when construction conditions merit opening patched areas to traffic before concrete is fully cured, and approved by the engineer, high early strength concrete (HES) shall be used in accordance with Section 902.

Texture the patch surface to match the texture of adjoining pavement. If pavement is to be overlaid, only-drag finish the patched surface. The finished patched surface shall meet the surface finish requirements of 601.03.11 except the finished patched surface profile shall meet a maximum 1/4 inch deviation using an approved minimum 10-foot metal static straightedge.

Subsection 602.16.3.2 – Consistency (04/19), Page 342

602.16.3.2 is deleted and replaced with the following:

602.16.3.2 Consistency: The slurry shall be of such consistency that the efflux time from the flow cone, when tested in accordance with ASTM C939, is 12 to 18 seconds for undersealing, and 15 to 26 seconds for slabjacking.

Subsection 602.16.5 – Dowel Bar Retrofit (10/18), Page 343

Paragraph 1, 2, and 3 of 602.16.5 is deleted and replaced with the following:

602.16.5 Dowel Bar Retrofit: Install coated 1 1/2 inch diameter by 18-inch long plain round dowel bars into slots cut across and through existing concrete pavement transverse joints. Remove the existing portland cement concrete pavement from the slots and retro fit the dowel bars across the pavement joints. Fill the voids surrounding the dowel bars with a rapid setting concrete patching material on the AML. Saw and seal the transverse joints as required in the plans.

All work shall conform to the plans, and the following requirements.

Patented processes or devices for simultaneous cutting of slots for dowel bar retrofitting shall conform to 107.03.

Subsection 602.16.5.2 – Construction Requirements (10/18), Page 344

Paragraph 6 of 602.16.5.2 is deleted and replaced with the following:

When using plastic coated dowel bars, lightly oil or grease the dowel bars prior to placement. The bar chairs shall provide a minimum of 1/2-inch clearance between the bottom of the dowel bar and the bottom of the slot. Center the dowel bars over the transverse joint. Place the bar in the middle of the slot to the depth shown on the plans, parallel to the roadway centerline and the roadway surface. The chairs shall hold the dowel bar securely in place during placement of the patching mix.

PART VII – INCIDENTAL CONSTRUCTION

TABLE OF CONTENTS:

Sections 741, 742, 743, and 744 (08/22), Page 350

Items 741, 742, 743, and 744 are deleted and replaced with the following:

SECTION 701 – CULVERTS AND STORM DRAINS:

All Subsections (07/20), Pages 351 – 363

701 is deleted and replaced with the following:

Section 701
Culverts and Storm Drains

701.01 DESCRIPTION. Furnish, install, and clean pipe, pipe arch, storm drains, and sewers, also referred to as culverts or conduits, in accordance with these specifications and in conformity with the lines and grades shown on the plans or as established by the engineer.

701.02 MATERIALS. Materials shall comply with the following sections and subsections:

Usable Soil	203.06.1
Selected Soil	701.08.1
Plastic Soil Blanket	203.10
Flowable Fill	710
Portland Cement Concrete	901
Mortar	1001.03
Stone	1003.03.1
Recycled Portland Cement Concrete	1003.03.2
Granular Material	1003.09
Bedding Material	1003.10
Thermoplastic Pipe	1006
Split Plastic Coupling Bands	1006.06
Plastic Yard Drain Pipe	1006
Gasket Material	1016.01.1
Reinforced Concrete Pipe	1016.02
Reinforced Concrete Pipe Arch	1016.03
Bituminous Coated Corrugated Steel Pipe and Pipe Arch	1007.02
Structural Plate for Pipe, Pipe Arch and Arch	1007.04
Corrugated Aluminum Pipe and Pipe Arch	1007.05
Coupling Bands	1007.09, 1007.08.1
Reinforcing Steel	1009
Geotextile Fabric	1019

701.02.1 Side Drain Pipe or Side Drain Pipe Arch: When an item for Side Drain Pipe or Side Drain Pipe Arch is included in the contract, furnish thermoplastic pipe, corrugated metal pipe or corrugated metal pipe arch, or reinforced concrete pipe or reinforced concrete pipe arch in conformance with Sections 1006, 1007, or 1016, as indicated by the pay item, unless otherwise specified.

701.02.2 Cross Drain Pipe or Cross Drain Pipe Arch: When an item for Cross Drain Pipe or Cross Drain Pipe Arch is included in the contract, furnish thermoplastic pipe, corrugated metal pipe or corrugated metal pipe arch, or reinforced concrete pipe or reinforced concrete pipe arch in conformance with Sections 1006, 1007 or 1016, as indicated by the pay item, unless otherwise specified.

701.02.3 Storm Drain Pipe or Storm Drain Pipe Arch: When an item for Storm Drain Pipe or Storm Drain Pipe Arch is included in the contract, furnish thermoplastic pipe, corrugated metal pipe or corrugated metal pipe arch, or reinforced concrete pipe or reinforced concrete pipe arch in conformance with Sections 1006 or 1016, as indicated by the pay item, unless otherwise specified.

701.02.4 Yard Drain Pipe: When an item for Yard Drain Pipe is included in the contract, furnish thermoplastic pipe in accordance with Section 1006 unless otherwise specified.

701.02.5 Material Type Abbreviations:

701.02.5.1 Reinforced Concrete Pipe:

RCP	Reinforced Concrete Pipe
RCPA	Reinforced Concrete Pipe Arch

701.02.5.2 Corrugated Metal Pipe:

CAP	Corrugated Aluminum Pipe
CAPA	Corrugated Aluminum Pipe Arch
CMP	Corrugated Metal Pipe
CMPA	Corrugated Metal Pipe Arch
CSP	Corrugated Steel Pipe
CSPA	Corrugated Steel Pipe Arch
BCCSP	Bituminous Coated Corrugated Steel Pipe
BCCSPA	Bituminous Coated Corrugated Steel Pipe Arch

701.02.5.3 Thermoplastic Pipe (TPP):

TPP	Thermoplastic Pipe
PVCP	Polyvinyl Chloride Pipe
RPVCP	Ribbed Polyvinyl Chloride Pipe
CPEPSW	Corrugated Polyethylene Pipe Single Wall
CPEPDW	Corrugated Polyethylene Pipe Double Wall
CPPPDW	Corrugated Polypropylene Pipe Double Wall

701.02.6 Joint Type Abbreviations:

T1	Type 1 Joint
T2	Type 2 Joint
T3	Type 3 Joint

701.02.7 Quality Assurance for Pipe: Manufacturing plants will be periodically inspected for compliance with specified manufacturing methods, and material samples will be randomly obtained for laboratory testing for verification of manufacturing lots. Materials approved at the manufacturing plant will be subject to visual acceptance inspections at the jobsite or point of delivery.

701.02.8 Pipe Definitions: Flexible pipe consists of all corrugated metal and thermoplastic pipe.

701.03 EXCAVATION. For all trench excavation, ensure that the sides of the trench are stable, as evidenced by the sides of the trench being able to maintain a vertical cut face. Consider the sides unstable if fissures develop in the face of or adjacent to the open excavation; if the edge of the excavation subsides; if material ravels, spalls, or slumps from the face of the excavation; or if the bottom of the excavation bulges or heaves. In all cases of apparent distress, or when the trench excavation exceeds 5 feet in depth, sloping, benching, and shoring will be required in accordance with the OSHA trench safety standards, 29 CFR § 1926 (P). Consider these and any more stringent trench safety standards as minimum contract requirements.

Submission of bid and subsequent award of contract will serve as certification that all trench excavation in excess of 5 feet will be in compliance LA R.S. 48:251.1.

Consider all available geotechnical information when designing the trench excavation safety system, including groundwater. Evaluate trench stability due to the effects of surcharge loads from adjacent structures, stored materials and equipment, or traffic. Ensure that excavated material is placed a sufficient distance back from the trench edge to preclude material from falling back into the trench, otherwise provide an adequate retention system.

Ensure that the bottom width of a pipe trench provides at least 18 inches of clearance on each side of the pipe. For flexible pipe with a diameter greater than or equal to 48 inches provide, a minimum of 24 inches of clearance on each side of the pipe. In accordance with 202.02, satisfactorily dispose of surplus excavated material that does not conform to the requirements of 203.06.1. Control rainfall runoff or excess moisture by proper selection of backfill materials, dewatering sumps, wells, well points, or other approved procedures during excavation, bedding installation, over-excavated trench backfilling, pipe placement, and pipe backfill.

701.03.1 Over-Excavation: When encountering unsuitable material as defined in 203.04, or a stable, non-yielding foundation cannot be obtained at either the established pipe grade or at the grade established for placement of the bedding, remove unstable or unsuitable material below this grade and replace with granular material complying with 1003.09, bedding materials complying with 1003.10, or Type A backfill complying with 701.08.1. Place all granular backfill materials below the established pipe or bedding grade in lifts less than 8 inches thick. Compact sufficiently with a dynamic mechanical hand compaction device over the surface of each lift to form a stable, non-yielding foundation at the surface of the established bedding or pipe grade.

When encountering rock, remove the rock below grade and replace it with granular material, bedding materials, or Type A backfill. Provide a compacted earth cushion thickness under the pipe of at least 1/2 inch per foot of fill height over the top of the pipe with a minimum thickness of 8 inches. Place all granular backfill materials below the established pipe or bedding grade in lifts less than 8 inches thick. Sufficiently compact with a dynamic mechanical hand operated compaction device over the surface of each lift to form a stable, non-yielding foundation at the surface of the established bedding or pipe grade.

Materials used to backfill in an over-excavated portion of a trench do not require encasement in a geotextile fabric.

701.04 FORMING PIPE BED. When specifying bedding material, construct in accordance with Section 726. Materials allowed for bedding shall comply with 1003.10 or may be type A backfill materials. When specifying bedding materials, perform additional excavation below established pipe grade and place the bedding material in lifts less than 8 inches thick. Lightly compact with a vibratory plate compactor over the surface of each lift then scarify 3 inches deep minimum 1/3 pipe diameter wide.

When the bottom of the pipe is not laid in a trench but constructed above natural soils, construct a uniform bed as specified for the bottom of a trench.

In lieu of removing and replacing unstable soil with granular material, bedding material, or Type A backfill material, a cabled articulated concrete block mattress meeting the requirements of Section 712 may be used with a 6-inch layer of bedding material between the pipe and the mattress installed in accordance with Section 726. Excavate the trench to a depth 6 inches plus the thickness of the mattress below the grade line of the pipe. Join adjacent mattress segments together to form a continuous supporting foundation beneath the pipe to the satisfaction of the engineer.

701.05 LAYING PIPE. Begin laying pipe at the downstream end of the line. Ensure that the pipe is in contact with the foundation throughout its length. Place bell or grooved ends of pipe and outside circumferential laps of riveted metal pipe facing upstream. Place riveted seam metal pipe with longitudinal laps at sides. Pipes in each continuous line shall have the same wall thickness. Handle metal pipes provided with lifting lugs only by these lugs.

After laying pipe and before placing backfill, the engineer will inspect the pipe for alignment, grade, integrity of joints, and coating damage.

701.06 JOINING PIPE.

701.06.1 Joint Usage: Joints types shall be selected in accordance with Table 701-1 and the roadway classification provided in the plans.. If the roadway classification is not provided in the plans, use Type 3 joints for all cross drain applications other than on local roads. Unless otherwise directed or specified, joint types for connecting side roads shall match the mainline roadway classification.

Table 701-1
Joint Type Selection

Joint Type	Application	Roadway Classification
Type 1 (T1)	Side Drain	All roadway classifications
Type 2 (T2)	Cross drains	2-lane Collector roadways and Local roadways
Type 3 (T3)	Cross drains	Freeways, Ramps, Arterials and multi-lane Collector roadways
	Storm drains, flumes, siphons, other watertight systems	All roadway classifications

701.06.2 Concrete Pipe: Concrete pipe may be either bell and spigot or tongue and groove. Join pipe sections so that ends are fully entered and inner surfaces are flush and even.

Use an approved mechanical pipe puller for joining pipes over 36 inches in diameter. For pipe 36 inches or less in diameter, use any approved method for joining pipe that does not damage the pipe.

Joints shall comply with 1016.01.1 and 1018.03. Seal with gasket material installed in accordance with the manufacturer's recommendations.

701.06.3 Metal Pipe: Firmly join metal pipe by coupling bands. Center bands over the joint.

For Type 1 joints, place approved gasket material in one corrugation recess on each side of the joint at the coupling band and on each band connection in such manner to prevent leakage.

When Type 2 or 3 joints are specified, join metal pipe sections as follows:

701.06.3.1 General: Seal band joints with gasket material. Place gasket material in accordance with the plan details.

701.06.3.2 Circular Section: Connecting bands shall be of an approved design. Install in accordance with plan details.

701.06.3.3 Arch Section: Connecting bands shall be a minimum of 12 inches wide for a pipe arch less than 36 inches round equivalent diameter, and a minimum of 21 inches wide for pipe arch 36 inches round equivalent diameter and greater. Connect bands at the ends by approved angle or strap connections. Use two-piece connecting bands for a pipe arch 36 inches round equivalent diameter and greater.

701.06.4 Thermoplastic Pipe: Joints for thermoplastic pipe shall be bell and spigot or split coupling bands.

701.06.4.1 Bell and Spigot Type Joint System: Join pipe sections so that ends are fully entered and inner surfaces are flush and even.

Use any approved method for joining pipe that does not damage the pipe.

After joints approval, seal with a rubber gasket material complying with 1007.08.4.1.

701.06.4.2 Split Coupling Type Joint System: Split coupling bands shall comply with all dimensional and material requirements of 1006.07. Center the bands over the joint. Secure the split coupling band to the pipe with a minimum of five stainless steel or other approved corrosion resistant bands.

