INDIANA DEPARTMENT OF TRANSPORTATION

STANDARDS COMMITTEE MEETING

Driving Indiana's Economic Growth

AGENDA

April 16, 2009 Standards Committee Meeting

MEMORANDUM

March 30, 2009

TO: Standards Committee

FROM: Mike Milligan, Secretary

RE: Agenda for the April 16, 2009 Standards Committee Meeting

A Standards Committee meeting is scheduled for 9:00 a.m. on April 16, 2009 in the N755 Bay Window Conference Room. Please enter the meeting through the double doors directly in front of the conference room. The following agenda items are listed for consideration.

Page No.

A. GENERAL BUSINESS ITEMS

OLD BUSINESS

Electronic votes from February 19, 2009 Minutes:
Ayes: 6
Nays: 0
Abstained: 2

NEW BUSINESS

1. Discussion on the Standard Drawings revision and approval process.

B. CONCEPTUAL PROPOSAL ITEMS

OLD BUSINESS

(No items on this agenda)

NEW BUSINESS

1. Slip-formed Concrete Railing 3

2. Evaluation of Ultrathin White Topping (UTW) 4

C. STANDARD SPECIFICATIONS, SPECIAL PROVISIONS AND STANDARD DRAWINGS PROPOSED ITEMS

OLD BUSINESS

(No items on this agenda)

NEW BUSINESS

Item No. 01 04/16/09 (2010 SS) 203-R-XXX	Mr. Heustis DYNAMIC CONE PENETROMETER TESTING FOR EMBANKMENT AND SUBGRADE	14
Item No. 02 04/16/09 (2010 SS) 400-R-553	Mr. Walker QUALITY CONTROL/QUALITY ASSURANCE, QC/QA, HOT MIX ASPHALT, HMA, PAVEMENT	18
Item No. 03 04/16/09 (2010 SS) Standard Drawings	Ms. Rearick 714-CCSP-02, 03 and 05	55

cc: Committee Members (11)
FHWA (2)

Mr. Heustis
Date: 03/19/09

CONCEPTUAL PROPOSAL

1. SLIP-FORMED CONCRETE RAILING.

CONCEPTUAL

PROPOSAL TO STANDARDS COMMITTEE

PROBLEM(S) ENCOUNTERED: Over the years, we have noticed that slip-formed concrete railing typically has heavier vertical cracking and is more likely to have consolidation issues compared to cast-in-place railings (as a result of trying to pour concrete in a moving operation). These deficiencies can lead to accelerated deterioration, especially considering that plows push snow and salt on to the shoulders and against the concrete barriers, where moisture & salt can sit for a while. Once corrosion starts it can continue not only in the barrier but continue into the deck as well where the barrier wall is anchored.

When attending field checks in the past few years, I have tried to stop the use of slip-formed railing by requesting that either an architectural treatment of the exterior faces be done or a note stating that slip-formed railing will not be allowed for this project.

PROPOSED SOLUTION: Please consider a change in the standards to prohibit the use of slip-formed concrete railings on our bridges.

APPLICABLE STANDARD SPECIFICATIONS: 706

APPLICABLE STANDARD DRAWINGS: 706 Series

APPLICABLE DESIGN MANUAL SECTION: TBD

APPLICABLE SECTION OF GIFE: 700

APPLICABLE RECURRING SPECIAL PROVISIONS: TBD

Submitted By: Jim Mickler (thru Ron Heustis)

Title: Greenfield District Bridge Inspection Engineer

Organization: INDOT

Phone Number: 317-467-3920

Date: Feb 2, 2009

APPLICABLE SUB-COMMITTEE ENDORSEMENT? None

Mr. Heustis
Date: 03/19/09

CONCEPTUAL PROPOSAL

2. EVALUATION OF ULTRATHIN WHITE TOPPING (UTW).

CONCEPTUAL

PROPOSAL TO STANDARDS COMMITTEE

PROBLEM(S) ENCOUNTERED: JTRP has issued the Final Report for SPR-2419 - Evaluation of Ultrathin White Topping (UTW). The project implementation plan is in 2 parts: Part 1 has recommended design & selection methodology for UTW and Part 2 has recommended construction specifications for UTW. A copy of the recommendations is attached with this proposal.

PROPOSED SOLUTION: Construction Management requests guidance from the Standards Committee on whether to proceed with developing construction specifications for UTW. The determination of when and where to use UTW will be determined by the Pavement Design section.

APPLICABLE STANDARD SPECIFICATIONS: None

APPLICABLE STANDARD DRAWINGS: None

APPLICABLE DESIGN MANUAL SECTION: None

APPLICABLE SECTION OF GIFE: None

APPLICABLE RECURRING SPECIAL PROVISIONS: None

Submitted By: Ron Heustis

Title: Mgr. of Construction Technical Support

Organization: INDOT

Phone Number: 317-234-2777

Date: 2/19/09

APPLICABLE SUB-COMMITTEE ENDORSEMENT? SPR-2419 Final Report

CHAPTER 9. IMPLEMENTATION RECOMMENDATIONS AND COST EFFECTIVENESS

The results discussed in Chapter 6 indicate that when proper bonding is achieved, UTW pavements can perform well. Additionally, no debonding was noted before 60,000 - 15,000 lb (67 kN) load applications and no cracking was observed until after 110,000 -15,000 lb (67 kN) load applications. These findings confirm the results observed in other states that UTW is a viable technique for the rehabilitation of distressed HMA pavements. As such, it is recommended that INDOT proceed with implementation of the UTW technique. Implementation can proceed statewide. The following sections outline the recommendations for implementation of the UTW rehabilitation technique in Indiana. These recommendations are based on the results of this research, existing INDOT practices, and ACPA (2007) recommendations.

9.1. Recommendations for Design Implementation

Site Selection

The UTW is appropriate for rehabilitation of distressed HMA pavements and composite pavements. The following is a list of criteria that should be considered when selecting a site to use UTW.

- Candidates for UTW overlays include HMA or composite (HMA over PCCP) roads, streets, and intersections that are good-to-fair structurally but exhibit surface distresses (rutting, shoving, slippage, and thermal cracking). UTW can be used in conjunction with widening. UTW overlays can also be used to

increase the structural capacity, improve friction, mitigate reflective cracking, and improve rideability of the existing pavement. Section 52-6.02 in the INDOT Design Manual can be modified to include UTW as an option for these cases.

- FWD testing should be conducted to evaluate the existing structural capacity of the pavement. A minimum structure number of 2.5 should be obtained. The capacity of the subgrade should also be checked so that it provides uniform support throughout. Problem areas should be identified and mitigated with full-depth patching. The INDOT Design Manual Chapter 52-7.03 covers requirements for rehabilitation projects and discusses the FWD and coring options.