After joints approval, seal with gasket material. Place gasket material in the first two corrugation recesses on each side of the pipe connection. Also place gasket material on each band connection to prevent leakage. When using flexible thermoplastic gasket material, it shall be a minimum of 1/2 inch in size. Tighten the bands to create overlap of the band and adequately compress the gasket material.

701.06.5 Connections: Use approved connections when joining new pipes to existing pipes. When using concrete collars to extend the ends of existing pipes that have been damaged construct the concrete collars in accordance with plan details, the applicable requirements of Section 901, and as directed. Wrap pipe joints with geotextile fabric before pouring concrete and in accordance with Section 1019.

701.06.6 Geotextile Fabric Wrapped Pipe Joints: For concrete, metal, and thermoplastic pipes, use Types 2 and 3 joints wrapped with geotextile fabric for a minimum of 12 inches on each side of the joint for pipe 36 inches or less in diameter and a minimum of 18 inches on each side of the joint for pipe greater than 36 inches in diameter. Wrap the ends of the fabric around the circumference of the pipe and overlap at least 10 inches. Secure the edges and ends of fabric for the entire circumference of the pipe.

701.07 RELAYING PIPE. If specified or directed, remove existing pipes and relay suitable sections as specified for new pipes.

701.08 BACKFILLING.

701.08.1 General: Prior to backfilling, remove pipes found to be damaged or out of alignment or grade; reinstall or replace.

Type A backfill material shall be stone, recycled portland cement concrete, or flowable fill.

Type B backfill materials are select soils. Select soils are natural soils with a maximum PI of 20, a maximum liquid limit of 35, and a maximum organic content of 5 percent. Soils with a silt content of 50 percent or greater and also a PI of 10 or less will not be allowed. Where Type B backfill materials are called for, Type A backfill materials may be substituted.

When using corrugated metal pipe, the backfill material shall be tested and shall have a resistivity greater than 1500 ohm-cm and a pH greater than 5 when tested in accordance with DOTD TR 429 and DOTD TR 430 respectively.

When using Type A backfill material, place geotextile fabric to surround this backfill in accordance with 726.03 between the aggregate backfill material and all other natural or placed soils in the trench or embankment. Take care to prevent damage to geotextile fabric during placement of backfill material. For concrete pipe, enclose not only the initial backfill with the fabric, but wrap the fabric over the top of the pipe with at least 12 inches of overlap.

When using a trench box or trench sheeting in unstable soils and/or for worker safety, and when moved during backfilling operations, immediately fill and provide additional compaction of the disturbed zone of backfill to the satisfaction of the engineer.

Initial backfill is a structural backfill encasing the pipe from the bottom of the pipe to the springline for concrete pipe and to a point one foot above the top of the pipe for flexible pipe. Final backfill is not a structural backfill. Final backfill extends from the top of the initial backfill to the top of the subgrade in cut areas or to the top of existing ground in fill areas. Consider and treat any fill required above the final backfill as embankment.

Backfill shall be placed and compacted in accordance with the plan details.

701.08.2 Pipes Subject to Construction Traffic: Construct the embankment or pipe backfill to a minimum height of 24 inches over the pipe before allowing heavy construction equipment to cross the installation. Where practical, do not construct installations with less than 24 inches of cover over the top of the pipe until after completing the heavy hauling over the pipe location. After completion of hauling operations, remove excess cover material. Remove and reinstall or replace, pipe damaged by hauling and backfilling operations at no direct pay.

701.08.3 Placement and Compaction: For all pipes, culverts, and conduits under paved and unpaved areas, where using Type A and Type B backfill material, thoroughly hand compact the Type A and Type B backfill under the pipe haunches and then dynamically compact in layers not exceeding 12 inches compacted thickness. Initially compact under the haunches of the pipe by hand tamping or other acceptable means, until reaching a level in which the dynamic tamping can commence. Compact each lift using a hand operated, dynamic mechanical compaction device over the surface of each lift. Verify satisfactory installation and performance, in accordance with 701.08.6. If using flowable fill, furnish, place, and consolidate in accordance with Section 710. Control placement operations during initial backfill operations without damage to protective coatings on metal pipes. Repair damaged coatings at no additional pay.

701.08.4 Deleted

701.08.5 Placement and Compaction- Trenchless or Partial Trench Condition: All pipes, culverts, drains, and conduits placed with any portion of the pipe above existing ground shall comply with 701.08.1, 701.08.2, 701.08.3; 701.08.4 shall be for the portion of the pipe within a trench and the portion of the pipe not constructed in a trench. The initial and final backfill of that portion of pipe above existing ground and not within a trench shall be constructed to such a width that the requirements for placement, compaction, and density are met.

701.08.6 Density Requirements: Under all paved areas which are to be under traffic, determine the maximum dry density of the backfill material, excluding flowable fill, in accordance with DOTD TR 415 or TR 418. Determine in-place density in accordance with DOTD TR 401. Place backfill, excluding flowable fill, at or near optimum moisture content in accordance with DOTD TR 415 or TR 418. Compact each layer by approved methods prior to the placement of a subsequent layer. The engineer will approve the compaction method upon validation that such method, including moisture control, will achieve at least 95 percent of maximum dry density in accordance with DOTD TR 401. Density testing on subsequent backfill layers may be waived by the engineer if installation has been in accordance with approved compaction methods and performance has been continuously satisfactory.

Under all unpaved areas, place initial and final backfill and compact evenly along the length of the culvert, pipe, or drain. Compact layered backfill to at least the density of the adjoining existing soils or the compaction required of the laterally adjoining layers of soil immediately outside the trench for embankment installations. Place and compact initial and final backfill at or near optimum moisture content in accordance with DOTD TR 415 or TR 418.

701.09 INSPECTION OF PIPES. After completion of embankment and prior to roadway surfacing, the engineer shall inspect pipes for proper alignment and integrity of joints. Correct any misaligned pipe or defective joints at no direct pay.

701.09.1 Thermoplastic Pipe: Test installed thermoplastic pipe to ensure that vertical deflections do not exceed 5.0 percent. Maximum allowable deflections shall be governed by the mandrel requirements stated herein.

Perform deflection tests no sooner than 30 calendar days after installation and compaction of backfill. Clean the pipe and inspect for offsets and obstructions prior to testing.

For pipe 36 inches and less in diameter, pull a mandrel through the pipe by hand to ensure that maximum allowable deflections have not been exceeded. The mandrel must be approved by the Department. Use of an unapproved, mandrel or a mandrel altered or modified after approval mandrel will invalidate the test. If the mandrel fails to pass through the pipe, the pipe is over-deflected.

Unless otherwise permitted, uncover over-deflected pipe and, if not damaged, reinstall. Do not reinstall damaged pipe. Remove and replace with new pipe. Any pipe subjected to any method or process other than removal, which attempts, even successfully, to reduce or cure any over-deflection, shall be removed and replaced with new pipe.

Use a rigid, nonadjustable, odd-numbered leg (minimum 9 legs) mandrel having a length not less than its nominal diameter or 24 inches, whichever is less. The minimum diameter at any point shall be 5.0 percent less than the base inside diameter of the pipe being tested. The mandrel shall be fabricated of steel, aluminum, or other approved material fitted with pulling rings at each end. The nominal pipe size and outside diameter of the mandrel shall be verified prior to pulling the mandrel through the pipe. Furnish a suitable carrying case.

For pipe larger than 36 inches in diameter, determine deflection by a method approved by the engineer. If a mandrel is selected, the minimum diameter, length, and other requirements shall conform to the above requirements.

Conduct mandrel testing in the presence of the engineer. Mandrel testing shall be at no direct pay.

701.09.2 Metal Pipe: If the inside diameter of metal pipe or rise dimension of metal pipe arch deflects more than 5.0 percent from original dimensions, remove and reinstall the metal pipes or pipe arches, unless they do not rebound or are damaged. Remove pipes or pipe arches which are damaged or do not rebound; and replace at no direct pay. Measurement of deflection will be made by the engineer away from rerolled ends.

701.10 CLEANING PIPES.

701.10.1 Existing Pipes: Clean designated pipes of soil, debris, and other materials to the invert of the pipe by approved methods that will not damage the pipes. Satisfactorily repair all damage caused by the contractor's operations at no direct pay.

Dispose of removed soil, debris, and other materials in accordance with 202.02 or as otherwise approved in writing.

701.10.2 Contractor Installed Pipes: Prior to final acceptance, clean pipes of all debris and soil to the invert of the pipe at no direct pay.

Dispose of removed soil, debris, and other materials in accordance with 202.02 or as otherwise approved in writing.

701.11 STUBBING AND PLUGGING PIPES.

Construct pipe plugs with Class R concrete complying with Section 901. Thickness of plug and method of construction shall be as directed.

When stubbing new pipes are to be stubbed into new or existing pipes or other structures, make the connection with approved mortar complying with 1001.03.

701.12 MEASUREMENT.

1. The length of new and re-laid pipe will be measured in linear feet along the pipe from end to end unless stated otherwise.
2. Pipe tees, elbows, and other fittings will be measured per each fitting. The length of pipe in such fittings will be included in the pay length measurement of pipes of which they form a part.
3. Excavation required for pipe installation will not be measured for payment, except as otherwise specified in 203.14 and 701.12.10.
4. Furnishing and placing backfill material below existing ground level for pipes will not be measured for payment. Backfill material needed to complete backfill above natural ground and around pipes that extend above natural ground will be measured for payment under applicable earthwork items. When specifying flowable fill, measure for payment in accordance with Section 710.

5. Plugging and stubbing of pipes will not be measured for payment.
6. Cleaning existing pipes will be measured by the length of pipe cleaned and accepted.
7. Concrete collars will be measured per each.
8. Dewatering of excavated areas will not be measured for payment.
9. Special shoring and bracing (depth > 5 feet), needed in addition to OSHA requirements for trench safety, will be measured by the square foot of wall area.
10. Trench excavation safety protection (depth > 5 feet) will be measured by the length of trench having a depth > 5 feet below natural ground.
11. Geotextile fabric will not be measured for payment.

701.13 PAYMENT. Payment for concrete and metal pipe will be made at the contract unit price per linear foot of the types and sizes specified, which includes all labor, materials, equipment, tools, and incidentals necessary to complete the work.

When thermoplastic pipe is shown on the plans or elected to be used by the contractor, payment will be made at the contract unit price per linear foot of the types and sizes specified in accordance with the payment schedule of Table 701-2.

Table 701-2
Payment Schedule for Thermoplastic Pipe

Percent Payment	Stage of Completeness
75	After placement and backfill has been completed
25	After the pipe has met vertical deflection requirements in accordance with 701.09.1

Payment for fabricating pipe tees, elbows, and other fittings will be made at the contract unit price per each fitting.

When unstable conditions are encountered, the additional excavation will not be measured for payment; however, the additional materials furnished and placed for the pipe foundation will be measured and paid for as follows:

1. Granular Materials: Payment will be made under the embankment item. The net section volume of the materials will be multiplied by 3 to determine the pay volume. When the contract does not include a pay item for embankment, payment will be made in accordance with 104.02.
2. Bedding Material: Measurement and payment will be made in accordance with Section 726. When the contract does not include a pay item for bedding material, payment will be made in accordance with 104.02.
3. Trench Excavation Safety Protection: When excavation depths exceed 5 feet from natural ground, safety precautions for excavations in compliance with OSHA are required and will be paid per linear foot of trench. When the contract does not include a pay item for trench excavation safety protection, payment will be made in accordance with 104.02.
4. Payment for cleaning existing pipes will be made at the contract unit price per cleaned linear foot.
5. Payment for concrete collars will be made at the contract unit price per each.
6. Payment for special shoring and bracing will be made at the contract unit price per square foot of wall area.

Payment will be made under:

Item No.	Pay Item	Pay Unit
701-01	Cross Drain Pipe	Linear Foot
701-02	Cross Drain Pipe Arch	Linear Foot
701-03	Storm Drain Pipe	Linear Foot
701-04	Storm Drain Pipe Arch	Linear Foot
701-05	Side Drain Pipe	Linear Foot
701-06	Side Drain Pipe Arch	Linear Foot
701-07	Yard Drain Pipe	Linear Foot
701-08	Relaying Pipe	Linear Foot
701-09	Pipe Fittings	Each
701-10	Reinforced Concrete Pipe (Extension)	Linear Foot
701-11	Reinforced Concrete Pipe Arch (Extension)	Linear Foot
701-12	Corrugated Metal Pipe (Extension)	Linear Foot
701-13	Corrugated Metal Pipe Arch (Extension)	Linear Foot
701-14	Cleaning Existing Pipes	Linear Foot
701-15	Concrete Collar	Each
701-16	Thermoplastic Pipe (Extension)	Linear Foot
701-17	Trench Excavation Safety Protection (Depth >5 feet)	Linear Foot
701-18	Special Shoring and Bracing (Depth >5 feet)	Square Foot

SECTION 704 – GUARDRAIL:

Subsection 704.02 – Materials (12/17), Page 373

704.02 is deleted and replaced with the following:

704.02 MATERIALS. Materials shall comply with the following sections and subsections:

Portland Cement Concrete (Class A1)	901
Reinforcing Steel	1009
Metal Beam Guardrail	1010.09
Guardrail Posts and Blockout	1010.10
Guardrail Hardware	1010.11
Wire Rope and Fittings for Highway Guardrail	1010.12

Welding shall comply with Section 809.

SECTION 705 – FENCES:

Subsection 705.03 – General Construction Requirements (05/18), Pages 376 and 377

705.03 is deleted and replaced with the following:

705.03 GENERAL CONSTRUCTION REQUIREMENTS. Conform to Section 201 when clearing and grubbing for fence installation.

Confine operations to the area adjacent to right-of-way lines and within the right-of-way.