UTW Thickness Design Method

It is recommended that designs initially be performed using the existing PCA method with in-situ material property data (back-calculated layer moduli and thicknesses) supplied by FWD testing. Such information can be provided by the INDOT Office of Research and Development. Training on the design method can be provided to INDOT pavement designers via a formal training course. After training, this design method could be used statewide. A research implementation project can be initiated to evaluate the new PCA-UTW design method spreadsheet (ACPA 2007) and the proposed FWD method for UTW design (in Chapter 7) prior to usage throughout the state.

A design program or spreadsheet based on the existing PCA design method and/or proposed FWD method should be developed to aid the designers. This could be developed as part of the research implementation project.

UTW Concrete Mixture Design

The success in the UTW performance seen in this project was due in part to the quality concrete mixture used. Therefore, it is recommended that the concrete mixture design have the following characteristics.

- Maximum water-cementitious materials ratio of 0.42. Fly ash can be used at the typical replacement rate (1.25:1) in these mixtures.
- Flexural strength at 7 days should be greater than 650 psi.
- Maximum aggregate size of 0.75 in (19 mm) can be used, but should not exceed 1/3 of the design thickness. Efforts should be made to match the thermal properties of the aggregates in the UTW with the thermal properties of the aggregates in the underlying HMA. Thus, the aggregate type in the existing HMA should be noted on the plans.
- Slump between 2 to 3 inches (50 to 75 mm). Slump should be sufficient enough to provide good workability and consolidation. Proper consolidation is needed to establish a good bond between the UTW and HMA layers. Depending on the mix components, water reducers or high-range water reducers may be needed to attain proper workability.
- Type III cement or accelerators may be used to increase the early strength development.
- Fibers may be added to the UTW mixture. Synthetic fibers such as polypropylene are commonly used in UTW applications. Fibers should be added at the manufacturers recommended rate. Fibers should be uniformly dispersed throughout the concrete mixture. (NOTE: There are conflicting reports in regards to the benefits of fibers. However, in some studies, including this study, fibers have been shown to be a benefit. Benefits noted include a decrease plastic shrinkage cracking, a delay load-induced cracking, and an improvement in post-cracking performance. A good reference on the use of fibers is *Design and Control of Concrete Mixtures*, 14th Ed. [2002] produced by the PCA.)

Joint Design

Joint spacing should be included as part of the plans. If there are joints in the underlying pavement, efforts should be made to match those in the UTW to the existing joints. Typically, the joints should be kept out of the wheel path of the

vehicles. Joints are not dowelled or tied. Details for joint layout around drainage structures should also be included in the plans. Or, a standard drawing for jointing around structures may be developed. A 2:1 joint spacing (feet) to thickness (inches) ratio is a good rule of thumb for determining the joint spacing. (NOTE: Joint spacing of 2 feet by 2 feet (600 mm by 600 mm) has been used in the past with thinner sections (ratio of 1:1 (joint spacing in feet: thickness in inches)). However, in this research project, relatively thin sections (2 to 2.5 inches (63 mm)) were used with a joint spacing of 4 feet by 4 feet (1200 mm by 1200 mm). No problems were attributed to this combination during either the mechanical or environmental loading.)

Repairs and Milling Thickness

If there are any significant distresses in the HMA (fatigue cracking, potholes, etc.) these should be mitigated with full-depth patching. Surface distresses such as thermal cracking, rutting, shoving, and/or slippage will be removed during the milling. There may be faulting at cracks or joints in existing composite pavements. Deteriorated cracks or joints should be repaired and load transition be reestablished prior to milling.

The depth of milling is dependent upon the following factors.

- Existing grade considerations.
- Thickness of the existing HMA.
- Type and severity of distresses.

Typically to match existing grade, the depth of the HMA milling will match the design thickness of the UTW. However, the other criteria should not be ignored. The remaining thickness of the HMA should be between 3 to 4 inches (75 to 100 mm). It is recommended that half of the existing HMA lift into which you are milling should be left after milling. Otherwise, the HMA lifts may separate and bonding with the UTW may be compromised. It is not necessary to mill the entire rutting depth. The INDOT Design Manual covers Milling of Asphalt Pavements in Section 52-7.05. This section will need to be modified to include UTW applications.

Transition

Transition details should be included in the design. Typically, a 12 foot (3600 mm) transition is adequate. The existing HMA should be milled at a taper over the first 6 feet (1800 mm) of the transition to an additional depth of the depth plus 3 inches (75 mm). The remaining 6 feet (1800 mm) of the transition should maintain this depth. A saw-cut should be made at the end of the transition. Transition milling is also covered in Section 52-7.05. A standard drawing for transitions may be developed for UTW applications.

9.2. Recommendations for Construction Implementation

Milling and Surface Cleaning

The existing INDOT specification on milling (Section 306 – INDOT 2008) should be adequate for the construction of UTW. However, the specification is somewhat limited on requirements for cleaning after milling, stating that "The roadway shall be cleaned prior to opening to traffic". Thus, given that a clean surface is optimal for the development of the bond between the UTW and HMA layers, the following recommendations are made in regards to the surface cleaning after the milling procedure.

Final surface cleaning should be performed just prior to the placement of the UTW concrete. It is recommended that the milled surface first be swept. After sweeping, the surface should be blown with compressed air. Power-washing with water is allowable, but, care should be made to ensure that no standing water is left on the milled surface.

Placement of UTW Concrete

The concrete can be placed using standard concrete paving techniques. Either fixed-form or slip-form paving can be utilized. The surface of the milled HMA should be kept below 120°F (49°C). Keeping the temperatures low will reduce the potential

for early-age shrinkage cracking. Water may be used to cool the surface but, no standing water should remain on the surface.

Efforts should be made to ensure that the concrete is adequately consolidated throughout. Particular attention should be paid to outside edges of the UTW layer. Lack of proper vibration of the concrete will lead to debonding and premature failure of the UTW layer.

Finishing and Texturing

Finishing of UTW should be done in accordance with Section 504.03. Texturing of the UTW can be done either by tining in accordance with Section 504.03 or the tining can be eliminated with texture provided by the burlap or turf drag.

Curing

Curing should be conducted in accordance with Section 504.04. However, in some instances it may be desirable to accelerate opening to traffic. In such cases, the curing time may be reduced. However, it is recommended that trial batches be conducted to ensure that the adequate strength gain (550 psi flexural strength - minimum required for opening to traffic) and durability can be attained under the accelerated curing regime.

Sawing of Joints

Joint sawing should be performed as soon as the concrete has hardened sufficiently to permit sawing without raveling, usually 2 to 12 hours after placement. Maturity methods as described in Joint Transportation Research Program Report FHWA/IN/JTRP-2007/5 are also recommended to determine the optimum time for saw-cutting. In this study both traditional sawing techniques as well as early-entry saw-cutting techniques were performed. Both techniques performed adequately and provided that the proper precautions are taken, both techniques can be employed with UTW. The saw-cut depth for traditional saw-cutting techniques should be 1/3 the UTW depth for longitudinal joints and 1/4 the UTW depth for transverse joints. Early-entry saw-cuts can be performed at lesser depths.