Where breaks in a run of fencing are required, and at intersections with existing fences, make appropriate adjustment in post spacing for the type closure indicated.

Place wood posts with small end up. When posts, braces, or anchors are to be embedded in concrete, install temporary braces as required to hold posts in proper position until concrete has set sufficiently to hold posts. Do not install fencing material on posts or place strain on bracing set in concrete for 72 hours after concrete has been placed. Set tops of posts to required grade and alignment. Cutting of wood post tops will be allowed only when approved. Treat cut ends with 2 applications of the same type preservative used for post treatment. Stretch wire taut.

Install ground rods along each segment of new or rebuilt fence in conformance with plan details.

SECTION 707 – CURBS AND GUTTERS:

Subsection 707.12.2 – Portland Cement Concrete (05/18), Page 386

707.12.2 is deleted and replaced with the following:

707.12.2 Portland Cement Concrete: The portland cement concrete in the curbs and/or gutters will be identified by lots and shall be subject to payment adjustments per linear foot in accordance with Table 901-4 for Class A1 concrete and Table 601-3 for Type B & D concrete. Size, sampling, and testing of each concrete lot shall be in accordance with the Materials Sampling Manual.

SECTION 713 – TEMPORARY TRAFFIC CONTROL:

Subsection 713.02 – Materials (08/21), Page 403

713.02 is deleted and replaced with the following:

713.02 MATERIALS. Materials for temporary signs, barricades, barriers, and related devices shall comply with the following sections and subsections:

Portland Cement Concrete	901
Reinforcing Steel	1009.01
Backing Material	1015.04.2
Reflective Sheeting	1015.05
Sign Enamels, Paints, Silk Screen, Overlay Film, and Digital Printing	1015.07
Temporary Pavement Markings	1015.08
Raised Pavement Markers & Adhesive	1015.09
Thermoplastic Pavement Markings	1015.10
Traffic Paint	1015.12
Barricade Warning Lights	1018.13

713.02.1 Temporary Pavement Markings: Temporary pavement markings shall be a minimum of 4 inches wide.

713.02.2 Reflective Sheeting: Reflective sheeting requirements for temporary signs, barricades, channelizing devices, drums, and cones shall comply with 1015.05.6

Subsection 713.07 – Pavement Markings (08/21), Page 407

Table 713-1 is deleted and replaced with the following:

Table 713-1
Temporary Pavement Marking[1,2]

		Two-Lane Highways	Undivided Multilane Highways	Divided Multilane Highways
Short Term	Required Striping that must be in place at the end of each day of paving and maintained until replaced with other short term or long term markings.	Centerlines 4-foot tape on 40-foot centers	Lane lines 4-foot tape on 40-foot centers	Lane lines 4-foot tape on 40-foot centers
		"Do Not Pass" and "Pass With Care" signs, as required	Double yellow centerline	
	Required Striping that must be in place, within 72 hours of removal or overlay of permanent striping, and maintained until replaced with either long-term striping or permanent striping.	Centerlines 4-foot tape on 40-foot centers	Lane lines 4-foot tape on 40-foot centers	Lane lines 4-foot tape on 40-foot centers
		No passing zone markings	Double yellow centerline	Edge lines
		Edge lines	Edge lines	
Long Term	Required Striping that must be in place within 30 days of removal or covering of permanent striping and maintained until permanent striping is installed.	Standard 10-foot long centerlines on 40-foot center	Standard 10-foot long lane lines on 40-foot center with raised pavement markers[3]	Standard 10-foot long lane lines on 40-foot center with raised pavement markers[3]
		No passing zone markings	Double yellow centerline with raised pavement markers[3]	Legends & Symbols
		Legends & Symbols	Legends & Symbols	
		Edge lines	Edge lines	Edge lines

[1]On all asphalt surface treatments, that are open to traffic, temporary reflectorized raised pavement markers (tabs) on 20-foot centers shall be used in lieu of the 4-foot tape on 40-foot centers.
[2]All work will be stopped and time will continue to be charged if the required markings in this table are not in place and maintained throughout the indicated time periods. Work will only resume after all required markings are in place and approved by the Project Engineer
[3]Raised Pavement Markers only to be applied on concrete surfaces when required in plans.

Subsection 713.07.1 – Short-term Pavement Markings (08/21), Pages 407 and 408

713.07.1 is deleted and replaced with the following:

713.07.1 Short-term Pavement Markings: Provide short-term pavement markings on all pavement surfaces under traffic according to Table 713-1.

When short-term pavement markings require no-passing zone markings or double yellow centerlines, use any of the temporary pavement markings listed in 713.02.

Removal of short-term pavement markings is only required on the final surface, unless otherwise indicated in the plans or required in order to avoid conflicting markings due to phasing.

Subsection 713.07.2 – Long-term Pavement Markings (08/21), Page 408

713.07.2 is deleted and replaced with the following:

713.07.2 Long-term Pavement Markings: Provide long-term pavement markings according to Table 713-1 and in accordance with plan details and standard plans. Layout work for exact location of markings will only be required on the final wearing surface.

These markings include all of the pavement markings listed in 713.02.

Subsection 713.11.2 – Temporary Pavement Markings (08/21), Page 419

The first paragraph of 713.11.2 is deleted and replaced with the following:

When the contract does not include a pay item for Temporary Pavement Markings, provision of these markings will be considered by the Department to be for the convenience of the contractor and will not be measured for payment. When the contract includes an item for Temporary Pavement Markings, these markings will be measured by the linear foot, mile, per each, or as specified and will include acceptable furnishing, placing, maintenance, and removal.

SECTION 724 – RUMBLE STRIPS:

Subsection 724.04 – Measurement (10/18), Page 457

The first paragraph of 724.04 is deleted and replaced with the following:

The quantity of Rumble Strips (Centerline or Shoulder/Edge) to be paid for will be the plan quantity in miles, constructed and accepted. The plan quantity will be determined based on the roadway length. Shoulder/edge rumble strips shall be measured per each shoulder. No deduction will be made for gaps.

SECTION 731 – RAISED PAVEMENT MARKERS:

All Subsections (08/18), Pages 479 – 481

731 is deleted and replaced with the following:

Section 731
Raised Pavement Markers

731.01 DESCRIPTION. Furnish and place raised pavement markers in accordance with the plans.

The contractor shall be responsible for field layout and alignment of raised pavement markers. Existing pavement striping shall generally be used as a guide in determining raised marker locations. Any required striping will be placed prior to installation of raised pavement markers.

731.02 MATERIALS.

731.02.1 Markers: Markers shall comply with 1015.09. Use the same product throughout the project. Mix epoxy components and dispense adhesive in accordance with manufacturer's recommendations.

731.02.2 Epoxy Adhesive: Epoxy resin adhesive system shall comply with 1017.03.

731.02.3 Bituminous Adhesive: Bituminous adhesive shall comply with 1015.09.3.2.

731.03 CONSTRUCTION REQUIREMENTS.

731.03.1 Weather Limitations: Do not apply markers if moisture is present.

731.03.1.1 Epoxy Adhesive: When using a standard set adhesive, do not apply markers at ambient air temperatures less than 50°F. When using a rapid set adhesive, do not apply markers at ambient air temperatures less than 35°F. When using a rapid set adhesive, application of markers will be permitted at ambient air temperatures between 35°F and 50°F, provided the adhesive is adequately heated to obtain proper viscosity for mixing and application, and is also identified as a rapid set type on container labels and Certificates of Delivery.

731.03.1.2 Bituminous Adhesive: Apply markers when the ambient air temperature reaches 35°F or greater, or in accordance with the manufacturer's recommendations.

731.03.2 Removal of Markers: Remove markers, when required, by methods that will not damage the pavement surface. Repair damage to pavement surface at no cost to the Department. After removing the markers, the debris and residue shall become the property of the contractor and be disposed of properly.

731.03.3 Cleaning of Surfaces: Surfaces, including ramps and gore areas, on which markers are to be applied must be cleaned of all materials that may reduce the bond of adhesive. Maintain surfaces in a clean dry condition until placement of markers.

731.03.4 Application of Markers: Do not place pavement markers on joints.

Place markers with bituminous adhesive on asphalt surfaces. Place markers with epoxy resin adhesive, or bituminous adhesive on portland cement concrete surfaces.

Apply markers to surfaces with adhesive in sufficient quantity to be slightly outside the entire perimeter of the marker.

731.04 MEASUREMENT. Raised pavement marker installation will be measured per each marker furnished, placed, and accepted.

Raised pavement marker removal will be measured per centerline miles (project length) including shoulders and ramps.

731.05 PAYMENT. Payment for installation of raised pavement markers will be made at the contract unit prices per each. Payment for removal of raised pavement markers will be made at the contract unit price per linear mile. Payment will include all labor, materials, equipment, and incidentals necessary to complete the work.

Item No.	Pay Item	Pay Unit
731-01	Non-reflectorized Raised Pavement Markers	Each
731-02	Reflectorized Raised Pavement Markers	Each
731-03	Removal of Raised Pavement Markers	Linear Mile

SECTION 740 – CONSTRUCTION LAYOUT:

Subsection 740.02 – Construction Requirements (08/20), Pages 526 and 527

740.02 is deleted and replaced with the following:

740.02 CONSTRUCTION REQUIREMENTS. Establish all lines and grades and stake out all project work, including sufficient vertical and horizontal control points for utility relocations for use by the Department and others.

The project survey control and horizontal alignment are based on the Louisiana State Plane Coordinate System. The construction plans and/or right-of-way map depicts the coordinates and datum of sufficient survey control points to establish or re-establish horizontal control throughout the length of the project. Employ such methods as approved by the Project Engineer for the location of the project alignment and other necessary survey control points in accordance with currently acceptable surveying standards and practices. When required, the Department will also provide one bench mark on or near the project for vertical control. Verify the values of any intermediate bench marks shown on the plans, by checking against the bench mark established by the Department for vertical control.

Employ qualified engineering and surveying personnel experienced in layout and construction of highways and bridges to correctly establish and keep complete and comprehensive records (field books or approved electronic files) of all lines and grades necessary from initial layout to final acceptance. Provide sufficient qualified staff, of at least one employee, on site during utility relocation periods. Provide any necessary survey work to ensure there are no utility conflicts with required construction. Provide daily documentation of utility relocation activities for incorporation into the project diaries.

The contractor shall be liable for the accuracy of the initial layout and all subsequent alignment and elevations and shall, at no additional pay, rebuild, repair or make good any portion of the work found to be incorrectly positioned either horizontally or vertically at any time before final acceptance. Notify the Engineer, in writing, immediately of any apparent errors in the plans. Compute and provide template grades to the Engineer. In order to obtain pipe order lengths, provide the appropriate grades to the Engineer two weeks in advance of the work.

Numbered notebooks for recording of all lines and grades will be provided by the Department and shall be properly indexed and cross referenced by the contractor before return to the Engineer for submittal with the final estimate. Computer generated printouts will be allowed when approved.

Set stationing for overlay projects using an approved measuring device that is accurate to 0.1 percent. Place stakes every 100 linear feet and maintain throughout construction.

When existing markings are to be removed or covered, or obliterated in such manner that the existing layout can no longer readily be determined in the field and the plans do not provide a proposed layout for pavement markings for the entire roadway or any section of roadway, then the existing pavement markings shall be recorded and submitted to the Engineer as the Existing Pavement Markings Layout for review.

All existing signs, including those being removed or replaced, must be documented in an inventory and should include the station and offset, sign type and condition, and submitted to the Engineer as the Existing Signs Inventory for review. The inventory must be in an acceptable format for use by the Project Engineer.

The Existing Pavement Markings Layout and the Existing Signs Inventory shall be submitted at least 7 days prior to the start of construction and may be used by the Project Engineer in conjunction with the District Traffic Operations Engineer in its entirety or in a modified version as the final pavement marking layout.

The installation of pavement markings shall not proceed until approval is granted by the District Traffic Operations Engineer.

PART VIII – STRUCTURES

SECTION 803 – DRILLED SHAFTS:

Subsection 803.03.3.2 – Testing Consultant (04/20), Page 566

803.03.3.2 is deleted and replaced with the following:

803.03.3.2 Testing Consultant: Use an experienced independent Testing Consultant that has been accepted by the Engineer prior to testing. Submit the consultant qualifications and the specifications for the test equipment to the Engineer prior to beginning drilled shaft installation. Perform all integrity testing and analyses under the supervision of a Registered Professional Engineer in the State of Louisiana.

A minimum of 3 years of experience in field testing and analyses of CSL test results is required for the CSL consultant.

The Thermal Integrity Profiling (TIP) testing consultant shall demonstrate 1 year of experience in TIP testing and an additional 5 years of experience with other nondestructive drilled shaft testing methods.

Subsection 803.03.5.1 – Integrity Test Report (04/20), Page 568

803.03.5.1 is deleted and replaced with the following:

803.03.5.1 Integrity Test Report: Provide as one document all integrity testing results, including CSL, TIP, and other Non-destructive Testing (NDT) results, along with all Shaft Construction Logs for the tested shaft. Testing results shall be in accordance with 803.05.11. For TIP testing, include any variation in temperature between wires, indicating cage misalignment and insufficient concrete cover as established using the thermal gradient. Follow ASTM D7949 Standard Test Methods for Thermal Integrity Profiling for minimum TIP report requirements.