Pay Items

The UTW overlay can be paid at a given thickness (mm or inches) on a per area basis (m^2 or SYD). Additionally, it may be necessary to include a pay item for volume of concrete (m^3 or CYD) for possible material overruns. This would address the situation where localized distressed areas were deeper than planned more overlay material is required. (This item is similar to the item used for bridge deck overlays.)

Acceptance

Prior to accepting the UTW pavement, bond checks should be conducted. Sounding of the pavement should be conducted to determine if there were any locations that were not adequately bonded during construction. Sounding can be conducted using a chain drag over the general area with a hammer used to isolate problem areas. This research indicated that if the bond was initially in tact, the UTW overlay could withstand several tens of thousands of load applications prior to any load induced debonding. Any panels that are not fully bonded should be removed and replaced. Removal of individual panels can be conducted using a jack-hammer. The concrete used for replacement should be the same mix design as used in the original construction.

9.3. Cost Effectiveness

In order to determine the cost-effectiveness of UTW overlays versus typical Mill and Overlay Asphalt, Life Cycle Cost Analysis (LCCA) was conducted using the RealCost 2.0 Spreadsheet Application. A simplified intersection of two, four-lane roads was developed. This intersection contained a paved area of approximately 2389 SYD. The comparison was between a 4 inch HMA overlay and a 2 inch UTW overlay. Unit costs used in the analysis were based on 2006 construction data obtained from INDOT. UTW

costs were prorated based on a per inch of pavement thickness basis. Analysis was conducted using the parameters included in INDOT Design Manual, Chapter 52. The analysis period was over a 40 year period and a discount rate of 4 percent was used. The Equivalent Uniform Annual Cost (EUAC) was determined. The design life of the UTW overlay was varied to determine the break even point with the typical design life for an HMA overlay at 8 years (standard design life) 6 years and 4 years to represent scenarios in which the HMA was not meeting the design life. Detailed inputs used in the analysis are included in Appendix E. Figure 9.1 illustrates the results of the analysis.

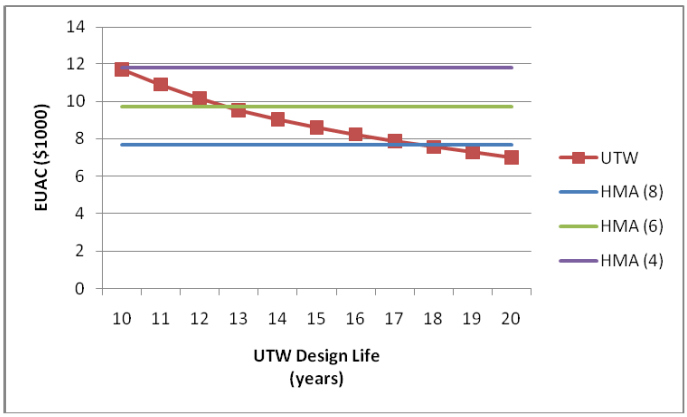

Figure 9.1 Cost Comparison

As can be seen from this figure, the UTW overlay becomes cost-effective against the HMA overlay (standard design life) at between 17 and 18 years. If the HMA fails to meet the design life the UTW becomes cost effective at design lives much sooner. The UTW break-even design life for HMA lasting 6 years was between 12 and 13 years and for an HMA pavement lasting 4 years the break-even point was 10 years. The design life for concrete pavement over existing pavement is 25 years (INDOT Design Manual). This design life would not necessarily be applicable for UTW overlays, though given the results of this study, a 15-20 year service life could be attainable. Thus, given the longer expected life of the UTW overlay, the UTW can be an economical alternative to HMA overlays.

PROPOSAL TO STANDARDS COMMITTEE

PROBLEM(S) ENCOUNTERED: The Department has been in need of alternate methods for controlling compaction of embankments to replace moisture/density control methods.

PROPOSED SOLUTION: INDOT Office of Geotechnical Engineering has developed a method for use of dynamic cone penetrometer testing (DCPT) to determine the strength of the soil and to use this as the acceptance3 test for embankment construction. DCPT has been used successfully for control of lime modified subgrade treatment for several years.

It is recommended that a Recurring Special Provision be adopted that will allow each District to elect when and where to apply DCPT for control of embankment construction. A draft provision is included with this proposal. The Basis for Use for this provision will be "As Determined by the District Testing and District Construction Offices."

APPLICABLE STANDARD SPECIFICATIONS: 203.23

APPLICABLE STANDARD DRAWINGS: NA

APPLICABLE DESIGN MANUAL SECTION: NA

APPLICABLE SECTION OF GIFE: 203

Submitted By: Ron Heustis

Title: Manager of Const. Tech. Support

Organization: INDOT

Phone Number: 317-234-2777

Date: March 20, 2009

This provision has been discussed and developed in cooperation with Nayyar Siddiki, Kurt Sommer, Ron Walker, Erik Seef, Joe Novak and Athar Khan.

Item No. 01 04/16/09 (2010 SS)
Mr. Heustis
Date: 04/16/09

NEW RECURRING SPECIAL PROVISION

203-R-XXX DYNAMIC CONE PENETROMETER TESTING FOR EMBANKMENT AND SUBGRADE
(Adopted xx/xx/xx)

The Standard Specifications are revised as follows:

SECTION 203, BEGIN LINE 831, DELETE AND INSERT AS FOLLOWS:

203.23 Embankment Other Than Rock and Shale, With Density *or Strength* Control

Unless otherwise specified, all embankments shall be compacted to at least 95% of their maximum dry density. The moisture content shall be controlled within -2 and +1 percentage points of optimum moisture content. Maximum density and optimum moisture content ~~shall~~ *will* be determined in accordance with AASHTO T 99 using method A for soil and method C for granular materials. *In lieu of accepting compaction by density control, the Department may elect to accept compaction based on the strength of the soil as determined by dynamic cone penetrometer testing, DCPT, in accordance with 203.24.1.*

SECTION 203, AFTER LINE 909, INSERT AS FOLLOWS:

203.24.1 Embankment Other Than Rock and Shale, With DCPT Control

In lieu of the compaction requirements of 203.23, the Department may elect to accept embankment compaction based on the strength of the soil as determined by dynamic cone penetrometer testing, DCPT, in accordance with ASTM D 6951.

The Department will establish the criteria for acceptance of compaction by DCPT by comparing density testing and DCPT results from test sections constructed by the Contractor using soils representative of those to be used in the embankment construction.

The Department's Office of Geotechnical Engineering shall be contacted prior to construction of test sections to determine the number of test sections required for the evaluation of the DCPT process, depending on the soils to be used in the embankment. The Engineer will select an area of approximately 100 ft (33 m) long, 21 ft (7 m) wide, and 2 ft (0.6 m) thick for construction of a DCPT test section. Representative samples of the soils to be used in each test section will be obtained prior to construction of the test section for sieve analysis and proctor testing in accordance with AASHTO T 88 and AASHTO T 99. The soil immediately below each test section shall be proofrolled in accordance with 203.26 prior to construction of the test section.