Subsection 803.05.11 – Integrity Testing (04/20), Page 578

803.05.11 is amended to include the following:

803.05.11 Integrity Testing: Non-destructive Testing (NDT), other than CSL or TIP, shall be performed in accordance with the plans and specifications. Test all drilled shafts, test shafts, and technique shafts using CSL when any of the following conditions occur:

1. Shaft is constructed with the placement of concrete through slurry.
2. Full-length casing is used to prevent water from entering the shaft.
3. Testing is specified in the plans.
4. Testing is required by the Engineer.

Perform TIP testing on drilled shafts, test shafts, and technique shafts in addition to, or instead of, CSL testing only as directed in the plans.

Subsection 803.05.11.1.3 – Testing Procedures (04/20), Page 579

The first paragraph of 803.05.11.1.3is deleted and replaced with the following:

Use the submitted and accepted Testing Consultant to perform CSL testing. Provide drilled shaft construction logs to the Testing Consultant.

Subsection 803.05.11.2 – Thermal Integrity Profiling (TIP) Testing (04/20), Page 579

803.05.11.2 is deleted and replaced with the following:

803.05.11.2 Thermal Integrity Profiling (TIP) Testing:

803.05.11.2.1 Testing Equipment: The TIP testing equipment shall be capable of performing the following functions and conform to ASTM D7949:

1. Perform TIP testing by measuring the heat generated by curing concrete placed in a shaft and comparing the expected temperature to the temperature at a given location.

2. Measure temperature using thermal wires tied to the shaft cage at various locations around the perimeter. Instrument the shaft and perform testing in accordance with ASTM D7949 Standard Test Methods for TIP of Concrete Deep Foundations.
3. Use method B of ASTM D7949.

803.05.11.2.2 Testing Procedures:

1. Contractor Assistance: Provide cooperative assistance, suitable access to the shafts to be tested, and labor as required to assist the TIP Consultant in performing the required tests. Prior to testing, provide the shaft lengths, thermal wire lengths and positions, and dates of shaft construction to the TIP Consultant. Coordinate with TIP Consultant to install the necessary TIP equipment prior to concreting the shaft.
2. Shaft Preparation: Attach thermal sensors to the reinforcing cage and align with longitudinal reinforcement. Space wires uniformly. Tie wires to reinforcing cage every 3 feet. Stretch wires tight and ensure there is minimal slack. The minimum number of wires installed shall be as specified below:

Table 803-7

Shaft Diameter, D (feet)	Minimum Number of Thermal Wires
D < 4.0	4
4 < D < 5.5	5
5.5 < D < 7.0	6
7.0 < D < 8.0	7
8.0 < D < 9.0	8
9.0 < D < 10.0	10
10.0 < D < 11.0	11
11.0 < D < 12.0	12

3. TIP Testing Procedure: Connect thermal sensors to recording apparatus. Document the measurement location in the shaft of each thermal sensor. Start recording data within 2 hours of completion of concrete placement. Transfer data to display apparatus upon completion of data collection.

Subsection 803.05.11.3.3 – TIP Test Results (04/20), Page 581

803.05.11.3 is amended to include the following:

803.05.11.3.3 TIP Test Results: The Geotechnical Engineer of Record will evaluate the TIP test results and determine whether the shaft construction is acceptable. Allow 7 working days for the evaluation to be conducted after receipt of the final TIP test results. If additional NDT is required in the plans, such as CSL, shafts will not be accepted until all required NDT is complete. The Geotechnical Engineer will evaluate the TIP test results for anomalies to determine if any defects may be present that need to be further investigated. Additional NDT testing may be required to determine the extent and severity of any defects. If the Geotechnical Engineer determines that the shaft is unacceptable based on TIP testing or other NDT, the shaft shall be considered defective.

Subsection 803.06.11 – Thermal Integrity Profiling (TIP) (04/20), Page 589

803.06 is amended to include the following:

803.06.11 Thermal Integrity Profiling (TIP): Measure the Thermal Integrity Profiling test per each drilled shaft tested and accepted.

Subsection 803.07.11 – Thermal Integrity Profiling (TIP) (04/20), Page 591

803.07 is amended to include the following:

803.07.11 Thermal Integrity Profiling (TIP): Payment for the Non-Destructive Test (Thermal Integrity Profiling) will be made at the contract unit price per each drilled shaft tested and shall include all labor, materials, equipment, and incidentals necessary to perform the required installation of instrumentation and testing services performed by Testing Consultant, and testing reports by TIP Consultant.

803-11	Thermal Integrity Profiling (Diameter)	Each

SECTION 804 – PILES:

Subsection 804.05 – Pile Driving Equipment (03/21), Page 597

804.05 is amended to include the following:

804.05 PILE DRIVING EQUIPMENT. Provide pile driving equipment including crane, hammer, leads, and template capable of handling and driving piles 25 percent longer than the plan pile lengths.

Subsection 804.06.1.2 – Abutment (End Bent) Fill (04/21), Page 599

804.06.1.2 is deleted and replaced with the following:

804.06.1.2 Abutment (End Bent) Fill:

Construct the embankment at bridge ends to full height in accordance with 813.03 before driving affected piles. Drive piles through compacted embankment using prebored holes with a minimum depth equal to the compacted embankment height at the prebored location. Prebore holes for pile driving in accordance with 804.07. If a surcharge has been placed, drive affected piles after settlement monitoring is complete and the surcharge has been removed.

SECTION 805 – STRUCTURAL CONCRETE:

Subsection 805.03.5 – Steel Stay-in-Place Forms (04/19), Page 623

The number 7 bullet of 805.03.5 is deleted and replaced with the following:

7. Repair damage to galvanized surfaces on the metal forms or the visually exposed surfaces of the support angles in accordance with 811.08.1.

Subsection 805.06 – Curing (09/21), Page 628

The first paragraph of 805.06 is deleted and replaced with the following:

Cure precast concrete in accordance with 805.09.4. Use wet cure method for all other concrete unless specified otherwise herein.

Subsection 805.06.1 – Wet Cure Method (09/21), Pages 628 and 629

805.06.1 is deleted and replaced with the following:

805.06.1 Wet Cure Method: Use water conforming to 1018.01. Begin curing immediately after concrete placement. Keep exposed surfaces damp by applying water with a fog nozzle (fogging operation) until the surface has set sufficiently to support covering materials. Maintain a layer of high humidity above the concrete surface and minimize water loss in the mix after placement and before application of covering materials. Do not allow large water droplets that drip from nozzle to fall onto plastic concrete.

After concrete surface finishing and when the surface is sufficient to support the covering materials, cover exposed concrete with two layers of pre-wet burlap, or combination of one layer of pre-wet burlap and one layer of polyethylene or other acceptable blanket materials. Secure covering materials to stay in contact with the concrete at all times. After placement, keep the concrete continuously wet for at least 7 curing days for cast-in-place concrete.

Subsection 805.06.2 – Membrane Cure Method (09/21), Page 629

805.06.2 is deleted and replaced with the following:

805.06.2 Membrane Cure Method: Membrane Cure Method using a curing membrane in accordance with 1011.01 may be substituted for Wet Cure Method for curing concrete in minor drainage structures.

Cover or shield exposed reinforcing steel and construction joint surfaces to prevent coating with curing membrane. Wet cure construction joint surfaces.

Apply curing membrane uniformly to surfaces. Apply curing membrane to exposed surfaces as soon as bleed water and other surface moisture has disappeared. Apply curing membrane to formed surfaces immediately after form removal. Do not apply curing membrane during rainfall or to surfaces with standing water. If rain falls on newly-coated concrete before the film has dried sufficiently to resist damage, or if the film is damaged or deficient, immediately apply a new coat of curing membrane to affected surfaces.

Apply curing membrane under pressure using mechanical sprayers using the method and rate recommended by the curing membrane manufacturer, but using a rate of not less than 1 gallon per 100 square feet of surface area. Use the fully atomizing type of spraying equipment with a tank agitator. Immediately, prior to, and during application, thoroughly mix the curing membrane, stirring continuously by mechanical methods.

Hand spraying is allowed on small irregular widths or shapes and on surfaces exposed by form removal. Thoroughly agitate the curing membrane prior to placing in the sprayer.

Apply the curing membrane in one or two applications. If the curing membrane is applied in two applications, apply the second application no more than 30 minutes after first application.

After final application of curing membrane, the membrane surface should have the appearance of a blank white sheet of paper.

Subsection 805.06.4 – Bridge Deck Curing (09/21), Page 629

805.06.4 is deleted and replaced with the following:

805.06.4 Bridge Deck Curing: Cure bridge decks using only Wet Cure Method with the following requirements:

Immediately after deck placement, and until completion of surface finishing, apply fogging operation in accordance with 805.06.1.

Immediately after surface finishing, apply Type 2 white-pigmented membrane curing compound to exposed surfaces in accordance with 805.06.2.

When concrete has set sufficiently to support covering materials without marring the surface, cover the concrete with first layer of pre-wet burlap with minimum length sufficient to cover the bridge deck from side to side of the concrete placement. Provide soaker hoses at a maximum of 10-foot intervals for additional soaking of the initial covering to cover the full width of the concrete placement. Overlap covering edges at least 12 inches. Do not allow initial wetting of burlap to dry before soaker hoses are in place and operational. Operate soaker hoses continuously to keep the initial covering saturated. Place second layer of pre-wet burlap or pre-wet burlap laminated with polyethylene over the initial covering and soaker hoses. Overlap covering edges at least 12 inches. Secure covering materials in place during the 7 curing days by taping and weighting the edges where they overlap or are vulnerable to movement by wind.

Close deck to all traffic, including vehicles of the contractor, until wet cure is completed and the concrete has attained at least 4000 psi compressive strength.

Subsection 805.07 – Removal of Forms and Falsework (09/21), Page 630

805.07 is deleted and replaced with the following:

805.07 REMOVAL OF FORMS AND FALSEWORK. Remove forms and falsework without overstressing or damaging the concrete, and in such a manner that will permit concrete to uniformly and gradually take stresses due to its own weight. Remove forms and falsework without causing concrete distortion.

Side forms may be removed after one curing day provided they are no longer resisting forces and if permitted by the Engineer. Curing days are as defined in 805.06. For cast-in-place concrete, forms and falsework supporting the weight of concrete may be removed when concrete attains the compressive strength requirements in Table 805-6. For slip formed concrete, Table 805-6 does not apply.

Removal of forms does not relieve the wet curing requirements of 805.06.1. Form curing method of 805.06.3 will cease upon removal of forms and other means of wet curing shall immediately be implemented, to the satisfaction of the Engineer, for the remainder of the required curing duration.

For precast concrete, forms and falsework may be removed when concrete attains the minimum strength requirements of Table 805-6, with the exception of non-prestressed box culverts, catch basins, junction boxes, end treatments, and temporary precast barriers, for which Table 805-6 does not apply.

Table 805-6 is deleted and replaced with the following:

Table 805-6
Removal of Forms and Falsework
Strength Requirements

Concrete Class	Compressive Strength, psi
A1, MASS (A1), and S	4000
A2 and MASS(A2)	6000
A3 and MASS(A3)	8500
M	2700
P1	3600
P2	5100
P3	6000

Table 805-7 is deleted.

Table 805-7
Forms and Falsework Removal Schedule
Cast-in-Place and Precast Non-Prestressed Concrete

The contents of this table are deleted.

Subsection 805.09.4 – Curing (09/21), Page 635

Paragraph 1, 2, 3, and 4 of 805.09.4 is deleted and replaced with the following:

805.09.4 Curing: Cure concrete in accordance with 805.06, Section 901, and as amended by this section.

Cure non-prestressed members for three curing days using steam cure method or wet cure method. Cure prestressed members until concrete reaches release strength using steam cure method or wet cure method.

Furnish and install two recording thermometers reporting time-temperature relationship for each 200 feet of bed.

Use thermocouple cure for all Class P2 and P3 concrete or when specified in the contract.

Subsection 805.09.4.2 – Wet Cure Method (09/21), Page 636

805.09.4.2 is deleted.

Subsection 805.09.4.3 – Combined Steam and Wet Cure Method (09/21), Page 636

805.09.4.3 is deleted.

Subsection 805.09.4.4 – Membrane Cure Method (09/21), Page 636

805.09.4.4 is deleted and replaced with the following:

805.09.4.4 Membrane Cure Method: Use Membrane Cure Method as an interim short term curing method for plastic concrete.

Maintain concrete in a surface saturated condition using foggers until finishing is complete. Immediately after finishing, apply curing membrane in accordance with 805.06.2.

When concrete has set sufficiently to prevent marring the surface, apply Steam Cure Method or Wet Cure Method for the remainder of the required cure time.

SECTION 807 – STRUCTURAL METALS:

Subsection 807.05.2.4 – Bolted Parts (04/19), Page 667

The number 4 bullet of 807.05.2.4 is deleted and replaced with the following:

4. When metallic thermal spray coatings are specified, conform to 811.08.2.

SECTION 811 – PAINTING AND PROTECTIVE COATINGS:

Subsection 811.03 – Materials (10/19), Pages 689 – 691

811.03 is deleted and replaced with the following:

811.03 MATERIALS. Materials shall comply with the following sections or subsections:

Paints	1008
Cold Tar Epoxy-Polyamide Paint	1008.04
Cold Galvanizing Repair Compound	1008.05
Maintenance Overcoating of Steel Bridges	1008.08

Unless otherwise specified, use a Zinc Paint System from the Approved Materials List for painting new and existing metals to be painted. Provide organic zinc primer compatible with the inorganic zinc primer as a repair and stripe coat component. Provide an intermediate coat compatible with both the inorganic and organic zinc primers. The paint supplier will certify at the time of paint approval, the materials (primers & intermediate coats) are compatible and will not affect the performance of the whole system as tested by NTPEP.

Show the paint system to be used on shop or working drawings. Use only one paint system from one manufacturer for the entire structure without modifications. Top coat colors shall be as defined in Table 811-1. When spot painting or zone painting existing metals, match existing top coat color.

Table 811-1
Top Coat Colors for Painting Metalwork

Description	SAE AMS-STD-595A Color Number
Black	17038
Silver	17178
Dark Bronze	30040
Weathered Steel	30045
Khaki	30372
Gray	36463

Provide a gloss finish for top coat. The Color Numbers in Table 811-1 are for pigment color matching purposes only.

Provide coating systems with visibly contrasting color tint for each full coat and stripe coat.

Provide anti-skid surface, compatible with the paint system and recommended by the manufacturer unless otherwise specified, on stair treads, walkway surfaces, platforms, and landings.

Coating materials shall not be used until the Project Engineer has inspected the materials and each batch of paint has been accepted by the DOTD Materials and Testing Section.

811.03.1 Abrasives: Use properly sized abrasives to achieve the required cleanliness and surface profile. Use abrasives meeting the requirements of SSPC-AB1, Mineral and Slag Abrasives; SSPC-AB2, Cleanliness of Recycled Ferrous Metallic Abrasives; or SSPC-AB3, Newly Manufactured or Re-Manufactured Steel Abrasive. Do not introduce any contamination that interferes with the coating application and performance, including chlorides and other salts.

For field applications, abrasives delivered to project site shall be new and conform to SSPC-AB3. Once used during the work, abrasives may be recycled provided the resulting conductivity and cleanliness conform to SSPC-AB2. Select a sample from each recycling machine in use and conduct the water-soluble contaminant and oil content tests outlined in SSPC-AB2 at least one time each week or more frequently, if directed. Conduct the non- abrasive residue and lead content tests as directed by the Project Engineer. If test results do not meet requirements, notify the Project Engineer immediately, remove and replace the abrasive, clean the recycling equipment, and conduct tests each day to confirm the equipment is functioning properly. Return to the weekly testing interval when directed.

811.03.2 Caulk: Unless otherwise specified, use caulks that are paintable, compatible with the coating system, and recommended by the coating manufacturer. Provide caulk conforming to Federal Specification TT-S-00230C, Type II, Class A. For painted metalwork, use caulk colored to contrast the color of the intermediate and top coats. For unpainted and painted sections of weathering steel, use caulk colored to match the color of the weathered steel in accordance with Table 811-1.

811.03.3 Penetrating Sealer: Use low viscosity 100 percent solids un-pigmented epoxy recommended by the coating manufacturer.

811.03.4 Rust Preventative Compound: Use a Class 3 rust preventative compound meeting the requirements of Military Specification MIL-C-11796C, Corrosion Preventative Compound, Petrolatum, Hot-Applied.

811.03.5 Soluble Salts Test Kit: Use a soluble salts test kit in accordance with SSPC-Guide 15 utilizing Multi-Step Ion-Specific Methods. Ensure the test patch/cell or sleeve creates a sealed, encapsulated environment during ion extraction and is suitable for testing all structural steel surfaces. A Fully Automated Conductivity Measuring System may be allowed, subject to acceptance by the Project Engineer.

811.03.6 Thinners, Solvents, and Cleaners: Use thinners, solvents, and cleaners listed on the coating manufacturer's product data sheet. For overcoating systems, use thinners, solvents, and cleaners that do not damage the existing coating system or inhibit the performance of the newly applied coatings.

SECTION 813 – CONCRETE APPROACH SLABS:

Subsection 813.03.5.1 – High Early Strength Concrete (02/19), Pages 731 and 732

813.03.5.1 is deleted and replaced with the following:

813.03.5.1 High Early Strength Concrete: When specified or when determined by the Project Engineer that construction conditions merit opening concrete approach slabs to traffic before concrete is fully cured, high early strength concrete (HES) shall be used in accordance with Section 902.

SECTION 816 – BRIDGE DRAINAGE SYSTEMS:

Subsection 816.02 – Materials (11/18), Page 745

The first paragraph of 816.02 is deleted and replaced with the following:

Materials shall comply with the plans and specifications and the following:

Culverts and Storm Drains	701.02
Manholes, Junction Boxes, Catch Basins, and End Treatments	702.02
Bedding Material	726.02
Structural Concrete	805.02
Deformed Reinforcing Steel	806.02
Structural Metals	807.02
Painting and Protective Coatings	811
Metals	1013
Stainless Steel Bolts	1013.08

SECTION 817 – TEMPORARY WORKS:

Subsection 817.03.1.1 – Temporary Detour Bridge (07/18), Pages 748 and 749

The first sentence of the second paragraph of 817.03.1.1 is deleted and replaced with the following:

Conform to Section 803 for drilled shafts, Section 804 for piles, Section 810 for bridge railings, and Section 704 for guardrails.

The first sentence of the fifth paragraph of 817.03.1.1 is deleted and replaced with the following:

Remove the detour bridge in accordance with 202.03. Remove piling completely.

Subsection 817.03.2.4 – Cofferdams (07/18), Page 750

The second sentence of the fourth paragraph is deleted and replaced with the following:

Conform to 105.19.

Subsection 817.03.2.7 – Temporary Detour Bridge (07/18), Page 754

817.03.2 is amended to include the following:

817.03.2.7 Temporary Detour Bridge: Conform to 817.03.1.1. All submittals shall be for review. Design temporary detour bridge in accordance with the latest version of AASHTO LRFD Bridge Design Specifications. Design all bents in the channel for the local scour depth shown on the plans. Provide as-designed bridge rating for HL-93 Inventory and HL-93 Operating. Refer to the LA DOTD Bridge Design and Evaluation Manual for as-designed rating requirements. Submit all design and rating calculations.

Provide detour bridge drawings and erection drawings. Include general bridge layout showing plan and elevation views. Include current ground line along detour centerline and water elevation at the time of construction. Provide superstructure and substructure details. Include pile types, lengths, and locations, and any other details required to construct the detour bridge.

When prefabricated steel bridge systems are used, submit the assembly and installation instructions from the original manufacturer a minimum of 90 days prior to installation. Construct in accordance with the original manufacturer's specifications and recommendations, and as specified in the plans and in the accepted submittals. A representative from the original manufacturer must be present at the project site and oversee the assembly and installation of the first erected span. Upon completion of the installation and prior to allowing vehicular traffic, submit for record a letter from the original manufacturer certifying that the bridge has been properly installed.

When prefabricated bridge systems are used, apply asphalt concrete overlay in accordance with the original manufacturer's specifications and recommendations, and Section 502. Do not apply asphalt concrete overlay if the manufacturer supplies deck panels with an epoxy anti-skid surface. Do not use an epoxy anti-skid surface and an asphalt concrete overlay surface in conjunction on the same bridge. Do not supply open grid decking.

Subsection 817.04.1 – Temporary Detour Bridge (07/18), Page 755

The first paragraph of 817.04.1 is deleted and replaced with the following:

Temporary detour bridge will be measured by the square foot and shall include all materials and labor required for construction of the temporary detour bridge, all striping, wearing surface, maintenance of the detour bridge, continual removal of debris accumulation, removal of the detour bridge, and restoration of the project site to the satisfaction of the Project Engineer. Square foot measurement will be made by multiplying the clear roadway width by the length of the bridge from beginning bridge joint at abutment to ending bridge joint at abutment along the centerline of the bridge.

SECTION 822 – ELECTRICAL SYSTEMS:

Subsection 822.05.1 – Pole Installation (11/18), Page 871

822.05 is amended to include the following:

822.05.1 Pole Installation: Poles shall be installed, leveled, and plumbed in accordance with the accepted manufacturer's pole drawings and approved methods. Unless shown otherwise on the plans, extend anchor bolts a minimum of 1/4 inch above the nut or as recommended by the manufacturer, whichever is greater. Where indicated in the plans, the space between the top of the foundation and the bottom of the pole base (or flange) shall be grouted with a non-shrink grout mixture in accordance with 1018.04 and neatly troweled to the contour of the pole base. A pvc drain pipe shall be inserted through the grout to provide ventilation and drainage from the interior of the pole base.

Subsection 822.11.5 – Light Poles (11/18), Page 877

822.11.5 is deleted and replaced with the following:

822.11.5 Light Poles: Light poles will be measured per each pole furnished and installed, which will include the pole, decals, ownership plate, wiring and connections to circuit conductors, grounding electrode, ground clamp, exothermic weld, base assembly, and all hardware and appurtenances required for a complete installation. When an aluminum pole is installed, oxide-inhibiting compound is required.

Subsection 822.11.6 – High Mast Poles (11/18), Page 877

822.11.6 is deleted and replaced with the following:

822.11.6 High Mast Poles: High mast poles will be measured per each pole furnished and installed, which will include the pole, luminaire ring, lowering assembly, drive assembly, wiring, electrical connections, fuses, grounding electrode, ground clamp, exothermic weld, mounting hardware, grout in accordance with 1018.04, and all hardware and appurtenances required for a complete installation.

PART IX – PORTLAND CEMENT CONCRETE

SECTION 901 – PORTLAND CEMENT CONCRETE:

Subsection 901.06.1.1 – Self-Consolidating Concrete (05/19), Page 918

901.06.1 is amended to include the following:

901.06.1.1 Self-Consolidating Concrete: Self-consolidating concrete (SCC) may be used for precast members, drilled shafts, and light pole foundations. SCC may be used for cast-in-place structural concrete as permitted by the Bridge Design Engineer Administrator.

SCC is concrete that is highly flowable, non-segregating concrete that can spread into place, fill the formwork, and encapsulate reinforcement without mechanical consolidation. This concrete leads to better surface finishes in precast operations and better consolidation around steel rebar.

901.06.1.1.1 Materials: Use concrete as indicated by the plans. A combined aggregate gradation in accordance with 1003.08.3 is required with the exception of the maximum allowable aggregate size of ½ inch. SCC shall have a slump flow spread measurement as measured by ASTM C1611 as shown in Table 901-1A. The SCC shall have a visual stability index rating (VSI) of 1 or 0 as measured according to ASTM C1611 Appendix. SCC being placed in an underwater condition shall incorporate a viscosity modifying admixture (VMA) incorporated in the mixture complying with ASTM C494.

Table 901-1A

Type of Construction	Range of Slump Flow Values
	Inches
Precast Members	20-30
Drilled Shafts/Light Pole Foundations	20-24
Cast-in-Place Structural Concrete	20-30

901.06.1.1.2 Consolidation: Mechanical consolidation is not typically necessary for SCC. However, internal vibrators shall be available on site to be used when internal vibration is needed, as determined by the Engineer, to prevent formation of a cold joint due to delays in placement, or if the concrete has a lower than expected slump flow. Internal vibration is not allowed for drilled shafts. If the vibratory action adversely effects the concrete, as determined by the Engineer, then the concrete shall be removed and replaced at no cost to the Department.

Subsection 901.06.2 – Quality Control Tests (05/19), Page 918

901.06.2 is amended to include the following:

For Self-Consolidating Concrete, perform slump flow spread measurement testing and visual stability index rating (VSI), in the presence of the Engineer, in lieu of slump testing and at the same required frequency as slump testing.

Subsection 901.07 – Substitutions (06/18), Page 920

Table 901-2 is deleted and replaced with the following:

Table 901-2
Portland Cement Concrete Mixture Substitutions

Structural Class[1]	**Substitute**
A1	No Substitutions
A2	No Substitutions
A3	No Substitutions
P1	P2, P3
P2	P3
P3	No Substitutions
S	No Substitutions
MASS(A1)	No Substitutions
MASS(A2)	No Substitutions
MASS(A3)	No Substitutions
Minor Structure Class[1]	
M	A1, B, D
R	A1, B, D, M
Pavement Type[1,2]	
B	D
D	B
E	No Substitutions

[1]The substituting mixture shall meet the requirements of Table 901-3 for its class or type. The substituting mix shall meet the strength requirements of the original mix.
[2]If approved by the engineer, small irregular areas of paving projects using Types B or D concrete may be substituted with Class A1 concrete.

Subsection 901.08.2 – Cementitious Material Substitution (06/20), Page 921

Paragraph 5 of 901.08.2 is deleted and replaced with the following:

When ASR mitigation is required, use 30% Class F Fly Ash, 50% GGBFS, or a ternary mixture containing both Class F Fly Ash and GGBFS at a minimum replacement rate of 50%.

The maximum substitution rate for ternary mixtures containing Type I, II, III, or IL portland cement is 70 percent of cement. When using Type IP or IS portland cement, the maximum substitution rate for ternary mixtures is 40 percent. Ternary combinations using both class C and F fly ash are allowable. When using fly ash ternary mixtures, replace portland cementwith class C and class F fly ash in equal amounts. When using combinations of GGBFS and fly ash, the amount of GGBFS must be equal to or greater than the amount of fly ash.

Subsection 901.13 – Acceptance and Payment Schedules (11/19), Page 931

901.13 is deleted and replaced with the following:

901.13 ACCEPTANCE AND PAYMENT SCHEDULES. Acceptance and payment schedules in Table 901-4 and Table 901-6 apply to all cast-in- place structural portland cement concrete. Tables 901-3 and 901-6 apply to Classes P1, P2, and P3; whereas, Table 901-4 does not apply. Acceptance and payment schedules in Table 901-5 apply to all minor structure portland cement concrete. Acceptance and payment schedules for portland cement concrete pavement are shown in Table 601-3 of Section 601.