Construction of each test section shall be completed in four 6 in. (150 mm) lifts. For test sections below the Contractor's selected option for the specified subgrade treatment, each lift shall be compacted to at least 95% of its maximum dry density. If the Contractor elects to use density and moisture control as the option for subgrade construction, each lift in test sections within the subgrade treatment area shall be compacted to 100% of its maximum dry density. The moisture content shall be controlled within -3 and+2 percentage points of optimum moisture content. Maximum dry density and optimum moisture content will be determined in accordance with AASHTO T 99. In-situ density will be determined in accordance with AASHTO T 310 and T 191. Moisture content will be determined in accordance with ITM 506.

NEW RECURRING SPECIAL PROVISION

203-R-XXX DYNAMIC CONE PENETROMETER TESTING FOR EMBANKMENT AND SUBGRADE (CONTINUED).

In-situ density and moisture testing will be performed at six random locations per lift in each test section in accordance with ITM 802. DCPT will be performed within 1 ft (0.3 m) of each of the six in-situ density locations in each lift. The number of blows required for 6 in. (150 mm) penetration at each test location in each lift will be recorded and averaged to establish the 6 in. (150 mm) penetration minimum blow count criteria for the specific soil. Blow counts greater than twelve or less than four will be discarded and a new random test location will be selected in that lift of the test section. If all test section blow counts for 6 in. (150 mm) penetration are outside of the range of twelve to four, the Office of Geotechnical Engineering shall be contacted for determination of target range of blow counts.

The DCPT blow count criteria established from the test sections will be used for DCPT acceptance of the remaining embankment or subgrade construction. The Department may also elect to calibrate a Campbell moisture probe during construction and testing of DCPT test sections. The Campbell moisture probe may then be used for moisture testing during construction of the remaining embankment or subgrade in lieu of moisture testing in accordance with ITM 506.

SECTION 203, AFTER LINE 1253, INSERT AS FOLLOWS:

The cost of all labor and equipment necessary to construct DCPT test sections shall be included in the cost of the pay items in this section.

NEW RECURRING SPECIAL PROVISION

203-R-XXX DYNAMIC CONE PENETROMETER TESTING FOR EMBANKMENT AND SUBGRADE (CONTINUED).

Other sections containing specific cross references:

203.23
201.03 Pg 112 205.03(n) Pg 167
202.02 Pg 116 207.04 Pg 182
202.06 Pg 121 211.04 Pg 189
203.19 Pg 146 214.05 Pg 197
203.28 Pg 159 717.04 Pg 566

203.28
203.09 Pg 138 215.11 Pg 200
203.20(b) Pg 148 713.09 Pg 541
205.07 Pg 168 714.08 Pg 544
206.11 Pg 177 715.14 Pg 558
207.06 Pg 183

Recurring Special Provisions affected:

203-R-XXX

Standard Sheets affected:

None

Motion: M
Second: M
Ayes:
Nays:

Action: Passed as submitted; revised

___ 20__ Standard Specifications Book

___ Create RSP (No. _____)
Effective _____Letting
RSP Sunset Date: _____

___ Revise RSP (No. _____)
Effective _____Letting
RSP Sunset Date: _____

Standard Drawing Effective _____
___ Create RPD (No. _____)
Effective _____Letting
___ Technical Advisory

GIFE Update Req'd.? Y___ N___
By - Addition or Revision

Frequency Manual Update Req'd? Y___ N___
By - Addition or Revision

Withdrawn ____

Received FHWA Approval? ____

PROPOSAL TO STANDARDS COMMITTEE

PROBLEM(S) ENCOUNTERED: The following items require revisions to sections 401, 402, 410, and 902

1. Warm Mix Asphalt (WMA) - WMA represents a group of technologies that allow a reduction in the temperature at which mixtures are produced and placed. The technology that is being used in Indiana is the water-injection foaming device. This process will be included in the national study on WMA and the FHWA Mobile Asphalt Lab Trailer will be in Indiana in 2009 to study the device. Until such time that the study is complete, a restriction on the use of this process is necessary for 401 and 402 mixtures. The WMA process should be limited to 401 ESAL category 1, 2, and 3 and 402 type A, B, and C mixtures. ESAL category 3 and type C WMA surface mixtures should also be limited to 15% RAP. The minimum plant discharge temperature should be included on the DMF and JMF for both HMA and WMA mixtures.

2. Pay Factors (401.19) - Sublot PWL air void contents greater than 7.0% should require referral to the Office of Materials Management for adjudication as a failed material in accordance with the new Failed Materials policy. This revision will make the specifications consistent with the policy.

3. SMA Mix Design (410.05) - AASHTO has adopted a new standard for designing SMA mixtures (R 46) and this reference should be made for section 410.05.

4. Editorial Revisions (401.20 and 410.20) - Editorial revisions should be made to QC/QA HMA and SMA Appeals sections to clarify these sections and to provide uniformity between the 401 and 410 sections.

5. Asphalt Emulsions (902.01(b)) - Revisions were made to AASHTO T 59 for Emulsified Asphalts to eliminate the reference to the ASTM procedure for the Saybolt Fural Viscosity test and to include only a partial reference to AASHTO T 72, which is used for all petroleum products. AMRL will audit the asphalt lab at Materials Management for AASHTO T 59. Because of this, a revision should be made to reference AASHTO T 59 for the Saybolt Fural Viscosity test rather than AASHTO T 72.

PROPOSED SOLUTION: Revise existing Recurring Special Provision 400-R-553, last revised 11/20/08, to incorporate the revisions listed above. Make the revised RSP effective with contracts let on or after 05/01/09.

Since RSP 400-R-553, which modifies the 2008 Standard Specifications, has been adopted into the 2010 Standard Specifications and will be deleted on 09/01/09, another version of the RSP will be required for contracts let on or after 09/01/09 to continue the required revisions. Both versions of the RSP are presented with this proposal.

APPLICABLE STANDARD SPECIFICATIONS: 401, 402, 410, and 902

APPLICABLE STANDARD DRAWINGS: None

APPLICABLE DESIGN MANUAL SECTION: None

APPLICABLE SECTION OF GIFE: Section 13

APPLICABLE RECURRING SPECIAL PROVISIONS: 400-R-553

Submitted By: Ron Walker

Title: Manager, Office of Materials Management

Organization: INDOT

Phone Number: 317-610-7251 x 204

Date: 3-25-09

APPLICABLE SUB-COMMITTEE ENDORSEMENT? These specifications are recommended by the INDOT/APAI Technical Committee

Item No. 02 04/16/09 (2010 SS)
Mr. Walker
Date: 04/16/09

REVISED RECURRING SPECIAL PROVISION

400-R-553 SECTION 401 – QUALITY CONTROL/QUALITY ASSURANCE, QC/QA, HOT MIX ASPHALT, HMA, PAVEMENT

400-R-553 HMA PROVISIONS
(Revised 04-16-09) NOTE: This RSP refers to the 2008 Standard Specifications

The Standard Specifications are revised as follows:

SECTION 401, BEGIN LINE 1, DELETE AND INSERT AS FOLLOWS:

SECTION 401 – QUALITY CONTROL/QUALITY ASSURANCE, QC/QA, HOT MIX ASPHALT, HMA, PAVEMENT

401.01 Description

This work shall consist of one or more courses of QC/QA HMA base, intermediate, or surface mixtures constructed on prepared foundations in accordance with 105.03.

401.02 Quality Control

The HMA shall be supplied from a certified HMA plant in accordance with ITM 583; Certified ~~Volumetric~~ Hot Mix Asphalt Producer Program. The HMA shall be transported and placed according to a Quality Control Plan, QCP, prepared and submitted by the Contractor in accordance with ITM 803; Contractor Quality Control Plans for Hot Mix Asphalt Pavements. The QCP shall be submitted to the Engineer at least 15 days prior to commencing HMA paving operations.

MATERIALS

401.03 Materials

Materials shall be in accordance with the following:

Asphalt Materials
  PG Binder.....902.01(a)
Coarse Aggregates 904
  Base Mixtures – Class D or Higher
  Intermediate Mixtures – Class C or Higher
  *Surface Mixtures – Class B or Higher
Fibers.....AASHTO ~~MP 8~~ *M 325*
Fine Aggregates 904
  *Surface aggregate requirements are listed in 904.03(d).

REVISED RECURRING SPECIAL PROVISION

400-R-553, CONTINUED.

401.04 Design Mix Formula

A design mix formula, DMF, shall be prepared in accordance with 401.05 and submitted in a format acceptable to the Engineer one week prior to use. The DMF shall state the maximum particle size in the mixture. The DMF shall state the calibration factor, test temperature, and absorption factors to be used for the determination of binder content using the ignition oven in accordance with ITM 586, the binder content by extraction in accordance with ITM 571, and a Mixture Adjustment Factor (MAF). The DMF shall state the source, type, and dosage rate of any stabilizing additives. Approval of the DMF will be based on the ESAL and mixture designation. A mixture number will be assigned by the Engineer. No mixture will be accepted until the DMF has been approved.

The ESAL category identified in the pay item correlates to the following ESAL ranges.

ESAL CATEGORY	ESAL
1	< 300,000
2	300,000 to < 3,000,000
3	3,000,000 to < 10,000,000
4	10,000,000 to < 30,000,000
5	≥ 30,000,000

QC/QA HMA may be produced as warm-mix asphalt (WMA) by using a water-injection foaming device for ESAL category 1, 2 and 3 mixtures. The DMF shall list the minimum plant discharge temperature for HMA and WMA as applicable to the mixture.

401.05 Volumetric Mix Design

The DMF shall be determined for each mixture from a volumetric mix design by a design laboratory selected from the Department's list of approved Mix Design Laboratories. A volumetric mixture shall be designed in accordance with ~~the respective~~ AASHTO *R 35* and ~~ASTM~~ *the respective AASHTO* reference~~s~~ as listed below.

~~Standard Specification for Superpave Volumetric Mix Design ..... AASHTO M 323~~

~~Standard Specification for Designing Stone Matrix Asphalt (SMA) ..... AASHTO MP 8~~

~~Standard Practice for Mixture Conditioning of Hot Mix Asphalt (HMA) ..... AASHTO R 30~~

~~Standard Practice for Superpave Volumetric Design for Hot Mix Asphalt (HMA) ..... AASHTO R 35~~

REVISED RECURRING SPECIAL PROVISION

400-R-553, CONTINUED.

~~Maximum Specific Gravity and Density of Bituminous Paving Mixtures ..... AASHTO T 209~~

~~Resistance of Compacted Asphalt Mixture to Moisture Induced Damage ..... AASHTO T 283~~

~~Method for Preparing and Determining the Density of Hot Mix Asphalt (HMA) Specimens by Means of the Superpave Gyratory Compactor ..... AASHTO T 312~~

~~Bulk Specific Gravity of Compacted Bituminous Mixtures Using Automatic Vacuum Sealing ..... ASTM D 6752~~

Bulk Specific Gravity and Density of Compacted Asphalt Mixtures Using Automatic Vacuum Sealing ..... AASHTO T 331

The single percentage of aggregate passing each required sieve shall be within the limits of the following gradation tables.

	Dense Graded, Mixture Designation – Control Point (Percent Passing)				
	25.0 mm	19.0 mm	12.5 mm	9.5 mm	4.75 mm
Sieve Size					
50.0 mm					
37.5 mm	100.0				
25.0 mm	90.0 - 100.0	100.0			
19.0 mm	< 90.0	90.0 - 100.0	100.0		
12.5 mm		< 90.0	90.0 - 100.0	100.0	100.0
9.5 mm			< 90.0	90.0 - 100.0	95.0 -100.0
4.75 mm				< 90.0	90.0 - 100.0
2.36 mm	19.0 - 45.0	23.0 - 49.0	28.0 - 58.0	32.0 - 67.0	
1.18 mm					30.0 - 60.0
600 µm					
300 µm					
75 µm	1.0 - 7.0	2.0 - 8.0	2.0 - 10.0	2.0 - 10.0	6.0 - 12.0

PCS Control Point for Mixture Designation (Percent Passing)					
Mixture Designation	25.0 mm	19.0 mm	12.5 mm	9.5 mm	4.75 mm
Primary Control Sieve	4.75 mm	4.75 mm	2.36 mm	2.36 mm	NA
PCS Control Point	40	47	39	47	NA

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Open Graded, Mixture Designation – Control Point (Percent Passing)		
	OG19.0	OG25.0
Sieve Size		
37.5 mm		100.0
25.0 mm	100.0	70.0 – 98.0
19.0 mm	70.0 – 98.0	50.0 – 85.0
12.5 mm	40.0 – 68.0	28.0 – 62.0
9.5 mm	20.0 – 52.0	15.0 – 50.0
4.75 mm	10.0 – 30.0	6.0 – 30.0
2.36 mm	15.0 ± 8.0	15.0 ± 8.0
1.18 mm	2.0 – 18.0	2.0 – 18.0
600 µm	1.0 – 13.0	1.0 – 13.0
300 µm	0.0 – 10.0	0.0 – 10.0
150 µm	0.0 – 9.0	0.0 – 9.0
75 µm	0.0 – 8.0	0.0 – 8.0
Percent of Binder	> 3.0	> 3.0

Dust/Calculated Effective Binder Ratio shall be taken from 0.6 to 1.2, when the aggregate gradation passes above the primary control sieve (PCS) control point and 0.8 to 1.6 when the aggregate gradation is less than or equal to the PCS. The Dust/Calculated Effective Binder Ratio for 4.75 mm mixtures shall be 0.9 to 2.0.