Table 901-3 – Master Proportion Table for Portland Cement Concrete (12/21), Page 932

Table 901-3 is deleted and replaced with the following:

Table 901-3[12]

Master Proportion Table for Portland Cement Concrete

	Average[8] Compressive Strength, psi at 28 days	Grade of Coarse Aggregate[1]	Surface Resistivity[2,13] (kΩ-cm)	Maximum Water/Cementitious Ratio, lb/lb	Air Content (Percent by volume)[3]	Slump Range[5], inches		
						Non- Vibrated[4]	Vibrated	Slip Form Paving[6]
Structural Class [7]								
A1	4,500	57M, 67, 89M[9], B,D	18	0.45	2 - 7	2-5	2-4[4]	N/A
A2	6,500[11]	57M, 67, 89M[9], B,D	18[11]	0.45	2 - 7	2-5	2-4[4]	N/A
A3	9,000[11]	57M, 67, 89M[9], B,D	18[11]	0.36	2 - 7	2-5	2-4[4]	N/A
P1	6,000[8]	57M, 67, 89M[9], B,D	18	0.44	2 - 7	N/A	2-6[10]	N/A
P2	8,500[8]	57M, 67, 89M[9], B,D	18	0.40	2 - 7	N/A	2-6[10]	N/A
P3	10,000[8]	57M, 67, 89M[9], B,D	18	0.40	2 - 7	N/A	2-6[10]	N/A
S	4,500	B, D	18	0.53	2 - 7	6-8	N/A	N/A
MASS(A1)	4,500	B, D	18	0.53	2 - 7	N/A	2-4[4]	N/A
MASS(A2)	6,500[11]	B, D	18[11]	0.46	2 - 7	N/A	2-4[4]	N/A
MASS(A3)	9,000[11]	B, D	18[11]	0.36	2 - 7	N/A	2-4[4]	N/A
Minor Structure Class [7]								
M	3,000	57M, 67, 89M[9], B,D	N/A	0.56	2 - 7	2-5	2-4[4]	1-2.5
R	1,800	57M, 67, B,D	N/A	0.70	2 - 7	2-5	2-4[4]	N/A
Pavement Type [7]								
B	4,000	B, D	N/A	0.53	2 - 7	N/A	2-4	1-2.5
D	4,000	B, D	N/A	0.53	2 - 7	N/A	2-4	1-2.5
E	4,000	57M, 67, 89M[9], B,D	N/A	0.40	2 - 7	N/A	2-4	1-2.5

N/A – Not Applicable

[1] Combined aggregate gradation shall comply with the requirements of 1003.08.2.

[2] Value based on a 4-inch X 8-inch cylinder tested at 28 days of age.

[3] See 901.08.3.

[4] Allow an 8-inch maximum slump when high-range water reducers or superplasticizers are used.

[5] Additional allowance in slump range to be approved by the Construction Engineer Administrator.

[6] Also slump range for other concrete placed by extrusion methods.

[7] See 901.08.1 for allowable types of cement.

[8] P1, P2, P3 values shown represent the minimum compressive strengths allowed for all test cylinders.

[9] Grade 89M coarse aggregate shall be used only when specified or permitted.

[10] No more than 2-inch slump differential for any design placement. Allow 8-inch maximum when high-range water reducers or superplasticizers are used.

[11] Average Compressive Strength, psi and Resistivity (kΩ-cm) at 56 days.

[12] Dry-cast concrete for concrete pipe is exempt from Table 901-3. See Section 1016 specifications.

[13] Resistivity requirements do not apply to Class A1 concrete used for curb, curb and gutter, or as a substitute for Class M.

Table 901-4 – Acceptance and Payment Schedules Cast-In-Place Structural Concrete (10/19), Page 933

Table 901-4 is deleted and replaced with the following:

Table 901-4
Acceptance and Payment Schedules
Cast-In-Place Structural Concrete

Average Compressive Strength per Lot, psi (28 to 31 days)[3]	
Class A1, S & MASS (A1)	**Percent of Contract Unit Price[1]**
4500 & above	100
4301 - 4499	98
4000 - 4300	90
below 4000	50 or remove and replace[2]
Class A2, & MASS (A2)	
6500 & above	100
6301 - 6499	98
6000 - 6300	90
below 6000	50 or remove and replace[2]
Class A3, & MASS (A3)	
9000 & above	100
8801 – 8999	98
8500 - 8800	90
below 8500	50 or remove and replace[2]

[1]When concrete is part of an item or not a direct pay item, lot sizes, sampling, and acceptance testing for the required quantities will be in accordance with 805.11. The value for each cubic yard required will be assessed at $350 for the purpose of applying payment adjustment percentages. The amount of payment adjustment for the quantity of concrete involved will be deducted from payment. Acceptance and payment schedules shall apply to the contract item itself for cast-in-place piling.

[2]When the average compressive strength of **any batch in a lot** is less than the specified strength a prompt investigation will be made. If concrete is allowed to remain in place by the Chief Engineer, payment will be based on 50 percent of the contract price unless associated cylinders were improperly molded or tested and investigative core strength results are above design strength (f'c). If concrete is not allowed to remain in place, the identifiable deficient areas shall be removed and replaced at no direct pay.

[3]Average Compressive Strength for A2 and A3 shall be taken at 56 to 59 days.

Table 901-6 – Acceptance and Payment Schedules Structural Concrete (12/21), Page 934

Table 901-6 is deleted and replaced with the following:

Table 901-6
Acceptance and Payment Schedules
Structural Concrete

Surface Resistivity per Lot, kΩ-cm (28 to 31 days)[3]	
Class A1, A2, A3, S, P1, P2, P3, & MASS(A1,A2,A3)	**Percent of Contract Price[2]**
18.0 & above	100
16.5 – 17.9	98
15.0 – 16.4	90
below 15.0	50 or remove and replace[1]

[1]When the average surface resistivity is less than 15.0 kΩ - cm, an investigation will be made. If concrete is allowed to remain in place by the Chief Engineer, payment will be based on 50 percent of the contract price. Any cores obtained in these investigations are for evaluation purposes only. Payment will be based on original acceptance samples.

[2]When concrete is part of an item or not a direct pay item, the value for each cubic yard of concrete required will be assessed at $350 for the purpose of applying payment adjustment percentages. The amount of payment adjustment for the quantity of concrete involved will be deducted from payment.

[3]Surface resistivity for A2, A3, MASS(A2), and MASS(A3) shall be taken at 56 to 59 days.

SECTION 902 – HIGH EARLY STRENGTH CONCRETE:

All Subsections (10/19), Page 934

Part IX is amended to include the following:

Section 902
High Early Strength Concrete

902.01 DESCRIPTION. This section specifies requirements for High Early Strength Concrete (HES), including methods for handling, sampling, testing, placing, and curing HES. HES shall be used when conditions merit the early opening to traffic of concrete pavements and bridge approach slabs, as specified in contract documents or as determined by the Engineer. All work shall be in accordance with the general requirements of the pay item associated with the use of HES unless otherwise specified herein.

902.02 MATERIALS. For pavement patching, use a rapid patching material that is on the AML or a Type B, D, or E concrete mixture. For bridge approach slabs, use Class A1 concrete. All HES mixtures shall conform to Section 901 with the following exceptions:

1. Type III cement is allowed.
2. Do not use chloride-type accelerators.
3. Surface Resistivity requirements do not apply to HES.
4. Type B or Type D may be substituted for the Class A1 concrete on approach slabs, but will be paid in accordance with Table 901-4 for Class A1 concrete.

Use the maturity method for compressive strength determination according to ASTM C1074. If any of the mix components change (material sources or mix proportions change by more than ±5%; admixture dosages change by more than ±20%), a new maturity curve must be developed and verified. Submit the HES mix design, trial batch results, and maturity curves to the Engineer for review.

Verify by trial batch that the proposed HES mix achieves the compressive strength specified in Table 901-3, and the appropriate early opening strength specified in 902.04.1 within the time frame specified in the contract documents.

Trial batch requirements may be waived, with written approval from the District Laboratory Engineer, for previously approved mix designs when all materials and proportions of the proposed design exactly match the previously approved mix design materials.

902.03 CONSTRUCTION REQUIREMENTS. Follow the manufacturer's or supplier's recommendations on mixing and placing HES unless otherwise specified in the contract documents or by the Engineer. Place the concrete continuously to prevent formation of cold joints. Promptly finish the concrete. Immediately after finishing, apply curing compound at one gallon per 50 square feet, resulting in a consistent surface appearance that roughly resembles the color of a blank sheet of white paper.

902.04 TESTING FOR OPENING TO TRAFFIC. A minimum of two wireless maturity sensors are to be placed in each identifiable concrete pour per mix design, for compressive strength determination with the use of maturity curves.

To verify the sensor results, a minimum of four concrete cylinders for the first placement and, thereafter, for every 1000 square yards of concrete placed or every month of concrete placement shall be made according to DOTD TR 226 and tested in accordance with DOTD TR 230. For bridge approach slabs, a minimum of four concrete cylinders per distinct approach slab placement shall be made and tested in accordance with the requirements of this section.

When the results of testing the verification cylinders vary from the maturity curve results by more than negative 10%, then the mix design shall no longer be used until a new maturity curve has been developed, and accepted by the Engineer.

The frequency of verification may be increased at the discretion of the Engineer.

902.04.1 Early Opening to Traffic: For early opening to traffic, attain the minimum compressive strength of 3000 psi for bridge approach slabs and 2000 psi for paving applications within the lane closure time frame specified in the plans, contract documents or where construction conditions merit, as determined by the Engineer.

When the mix does not achieve the minimum required compressive strength specified in the required time frame, its use shall be discontinued until the cause can be determined to the satisfaction of the Engineer. When this occurs for two placements, the Engineer may determine the mix to be invalid and require a new mix design to be accepted before work continues, at no additional cost or time to the department.

902.05 ACCEPTANCE TESTING. Acceptance for compressive strength will be in accordance with the requirements of the pay item associated with the use of HES. If the results of the testing for opening to traffic meet the minimum requirements for compressive strength of the pay item associated with the use of HES, then these results may be used in lieu of acceptance testing with the approval of the Chief Construction Engineer.

PART X – MATERIALS

SECTION 1001 – PORTLAND CEMENT AND CEMENTITIOUS MATERIALS:

Subsection 1001.04 – Fly Ash and Natural Pozzolans (06/20), Page 936

1001.04 is deleted and replaced with the following:

1001.04 FLY ASH AND NATURAL POZZOLANS. Use fly ash from the Approved Materials List. Comply with AASHTO M 295 for Class C and Class F. Comply with ASTM C618 for Class N. Alkali content calculated in accordance with DOTD TR 531 shall not exceed 3.0 percent by weight.

SECTION 1002 – ASPHALT CEMENT, EMULSIONS, AND ADDITIVES:

Subsection 1002.02.2 – Crumb Rubber (07/18), Page 938

1002.02.2 is deleted and replaced with the following:

1002.02.2 Crumb Rubber: Waste Tire Rubber must be pre-qualified by the Materials Laboratory. The maximum size of rubber particles shall be 30 mesh crumb (90-100 percent passing the No. 30 sieve) with a maximum replacement of 10 percent by weight of asphalt material.

SECTION 1003 – AGGREGATES:

Subsection 1003.01.1 – Test Methods (03/21), Page 951

Table 1003-1 is deleted and replaced with the following:

Table 1003-1
Aggregate Test Procedures

Property	Test Procedure
Deleterious Materials	DOTD TR 119
Flat and Elongated Particles	ASTM D4791
Magnesium Sulfate Soundness	AASHTO T 104
Los Angeles Abrasion	AASHTO T 96
Alkali-Silica Reactivity (Chemical Method)	ASTM C289
Alkali Reactivity (Mortar-Bar Method)	ASTM C1260
Reactivity of Concrete Aggregates	AASHTO R80
Alkali Reactivity of Carbonate Rocks (Rock-Cylinder Method)	ASTM C586
Organic Impurities	AASHTO T 21
Unit Weight	AASHTO T 19
Specific Gravity & Absorption of Fine Aggregate	AASHTO T 84
Specific Gravity & Absorption of Fine Lightweight Aggregate	DOTD TR 123
Specific Gravity & Absorption of Coarse Aggregate	AASHTO T 85
Polish Value	AASHTO T 278 and T 279
Amount of Material Finer than the No 200 (75 µm) Sieve	DOTD TR 112
Sieve Analysis (Gradation)	DOTD TR 113
pH of Soil and Water	DOTD TR 430
pH of Aggregates	DOTD TR 122
Atterberg Limits (LL, PL, & PI)	DOTD TR 428
Organic Content	DOTD TR 413
Percent Crushed	DOTD TR 306
Mechanical Analysis of Extracted Aggregate	DOTD TR 309
Sand Equivalent	DOTD TR 120
Fine Aggregate Angularity	DOTD TR 121
Micro-Deval	AASHTO T 327
Moisture Sensitivity (TSR)	DOTD TR 322
Mortar Strength	AASHTO T 71
Methylene Blue	AASHTO TP 57-99
Abrasion of Lightweight Coarse Aggregate	DOTD TR 111
Determining Chloride Content and Organic Additive for PCC	DOTD TR 643
Chemical Analysis	ASTM C114
Potential Carbonate Reactivity	ASTM C1105
Potential Alkali-Silica Reactivity	ASTM C1293
Clay Lumps and Friable Particles	AASHTO T 112

Subsection 1003.01.2.3 – Los Angeles Abrasion (03/21), Page 952

1003.01.2.3 is deleted and replaced with the following:

1003.01.2.3 Los Angeles Abrasion: For coarse natural aggregates, lightweight aggregates and RPCC source approval, maximum Los Angeles abrasion loss is 40.0 percent. The Los Angeles abrasion loss for lightweight aggregates will be calculated in accordance with DOTD TR 111.