The optimum binder content for dense graded mixtures shall produce 4.0% air voids at N_{des} and for open graded mixtures shall produce 15.0% – 20.0% air voids at N_{des}. The design for dense graded mixtures shall have at least four points, including a minimum of two points above and one point below the optimum. A one point design may be used for open graded mixtures. The maximum specific gravity of the ~~uncompressed~~ *uncompacted* mixture shall be determined in accordance with AASHTO T 209, *Section 9.5.1. The bulk specific gravity of the gyratory specimens shall be determined in accordance with AASHTO T 166, Method A for dense graded mixtures and AASHTO T 331 for open graded mixtures.*

The percent draindown of open graded mixtures shall not exceed 0.30% in accordance with AASHTO T 305. Open graded mixtures may incorporate fibers. *The binder for open graded mixtures containing fibers may be reduced by one temperature classification, 6°C, for the upper temperature classification. The fiber type and minimum dosage rate shall be in accordance with AASHTO M 325.*

Dense graded mixture shall be tested for moisture susceptibility in accordance with AASHTO T 283 except that the loose mixture curing shall be replaced by mixture conditioning for 2 h in accordance with AASHTO R 30. The minimum tensile strength ratio, TSR, shall be 80%. The 6 in. (150 mm) mixture specimens shall be compacted in accordance with AASHTO T 312. If anti-stripping additives are added to the mixture to be in accordance with the minimum TSR requirements, the dosage rate shall be submitted with the DMF.

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A PG binder grade or source change will not require a new mix design. If the upper temperature classification of the PG binder is lower than the original PG grade, a new TSR value is required. A new DMF shall be submitted for a binder grade change and shall reference the originating DMF/JMF number.

The MAF equals the Gmm from the mixture design divided by the following: 2.465 for 9.5 mm mixtures and 2.500 for 12.5 mm, 19.0 mm, and 25.0 mm mixtures. If the MAF calculation results in a value where $0.980 \leq MAF \leq 1.020$, then the MAF shall be considered to be 1.000. ~~If the calculated MAF is outside of the above range, then the actual calculated value shall be used.~~ *If the MAF is greater than 1.020, the calculated MAF value shall have 0.020 subtracted from the value. If the MAF is less than 0.980, the calculated MAF value shall have 0.020 added to the value.* The MAF does not apply to OG mixtures.

Changes in the source or types of aggregates shall require a new DMF. A new DMF shall be submitted to the District ~~Materials and Tests~~ *Testing* Engineer for approval one week prior to use.

~~Changes in the source of specified binders, except for PG 58-28 or PG 64-22, shall require a new DMF. Changes in the grade of a specified binder shall require a new DMF.~~

The mixture design compaction temperature for the specimens shall be 300 ± 9°F (150 ± 5°C) for dense graded mixtures and 260°F (125°C) for open graded mixtures.

Design criteria for each mixture shall be based on the ESAL shown in the contract documents and shall be as follows:

GYRATORY COMPACTION EFFORT					
ESAL	N_{ini}*	N_{des} *	N_{max}*	Max. % Gmm @ N_{ini}	Max. % Gmm @ N_{max}
DENSE GRADED					
< 300,000	6	50	75	91.5	98.0
300,000 to < 3,000,000	7	75	115	90.5	98.0
3,000,000 to < 10,000,000	8	100	160	89.0	98.0
10,000,000 to < 30,000,000	8	100	160	89.0	98.0
≥ 30,000,000	9	125	205	89.0	98.0
OPEN GRADED					
ALL ESAL	NA	20	NA	NA	NA
* N_{ini} , N_{des} , N_{max} , - definitions are included in AASHTO PP 28					

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VOIDS IN MINERAL AGGREGATE (VMA) CRITERIA @ N_{des}	
Mixture Designation	Minimum VMA, Percent
4.75 mm	16.0
9.5 mm	15.0
12.5 mm	14.0
19.0 mm	13.0
25.0 mm	12.0
OG19.0 mm	NA
OG25.0 mm	NA

VOIDS FILLED WITH ASPHALT (VFA) CRITERIA @ N_{des}	
ESAL	VFA, Percent
< 300,000	70 – 80
300,000 to < 3,000,000	65 – 78
3,000,000 to < 10,000,000	65 – 75
10,000,000 to < 30,000,000	65 – 75
≥ 30,000,000	65 – 75
Note 1: For 9.5 mm mixtures, the specified VFA range shall be 73% to 76% for design traffic levels ≥ 3 million ESALs.	
Note 2: For 25.0 mm mixtures, the specified lower limit of the VFA shall be 67% for design traffic levels < 0.3 million ESALs.	
Note 3: For 4.75 mm mixtures, the specified VFA range shall be 75% to 78% for design traffic levels ≥ 3 million ESALs.	
Note 4: For OG19.0 mm and OG25.0 mm mixtures, VFA is not applicable.	

401.06 Recycled Materials

Recycled materials may consist of reclaimed asphalt pavement, RAP, or asphalt roofing shingles, ARS, or a blend of both. RAP shall be the product resulting from the cold milling or crushing of an existing HMA pavement. The RAP shall be processed so that 100% will pass the 2 in. (50 mm) sieve when entering the HMA plant. ARS shall consist of waste from a shingle manufacturing facility. No tear-off materials from roofs will be allowed. ARS shall be stockpiled separately from other materials. The coarse aggregate in the recycled materials shall pass the maximum size sieve for the mixture being produced.

Recycled materials may be used as a substitute for a portion of the new materials required to produce HMA mixtures. When only RAP is used in the mixture, the RAP shall not exceed 25.0% by weight (mass) of the total mixture. When only ARS is used in the mixture, the ARS shall not exceed 5.0% by weight (mass) of the total mixture. For substitution or use, 1.0% of ARS is considered equal to 5.0% RAP. The percentages of recycled materials shall be as specified on the DMF.

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~~Recycled materials shall not be used in ESAL Category 3, 4, or 5 surface mixtures or open graded mixtures.~~ *A maximum of 15.0% RAP or 3.0% ARS by weight (mass) of the total mixture may be used in ESAL category 3, 4, or 5 surface mixtures and open graded mixtures. The RAP recycled material for the ESAL category 3, 4, or 5 surface mixtures shall be 100% passing the 3/8 in. (9.5 mm) sieve and 95 to 100% passing the No. 4 (4.75 mm) sieve.*

A maximum of 25.0% RAP or 5.0% ARS by weight (mass) of the total mixture may be used in WMA for ESAL category 1, 2 and 3 mixtures except ESAL category 3 surface mixtures.

The combined aggregate properties of a mixture with recycled materials shall be determined in accordance with ITM 584 and shall be in accordance with 904. Gradations of the combined aggregates shall be in accordance with 401.05.

Mixtures containing 15.0% or less RAP shall use the same grade of binder as specified. The binder for mixtures containing greater than 15.0% and up to 25.0% RAP shall be reduced by one temperature classification, 6°C, for both the upper and lower temperature classifications.