Subsection 1003.01.4.1 – Alkali Silica Reactivity (ASR) of Sands and Gravels in Portland Cement Concrete (03/21), Page 954

1003.01.4.1 is deleted and replaced with the following:

1003.01.4.1 Alkali Silica Reactivity (ASR) of Sands and Gravels in Portland Cement Concrete: For source approval, aggregates for use in portland cement concrete are tested for alkali silica reactivity properties in accordance with ASTM C1260, using a portland cement from the Department's Approved Materials List. Aggregates categorized as "innocuous" (non-reactive, less than 0.10% expansion) are allowed without restriction. If ASTM C1260 designates aggregates as "potentially deleterious," (greater than or equal to 0.10% expansion but less than or equal to 0.20% expansion) then use a mixture with cementitious substitution as specified for ASR mitigation in Section 901.08.2. If ASTM C1260 results exceed 0.20%; aggregates must be further evaluated by means of ASTM C1293 to determine reactivity. If ASTM C1293 results are less than 0.04% expansion, the aggregate is considered "innocuous". If ASTM C1293 results are greater than or equal to 0.04% expansion; the aggregate is considered "reactive". Concrete mixtures incorporating aggregates designated as "reactive" will not be allowed. The aggregate source will not be given a concrete user code until this evaluation is complete. Aggregates must wait a minimum of 6 months after a failing ASTM C1293 result, to resubmit the material for evaluation; a passing ASTM C1293 must be submitted with request for re-certification.

Subsection 1003.01.4.2 – Alkali Carbonate Reactivity (ACR) and Alkali Silica Reactivity (ASR) of Limestone in Portland Cement Concrete (03/21), Page 954

1003.01.4.2 is deleted and replaced with the following:

1003.01.4.2 Alkali Carbonate Reactivity (ACR) and Alkali Silica Reactivity (ASR) of Limestone in Portland Cement Concrete: For source approval, limestone aggregates for use in portland cement concrete will be evaluated for alkali carbonate reactivity (ACR) and alkali silica reactivity (ASR) utilizing AASHTO R80. If the aggregate's chemical composition (Cao/Mgo ratio vs Al2O3) plots outside of the diverging lines of the CSA A23.2 - 26A chart; the aggregate is considered non-expansive for ACR. Aggregate shall then be checked for ASR. If ASTM C1260 designates aggregates as "potentially ASR deleterious," (greater than or equal to 0.10% expansion but less than or equal to 0.20% expansion) then use a mixture with cementitious substitution as specified for ASR mitigation in Section 901.08.2. If ASTM C1260 results exceed 0.20%; aggregate must be further evaluated by means of ASTM C1293 to determine ASR reactivity. If ASTM results are less than 0.04% expansion, the aggregates are considered "innocuous". If ASTM C1293 results are greater than or equal to 0.04% expansion; the aggregate is considered reactive and will not be allowed in concrete mixtures. If the aggregate plots inside of the diverging lines of the CSA A23.2 - 26A chart; then the aggregate in considered "potentially ACR expansive" and shall be further appraised by ASTM C1105 testing. If ASTM C1105 results are less than 0.03%, then aggregates are considered "innocuous". If ASTM C1105 results are greater than or equal to 0.03% expansion; the aggregate is considered "ACR reactive". Concrete mixtures incorporating aggregates designated as "ASR reactive and/or ACR reactive" will not be allowed. The aggregate source will not be given a concrete user code until these evaluations (ASTM C1260, Chemical composition plot of CSA A23.2 - 26A chart and/or ASTM C1105/C1293) are complete. Aggregates must wait a minimum of 6 months after a failing ASTM C1105 and/or ASTM C1293 results, to resubmit the material for evaluation; passing ASTM C1293 and/or ASTM C1105 results must be submitted with request for re-certification.

Subsection 1003.05.2 – Sand-Clay-Gravel (09/19), Page 959

1003.05.2 is amended by deleting the phrase "For material passing the No. 40 (425 μm) sieve, comply with the following after lime treatment:" and replacing with the following:

For material passing the No. 40 (425 μm) sieve, comply with the following prior to lime treatment:

Subsection 1003.07 – Aggregates for Asphalt Surface Treatment (08/18), Page 961

Table 1003-15 is deleted and replaced with the following:

Table 1003-15
Asphalt Surface Treatment Aggregates Percent Passing

		Size 1		Size 2	Size 3
U.S. Sieve	Metric Sieve	Slag or Stone Aggregate (Size No. 5)	Crushed Gravel[2] or Lightweight Aggregate	All Aggregate (Size No. 7)	All Aggregate (Size No. 8)
1 1/2inch	37.5 mm	100	100	—	—
1 inch	25.0 mm	90-100	95-100	—	—
3/4 inch	19.0 mm	20-55	60-90	100	—
1/2 inch	12.5 mm	0-10	—	90-100	100
3/8 inch	9.5 mm	0-5	0-15	40- 80	85-100
No. 4	4.75 mm	—	0-5	0-15	10-40
No. 8	2.36 mm	—	—	0-5	0-10
No. 16	1.18 µm	—	—	—	0-5
No. 200	75 µm1	0-1	0-1	0-1	0-1

1. The percentage passing the No. 200 (75 µm) sieve shall be 0 - 2 percent for crushed aggregate when the materials finer than the No. 200 (75 µm) sieve consist of dust fraction from crushing and handling, essentially free of clay.
2. Uncrushed gravel may be used for Size 1 aggregate if more than one application of Asphalt Surface Treatment is required.

Subsection 1003.10 – Bedding Material (04/18), Page 965

Table 1003-21 is deleted and replaced with the following:

Table 1003-21
Gradation for Bedding, Sand-Aggregate

US Sieve Size	**Percent Passing by Weight (Mass)**
1 1/2 inches	95-100
No. 4	30-50
No. 10	20-45
No. 200	0-10

SECTION 1006 - THERMOPLASTIC PIPE (TPP):

All Subsections (11/20), Pages 979 and 980

1006 is deleted and replaced with the following:

Section 1006
Thermoplastic Pipe (TPP)

1006.01 GENERAL. Thermoplastic pipe and joint systems for cross drains, storm drains, and side drains shall be from the Approved Materials List. Thermoplastic pipe for underdrains and yard drains shall be perforated or non-perforated, as specified, and shall be from the Approved Materials List. Perforations, if specified, shall comply with AASHTO M252 for polyethylene pipe and with AASHTO M330 for polypropylene pipe.

1006.02 POLYVINYL CHLORIDE PIPE (PVCP). PVCP and gasket materials shall comply with AASHTO M278 or ASTM D3034, SDR 35.

1006.03 RIBBED POLYVINYL CHLORIDE PIPE (RPVCP). RPVCP may be either open profile or dual wall construction in accordance with the specified ASTM standards. Pipe and gasket materials shall comply with ASTM F794 or ASTM F949, Series 46 with UV inhibitors. The resin shall have a minimum cell classification of 12454-C in accordance with ASTM D1784.

1006.04 CORRUGATED POLYETHYLENE PIPE SINGLE WALL (CPEPSW). CPEPSW shall be perforated and shall comply with AASHTO M252, Type C. Perforations shall comply with AASHTO M252. Do not use CPEPSW as shoulder outlet underdrain pipe.

1006.05 CORRUGATED POLYETHYLENE PIPE DOUBLE WALL (CPEPDW). When used for cross or side drains, CPEPDW pipe and gasket materials shall comply with AASHTO M294, Type S, with a minimum resin cell classification of 435400C in accordance with ASTM D3350.

When used for plastic underdrain pipe, the pipe and joint system shall comply with AASHTO M252.

When used for yard drain pipe, the pipe and joint system shall comply with AASHTO M252, Type S, with a minimum resin cell classification of 424420C in accordance with ASTM D3350, or AASHTO M294, Type S, with a minimum resin cell classification of 435400C in accordance with ASTM D3350.

1006.06 CORRUGATED POLYPROPYLENE PIPE (CPPP).

1006.06.1 Corrugated Polypropylene Pipe Double Wall (CPPPDW): When used for storm drains, cross drains, side drains, or yard drains, the CPPPDW pipe, fittings, and gasket materials shall comply with AASHTO M330, Type S.

1006.06.2 Corrugated Polypropylene Pipe Triple Wall (CPPPTW): When used for storm drains, cross drains, side drains, or yard drains, the CPPPTW pipe, fittings, and gasket materials shall comply with AASHTO M 330, Type D.

1006.07 JOINT SYSTEMS FOR THERMOPLASTIC PIPE (TPP). Use pipe and joint systems from the Approved Materials List. Joint systems shall comply with 1018.03. A Type 2 or 3 joint system may be substituted for a Type 1 joint system; a Type 3 joint system may be substituted for a Type 2 joint system.

When using split coupling bands, use one piece that is composed of the same material as the pipe. The bands shall be the same thickness as the base pipe. The width of the band shall be equal to one-half the diameter of the pipe but a minimum of 12 inches wide.

Thermoplastic pipe gaskets shall be a part of a pipe/gasket system designed by the manufacturer and shall be from the Approved Materials List (AML), and comply with ASTM F477.

SECTION 1008 – PAINTS:

Subsection 1008.02 – Zinc Paint Systems (10/19), Pages 985 and 986

1008.02 is deleted and replaced with the following:

1008.02 ZINC PAINT SYSTEMS. The zinc paint system shall be from the Approved Materials List. Each system will be tested in accordance with AASHTO R 31. Zinc paint systems shall conform to the specification requirements of AASHTO R 31. All zinc paint systems shall meet the performance requirements listed in the latest Northeast Protective Coating Committee (NEPCOAT) Acceptance Criteria for New and 100 percent Bare Existing Steel for Bridges. The latest acceptance criteria can be found on the NEPCOAT website at www.nepcoat.org under the Qualified Products for Protective Coatings for New and 100 percent Bare Existing Steel for Bridges document.

Paint used on projects will be sampled and tested and shall comply with the following requirements:

Table 1008-1
Zinc Paint System Properties

Property	Test Method	Tolerance[1]
Pigment Content.	ASTM D2698	±2.0%
Density	ASTM D1475	±0.25 lbs/gal (±0.03 kg/l)
Solids Content	ASTM D2369	±2.0%
Non-volatile in Vehicle Content	ASTM D2698	±2.0%
Viscosity	ASTM D562	±5 KU
Dry to Touch	ASTM D1640	±10%
Dry Through	ASTM D1640	±10%
Sag, Lenetta	ASTM D4400	±10%
Infrared Spectrum	DOTD TR 610	Match Original[2]

[1]Target Values shall be established by the Materials and Testing Section upon qualification of the paint system.
[2]Standards for infrared spectrum shall be kept on file and compared to project samples for acceptance purposes.

Unless specified otherwise, the topcoat shall be tinted to match color 36463 from SAE AMS-STD-595A for non-weathering steel, and tinted to match color 30045 from SAE AMS-STD-595A for weathering steel.

Subsection 1008.08 – Maintenance Overcoating of Steel Bridges (10/19), Pages 989 and 990

1008.08 is deleted and replaced with the following:

1008.08 MAINTENANCE OVERCOATING OF STEEL BRIDGES. Use an overcoat system from the Approved Materials List. For source approval, a field trial is required, which consists of a three year side-by-side comparison between the new overcoat system and a corrosion inhibiting alkyd paint "control" system. Both systems shall overcoat a red lead paint system and/or approved alternate system. The new overcoat paint system shall perform as well or better than the control system in the areas of blistering, rusting, fading, chalking, and adhesion. Alternate testing programs such as NTPEP and NEPOVERCOAT will be allowed if approved by the Materials Engineer Administrator.

Paint used on projects will be sampled and tested and shall comply with the following requirements:

Table 1008-6
Paint Overcoat System Properties

Property	Test Method	Tolerance[1]
Pigment Content	ASTM D2698	±2.0%
Density	ASTM D1475	±0.25 lbs/gal (±0.03 kg/l)
Total Solids Content	ASTM D2369	±2.0%
Non-volatile in Vehicle Content	ASTM D2698	±2.0%
Viscosity	ASTM D562	±5 KU
Dry to Touch	ASTM D1640	±10%
Dry Through	ASTM D1640	±10%
Sag, Lenetta	ASTM D4400	±10%
Infrared Spectrum	DOTD TR 610	Match original[2]

[1]Target values shall be established by the Materials and Testing Section upon qualification of the paint system.

[2]Standards for infrared spectrum shall be kept on file and compared to project samples for acceptance purposes.

Unless specified otherwise, the topcoat shall be tinted to match color 36463 from SAE AMS-STD-595A for non-weathering steel, and tinted to match color 30045 from SAE AMS-STD-595A, for weathering steel.

SECTION 1009 – REINFORCING STEEL, STRAND, AND WIRE ROPE:

Subsection 1009.03.1 – Pavement Dowel Bars (10/18), Page 992

1009.03.1 is deleted and replaced with the following:

1009.03.1 Pavement Dowel Bars: Steel dowel bars shall comply with 1009.01.1, 1009.01.2, or 1009.01.3. Dowels shall have a uniformly round cross section and shall be saw cut, smooth and free of burrs, projections and deformations.

When, plastic coated dowels are being used, coated dowel bars shall be undercoated with an adhesive and given an outer coat of polypropylene or polyethylene. Coated dowel bars shall comply with AASHTO M 254. Type B coatings shall meet the requirements of ASTM A 775. Any damage to Type B coated dowels shall be repaired in accordance with ASTM A 775. For PCCP, place coated dowel bars in approved dowel bar assemblies in accordance with the plans.

Prior to placement of concrete, ensure dowel bars are entirely covered with an approved bond breaker that is one of the following:

1. Paraffin based lubricant, either Dayton Superior DSC BB-Coat or Valvoline Tectyl 506
2. White-pigmented curing compound conforming to ASTM C309, Type 2, Class A, with 22% minimum nonvolatile compound consisting of 50% paraffin wax
3. Any other bond breaker that is submitted with documentation sufficient to validate that it is equal to the above alternatives. Any approved equal must be reviewed and approved through the DOTD Materials Laboratory prior to use.