401.07 Lots and Sublots

Lots will be defined as ~~4000~~ *5000* t (~~4000~~ *5000* Mg) of base or intermediate mixtures or ~~2400~~ *3000* t (~~2400~~ *3000* Mg) of surface mixture. Lots will be further sub-divided into sublots not to exceed 1000 t (1000 Mg) of base or intermediate mixtures or 600 t (600 Mg) of surface mixture. Partial sublots ~~or~~ *of* 100 t (100 Mg) or less will be added to the previous sublot. Partial sublots greater than 100 t (100 Mg) constitute a full sublot. *Partial lots of four sublots or less will be added to the previous lot, if available.*

401.08 Job Mix Formula

A job mix formula, JMF, shall be developed by a certified HMA producer. A JMF used in the current or previous calendar year that was developed to N_{des} will be allowed. The mixture compaction temperature shall be 300 ± 9°F (150 ± 5°C) for dense graded mixtures and 260 ± 9°F (125 ± 5°C) for open graded mixtures. The JMF *shall list the minimum plant discharge temperature for HMA and WMA as applicable to the mixture. The JMF* for each mixture shall be submitted to the Engineer and shall use the same MAF as the DMF.

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401.09 Acceptance of Mixtures

Acceptance of mixtures for binder content, VMA at N_{des}, and air voids at N_{des} for each lot will be based on tests performed by the Engineer. ~~Acceptance testing for surface mixtures will include tests for moisture content.~~ The Engineer will randomly select the location(s) within each sublot for sampling in accordance with ITM 802. *The first 300 t (300 Mg) of the first sublot of the first lot for each DMF/JMF will not be sampled.* An acceptance sample will consist of two plate samples with the first being at the random location and the second 2 ft (0.6 m) ahead station. A backup sample consisting of two plate samples shall be located 2 ft (0.6 m) towards the center of the mat from the acceptance sample. ~~For surface mixtures, an additional sample shall be located 2 ft (0.6 m) back station from the random sample location.~~

Samples from each location shall be obtained from each sublot from the pavement in accordance with ITM 580. *The Engineer will take immediate possession of the samples.*

The binder content will be determined in accordance with ITM 586 or ITM 571 as directed by the Engineer. The maximum specific gravity will be determined in accordance with AASHTO T 209, *Section 9.5.1*. The air voids will be determined in accordance with AASHTO PP 28 based on the average bulk specific gravity from two gyratory specimens and the MSG for the sublot. The VMA will be determined in accordance with AASHTO PP 28 based on the average bulk specific gravity from two gyratory specimens, the percent aggregate in the mixture from the sublot and the BSG of the aggregate blend from the DMF/JMF as applicable. The gyratory pills will be prepared in accordance with AASHTO T 312.

The bulk specific gravity of gyratory specimens for dense graded mixtures will be determined in accordance with AASHTO T 166, *Method A* except samples are not required to be dried overnight. The bulk specific gravity of gyratory specimens for open graded mixtures, OG19.0, OG25.0 will be determined in accordance with ~~ASTM D 6752, except as follows. The duration of the test from initiating the vacuum extraction to weighing the specimen after the water bath will not exceed five minutes. The mass of water absorbed by the specimen while in the water bath will be subtracted from the mass of the specimen obtained in the water bath. Any test in which the mass of water absorbed by the specimen exceeds 5 g is invalid~~ *AASHTO T 331*.

~~The mixture properties for each sublot shall meet the requirements for the tolerances from the JMF as shown in the table as follows.~~

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~~ACCEPTANCE TOLERANCES~~	
~~MIXTURE PROPERTIES~~	~~TOLERANCES FROM THE JMF~~
~~DENSE GRADED~~	
~~Air Voids~~	~~JMF ± 1.0%~~
~~Binder Content~~	~~JMF ± 0.5%~~
~~VMA~~	~~JMF ± 1.0%~~
~~OPEN GRADED~~	
~~Air Voids*~~	~~JMF ± 3.0%~~
~~Binder Content~~	~~JMF ± 0.5%~~
~~* Gmb will be determined in accordance with ASTM D 6752~~	

~~The maximum percent of moisture in the mixture shall not exceed 0.10 from plate samples.~~

A binder draindown test in accordance with AASHTO T 305 for open graded mixtures shall be completed once per lot in accordance with 401.07 and shall not exceed 0.50%.

The Engineer's acceptance test results for each sublot will be available after the sublot and testing are complete.

Air voids, binder content and VMA values will be reported to the nearest ~~0.1~~ *0.01*%. ~~Moisture and d~~*D*raindown test results will be rounded to the nearest 0.01%. Rounding will be in accordance with 109.01(a).

~~Pay factors will be determined in accordance with 401.19(a).~~ *Pay factors for dense graded mixtures with original contract pay item quantities greater than or equal to one lot will be determined in accordance with 401.19(a). Partial lots of four sublots or less will have pay factors determined in accordance with 401.19(b) if the previous lot is not available.*

Pay factors for dense graded mixtures with original contract pay item quantities less than one lot and open graded mixtures will be determined in accordance with 401.19(b).

The Contractor may request an appeal of the Engineer's test results in accordance with 401.20.

Fibers incorporated into the mixture will be accepted on the basis of a type A certification for the specified material properties for each shipment of fibers. Fibers from different manufacturers and different types of fibers shall not be intermixed.

In the event that an acceptance sample is not available to represent a sublot~~(s)~~, all test results of the previous sublot will be used for acceptance. If the previous sublot is not available, the subsequent sublot will be used for acceptance.

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CONSTRUCTION REQUIRMENTS

401.10 General

Equipment for HMA operations shall be in accordance with 409. The Contractor shall submit to the Engineer ~~a~~ written ~~Certificate of Compliance~~ *documentation* that includes the manufacturer's make, model, serial number, manufactured year, and the manufacturer's literature with pictures. The ~~Certificate of Compliance~~ *documentation* shall be submitted prior to use and shall certify that the paving equipment proposed for the project is new and includes the modifications or have been modified in accordance with the following.

The paver shall be equipped with means of preventing the segregation of the coarse aggregate particles when moving the mixture from the paver hopper to the paver augers. The means and methods used shall be in accordance with the paver manufacturer's instructions and may consist of chain curtains, deflector plates, or other such devices, or any combination of these.

The following specific requirements shall also apply to identified HMA pavers:

1. Blaw-Knox HMA pavers shall be equipped with the Blaw-Knox Materials Management Kit, MMK.

2. Cedarrapids HMA pavers shall be those that were manufactured in 1989 or later.

3. Barber-Green/Caterpillar HMA pavers shall be equipped with deflector plates as identified in the December, 2000 Service Magazine entitled "New Asphalt Deflector Kit {6630-DFL, 6631-DFL, or 6640-DFL}".

The Contractor is also required to demonstrate to the Engineer prior to use, that the modifications to the paving equipment have been implemented on all pavers to be used on the project.

Fuel oil, kerosene, or solvents shall not be transported in open containers on equipment. Cleaning of equipment and small tools shall not be accomplished on the pavement or shoulder areas.