The use of oil-based or asphalt-based bond breakers is prohibited.

SECTION 1011 – CONCRETE CURING MATERIALS, ADMIXTURES, SPECIAL FINISHES, MODIFIERS, AND FIBER REINFORCEMENTS:

All Subsections (10/19), Pages 998 - 1000

1011 is deleted and replaced with the following:

Section 1011
Concrete Curing Materials, Admixtures, Special Finishes, Modifiers, and Fiber Reinforcements

1011.01 CURING MATERIALS.

1011.01.1 Liquid Membrane-Forming Compounds: This material shall comply with ASTM C309 and shall be from the Approved Materials List. Allowable types are Type 2 white-pigmented or Type 1-D, clear or translucent with a fugitive dye, as specified.

1011.01.2 Moist Cure Materials:

1011.01.2.1 Sheet Material: Use sheet materials for curing concrete meeting the physical and performance requirements of ASTM C171.

1011.01.2.2 Burlap Cloth: Use burlap cloth made from Jute or Kenaf complying with AASHTO M 182, Class 3.

1011.02 ADMIXTURES.

1011.02.1 Physical Requirements: Use concrete admixtures from the Approved Materials List in conformance with ASTM C494, ASTM C260, ASTM G109, and ASTM C1582, as applicable.

1011.02.2 Chemical Requirements: The contribution of chloride ion resulting from the addition of admixtures to the concrete shall not exceed 0.02 pound per cubic yard of concrete, when tested in accordance with DOTD TR 643.

1011.02.3 Acceptance Testing: The admixture shall be tested by analytical infrared (IR) spectroscopy in accordance with DOTD TR 610. The IR spectrum shall compare favorably to the standard IR spectrum of the original material tested and on file at the Materials and Testing Section. The percent solids by weight, determined in accordance with DOTD TR 524, shall not deviate more than ±10 percent from that of the original approved material and shall not exceed the manufacturer's stated limits. Tests to determine rate of hardening, compressive strength or other properties may be made at any time during the work to ensure continued compliance with these specifications.

1011.03 SPECIAL FINISH FOR CONCRETE. Use material from the Approved Materials List. The material shall provide a uniform-textured finish complying with these specifications. Follow the manufacturer's recommendation for method of mixing, method of application, and rate of application, except that the rate shall not exceed 60 square feet per mixed gallon. Modifications to the manufacturer's recommendations will not be permitted.

Use a one-component coating system containing pigments, sand, and resins. The coating shall contain fungicides to prevent the growth of mildew, mold, etc. Unless specified otherwise, color of the material when applied to the test panel shall match color 36463 from SAE AMS-STD-595A.

For project samples, comply with Table 1011-1.

Table 1011-1
Special Finish Sample Acceptance

Property	Test Method	Specifications Acceptance[1]
Density	ASTM D1475	Target Value ±0.25 lbs/gal
Viscosity	ASTM D562	Target Value ±5 KU
Dry to Touch	ASTM D1640	Target Value ±10%
Dry Through	ASTM D1640	Target Value ±10%
Solids percent	ASTM D2369	Target Value ±2%
Volatile percent	ASTM D2369	Target Value ±2%
Infrared Spectrum	DOTD TR 610	[2]

1. Target Values shall be established by the Materials Section upon qualification of the paint system.
2. Standards for infrared spectrum shall be kept on file and compared to project samples for acceptance purposes

For source approval, comply with the following:

1. The average number of cycles to failure shall be not less than 50 cycles when tested in accordance with ASTM C666, Method A. Test specimens shall show no flaking, cracking, spalling or loss of bond.
2. The material shall be unaffected except for slight chalking or discoloration when exposed to 1000 hours of accelerated weathering using UV-B lamps in accordance with ASTM G154.

1011.04 MODIFIERS.

1011.04.1 Formulated Latex: Use a styrene butadiene latex modifier produced in the United States at a proportion no greater than 24.5 gallons per cubic yard of concrete.

Use a latex modifier that is non-toxic, film-forming, and a polymeric emulsion of which 90 percent of the non-volatiles are styrene butadiene polymers. Use a modifier that is homogeneous, uniform in composition, and free from chlorides. Conform to chemical and physical properties specified in Table 1011-2, when tested in accordance with the requirements of FHWA Report No. RD-78-35.

Table 1011-2
Formulated Latex Modifier Chemical and Physical Properties

Property	Value or Range	Testing Standards
Butadiene Content	30% - 40%	FHWA 4.A.1
Solids	46% - 53%	FHWA 4.A.2
pH	8.5 - 12	FHWA 4.A.4
Coagulum	0.10% (max.)	FHWA 4.A.5
Surface Tension	50 dynes/cm (max.)	FHWA 4.A.8
Particle Size:		
Mean Angstrom	1400 - 2500	FHWA 4.A.9
Median Angstrom	1400 - 2500	FHWA 4.A.9
Distribution	Unimodal	FHWA 4.A.9
95% Range Angstrom	2000 (max.)	FHWA 4.A.9
Freeze-thaw Stability (% coagulum after 2 cycles)	0.10 (max.)	FHWA 4.A.10
Concrete Slump (in.)	Greater than standard	ASTM C143
Concrete Air Content (%)	9% (max.)	ASTM C231
Time for 50% Slump Loss	+/- 25% standard	ASTM C143
Concrete Compressive Strength (24 hr and 28 day) (psi)	75% standard (min.)	ASTM C39
Compressive Strength Loss (28 - 42 day)	20% (max.)	ASTM C39
Concrete Flexural Strength (24 hr and 28 day) (psi)	Greater than standard	ASTM C78
Flexural Strength Loss (28 - 42 day)	25% (max.)	ASTM C192
Deicer Scaling (50 cycles) / Median Grading:		
Median Grading	3 (max.)	FHWA 4.B.6
Worst Rated	Below 5	FHWA 4.B.6
Chloride Permeability (95% absorbed):		
1/16 - 1/2 in (% Cl-)	0.320 (max.)	FHWA 4.B.7
1/2 - 1 in (% Cl-)	0.064 (max.)	FHWA 4.B.7

1011.05 FIBER REINFORCEMENTS.

1011.05.1 Physical Requirements Fiber: Use fibers from the Approved Materials List.

Fibers shall comform to ASTM C1116 (with the exception of ASTM C666 for Freeze/Thaw which is not required) and each fiber type's subsequent ASTM standard:

1. Steel Fibers: ASTM A820 (Steel Fibers shall comply with the "Buy American" clause).
2. Glass Fibers: ASTM Cl666 (prove ASR resistance).
3. Polyolefin Fibers: ASTM D7508.
    a. Minimum tensile strength of macro-synthetic fibers shall be 50 ksi when tested in accordance with ASTM D3822.
    b. Macro-synthetic fibers shall have an aspect ratio (L/D) between 50 and 150.
    c. Micro-synthetic fibers shall produce a minimum of 50% or greater reduction in Plastic Shrinkage Cracking of Restrained Fiber Reinforced Concrete when tested in accordance with ASTM Cl579.
4. Natural Fibers: ASTM D7357.

Fibers and their dosage shall obtain a minimum residual strength ratio (Re_3) of 25%, when tested in accordance to ASTM C1609.

Fibers shall have a fixed length and aspect ratio, and any changes in either parameter shall be approved by the Department.

SECTION 1016 – CONCRETE PIPE AND PRECAST REINFORCED CONCRETE DRAINAGE UNITS:

Subsection 1016.06 – Precast Reinforced Concrete Manholes, Catch Basins, Junction Boxes, and Safety Ends (02/19), Pages 1038 and 1039

1016.06 is deleted and replaced with the following:

1016.06 PRECAST REINFORCED CONCRETE MANHOLES, CATCH BASINS, JUNCTION BOXES, AND SAFETY ENDS. Comply with the dimensions shown on the plans, and the following:

Circular precast concrete manholes shall comply with ASTM C478, except that Class A1 concrete shall be used.

Square or rectangular precast concrete catch basins, junction boxes and drain manholes shall comply with ASTM C858, except that Class A1 concrete shall be used and surface resistivity requirements do not apply.

Precast safety ends shall comply with 702.04.3.

Portland cement concrete shall attain a minimum compressive strength of 4500 psi before shipping of the units.

Castings for frames, grates and covers shall comply with 1013.05 for steel and shall comply with 1013.06 for gray iron or malleable iron castings. Galvanization shall conform to ASTM A123.

1016.06.1 Casting Concrete: When multiple castings are to be made using the same forms, the use of metal forms are required. Concrete shall be placed into each sectional unit without interruption and shall be consolidated to force the concrete into the corners of forms and prevent formation of stone pockets or cleavage planes.

1016.06.2 Reinforcement: Reinforcement shall be as shown on the plans, and shall not vary more than 1/4 inch from the positions shown, except at pipe connections. Cover on reinforcement shall not be less than that shown on the plans.

SECTION 1017 – EPOXY RESIN SYSTEMS:

Subsection 1017.02 – Epoxy Resin Adhesives (General Use) (10/19), Page 1042

Table 1017-1 is deleted and replaced with the following:

Table 1017-1
Epoxy Resin Adhesives

		Type I		Type II		Type III		Type IV		Type V		Type VI & Type VII	
Property	**Test Method**	**Min.**	**Max.**	**Min.**	**Max.**	**Min.**	**Max.**	**Min.**	**Max.**	**Min.**	**Max.**	**Min.**	**Max.**
Compressive Strength, psi	DOTD TR 705												
3 hours		—	—	—	—	1000	—	—	—	—	—	—	—
24 hours		5000	—	—	—	3000	—	5000	—	—	—	—	—
Tensile Bond Strength, psi	DOTD TR 706												
24 hours (dry cure)		350	—	—	—	250	—	350	—	—	—	—	—
72 hours (moist cure)		—	—	150	—	—	—	—	—	150	—	—	—

SECTION 1018 – MISCELLANEOUS MATERIALS:

Subsection 1018.03.1 – General (11/20), Pages 1044 and 1045

1018.03.1 is deleted and replaced with the following:

1018.03.1 General: All pipe joint systems and materials shall be approved by the Materials Engineer Administrator. For source approval on all pipes exceeding 12 inches in diameter and for all concrete drainage units, joint types are determined by hydrostatic joint testing in accordance with Table 1018-1, with the modifications of 1018.03.2.

Table 1018-1
Joint Type Determination

Type of Pipe	Test Method
Concrete Pipe and Drainage Units	ASTM C443
Metal Pipe	AASHTO M36
Thermoplastic Pipe – CPEPDW	AASHTO M294
Thermoplastic Pipe – PVCP	AASHTO M278 or ASTM D3034
Thermoplastic Pipe – RPVCP	ASTM F794 or ASTM F949
Thermoplastic Pipe – CPPPDW	AASHTO M330
Thermoplastic Pipe – CPPPTW	AASHTO M330

SECTION 1019 – GEOTEXTILE FABRIC AND GEOCOMPOSITE SYSTEMS:

Subsection 1019.01.1 – General Requirements (06/19), Page 1051

1019.01.1 is amended to include the following:

High strength geotextile fabric required under roadway embankment shall be manufactured from high-tenacity polyester yarns which are woven into a stable network. The fabric shall be inert to biological degradation and resistant to chemicals encountered naturally in soils, alkalis, and acids. Prior to installation, a Certificate of Analysis shall be submitted indicating each lot meets specification criteria. The contractor shall send samples to an accredited third party lab or require it from the manufacturer to test materials for compliance with performance requirements. High strength geotextile fabric is not required to be on the AML.

Subsection 1019.01.2 – Detailed Requirements (06/19), Page 1053

Table 1019-1 is deleted and replaced with the following:

Table 1019-1
Geotextile Fabrics

		Requirements									
		Classes							Types		
Property	**Test Method**	**A**	**B**	**C**	**D**	**S**	**F**	**G**	**1**	**2**	**3**
AOS, Metric Sieve, µm, Max.	ASTM D4751	300	300	300	212	600	850	850	850	—	—
Grab Tensile, N, Min.	ASTM D4632	330	400	580	800	800	400	400	—	—	—
% Elongation @ Failure, Min.	ASTM D4632	—	—	50	50	—	—	—	—	—	—
% Elongation @ 200 N, Max.	ASTM D4632	—	—	—	—	—	—	50	—	—	—
Burst Strength, N, Min.	ASTM D3787	440	620	930	1290	1390	—	—	—	—	—
Puncture, N, Min.	ASTM D4833	110	130	180	330	330	—	—	—	—	—
Trapezoid Tear Strength, N, Min.	ASTM D4533	110	130	180	220	220	—	—	—	—	—
Permittivity, $Sec.^{-1}$, Min.	ASTM D4491	1.0	1.0	1.0	1.0	0.2	0.01	0.01	0.2	—	—
Grab Tensile Strength Retained after weathering 150 h, UVA lamps, %, Min	ASTM D4632 ASTM G154	70	70	70	70	70	—	—	—	—	—
Grab Tensile Strength Retained after weathering 500 h, UVA lamps, %, Min	ASTM D4632 ASTM G154	—	—	—	—	—	70	70	—	—	—
Strength @ Ultimate, kN/M	ASTM D-4595	—	—	—	—	—	—	—	140	390	650
Strength @ 5% Strain*, kN/M	ASTM D-4595	—	—	—	—	—	—	—	52	130	250
Long-term Design Strength, kN/M	GRI-GT7	—	—	—	—	—	—	—	66	195	290

*Minimum value shown in table must be met unless otherwise approved by the engineer