Segregation or flushing or bleeding of HMA mixtures will not be permitted. Corrective action shall be taken to prevent continuation of these conditions. Segregated or flushed or bleeding HMA mixtures shall be removed if directed. All areas showing an excess or deficiency of binder shall be removed and replaced.

All mixtures that become loose and broken, mixed with dirt, or is in any way defective shall be removed and replaced.

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401.11 Preparation of Surfaces to be Overlaid

The subgrade shall be shaped to the required grade and sections, free from all ruts, corrugations, or other irregularities, and uniformly compacted and approved in accordance with 207. Milling of an existing pavement surface shall be in accordance with 306. Surfaces on which a mixture is placed shall be free from objectionable or foreign materials at the time of placement.

~~Compacted aggregate bases and rubblized~~ *Rubblized concrete* pavements shall be primed in accordance with 405. PCCP, milled asphalt surfaces, and asphalt surfaces shall be tacked in accordance with 406. Contact surfaces of curbing, gutters, manholes, and other structures shall be tacked in accordance with 406.

401.12 Process Control

The Engineer and Contractor will jointly review the operations to ensure compliance with the QCP. Continuous violations of compliance with the QCP will result in suspension of paving operations.

401.13 Weather Limitations

HMA courses of less than 138 lb/syd (75 kg/m^2) shall be placed when the ambient temperature and the temperature of the surface on which it is to be placed is 45°F (7°C) or above. No mixture shall be placed on a frozen subgrade.

401.14 Spreading and Finishing

The mixture shall be placed upon an approved surface by means of laydown equipment in accordance with 409.03(c). Prior to paving, both the planned quantity and lay rate shall be adjusted by multiplying by the MAF. When mixture is produced from more than one DMF or JMF for a given pay item, the MAF will be applied to the applicable portion of the mixture for each. The temperature of each mixture at the time of spreading shall not be more than 18°F (10°C) below the minimum mixing temperature as shown on the JMF for mixtures compacted in accordance with 402.15.

Planned HMA courses greater than ~~165 lb/syd (90 kg/m^2)~~ *220 lb/syd (120 kg/m^2)* placed under traffic, shall be brought up even with each adjacent lane at the end of each work day. Planned HMA courses less than or equal to ~~165 lb/syd (90 kg/m^2)~~ *220 lb/syd (120 kg/m^2)* shall be brought forward concurrently, within practical limits, limiting the work in one lane to not more than one work day of production before moving back to bring forward the adjacent lane. Traffic shall not be allowed on open graded mixtures.

Hydraulic extensions on the paver will not be permitted for continuous paving operations. Fixed extensions or extendable screeds shall be used on courses greater than the nominal width of the paver except in areas where the paving width ~~vary~~ *varies*. Hydraulic extensions may be used in tapers and added lanes less than 250 ft (75 m) in length.

Automatic slope and grade controls shall be used as outlined in the QCP.

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HMA mainline and HMA shoulders which are 8.0 ft (2.4 m) or more in width shall be placed with paving equipment in accordance with 409.03(c)1.

When laying mixtures with density not controlled by cores, the speed of the paver shall not exceed 50 ft (15 m) per min. Rollers shall be operated to avoid shoving of the HMA and at speeds not to exceed 3 mph (4.5 km/h). However, vibratory rollers will be limited to 2.5 mph (4 km/h).

The finished thickness of any course shall be at least two times but not more than four times the maximum particle size as shown on the DMF.

401.15 Joints

Longitudinal joints in the surface shall be at the lanelines of the pavement. Longitudinal joints below the surface shall be offset from previously constructed joints by approximately 6 in. (150 mm), and be located within 12 in. (300 mm) of the lane line.

Transverse joints shall be constructed by exposing a near vertical full depth face of the previous course. For areas inaccessible to rollers, other mechanical devices shall be used to achieve the required density.

If constructed under traffic, temporary transverse joints shall be feathered to provide a smooth transition to the driving surface.

401.16 Density

Acceptance will be based on lots and sublots in accordance with 401.07.

Density of the compacted dense graded mixture will be determined from cores except where:

(a) the total planned lay rate to be placed over a shoulder existing prior to the contract award is less than 385 lb/syd (210 kg/m^2); or

(b) the first lift of material placed at less than 385 lb/syd (210 kg/m^2) over a shoulder existing prior to the contract award.

Density of any random core location(s) in these areas will be assigned a value of 92.0 %MSG and compaction shall be in accordance with 402.15.

Open graded mixtures shall be compacted with six passes of a static tandem roller and will be assigned a value of 84.0% of MSG. Vibratory rollers shall not be used on open graded mixtures.

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Density acceptance by cores will be based on samples obtained from two random locations selected by the Engineer within each sublot in accordance with ITM 802. One core shall be cut at each random location in accordance with ITM 580. The transverse core location will be located so that the edge of the core will be no closer than 3 in. (75 mm) from a confined edge or 6 in. (150 mm) from a non-confined edge of the course being placed. The maximum specific gravity will be determined from the samples obtained in 401.09.

The Contractor shall obtain cores in the presence of the Engineer with a device that shall produce a uniform 6 in. (150 mm) diameter pavement sample. Coring shall be completed prior to the random location being covered by the next course. Surface courses shall be cored within two work days of placement. Damaged core(s) shall be discarded and replaced with a core from a location selected by adding 1.0 ft (0.3 m) to the longitudinal location of the damaged core using the same transverse offset.

The Contractor and the Engineer shall mark the core to define the course to be tested. If the core indicates a course thickness of less than two times the maximum particle size, the core will be discarded and a core from a new random location will be selected for testing.

The Engineer will take immediate possession of the cores. If the Engineer's cores are subsequently damaged, additional coring will be the responsibility of the Department. Subsequent core locations will be determined by subtracting 1.0 ft (0.3 m) from the random location using the same transverse offset.

The density for the mixture will be expressed as the percentage of maximum specific gravity (%MSG) obtained by dividing the average bulk specific gravity by the maximum specific gravity for the sublot, times 100. *Samples for the bulk specific gravity and maximum specific gravity will be dried in accordance with ITM 572.* The Engineer will determine the ~~BSG~~ *bulk specific gravity* of the cores in accordance with AASHTO T 166, *Method A*. The maximum specific gravity will be determined in accordance with AASHTO T 209, *Section 9.5.1* ~~from samples prepared in accordance with ITM 572. The target value for density of dense graded mixtures of each sublot shall be 92.0%~~.

Within one work day of coring operations the Contractor shall clean, dry, and refill the core holes with HMA of similar or smaller size particles.

~~The test results for each sublot shall meet the requirements for the tolerances as shown in the table below.~~

~~DENSE GRADED ACCEPTANCE TOLERANCE~~	
~~Core Density~~	~~94.0 ± 2.0 %MSG~~

~~Pay factors will be determined in accordance with 401.19(b).~~

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The Engineer's acceptance test results for each sublot will be available when the sublot testing is complete. Acceptance of the pavement for density (%MSG) will be reported to the nearest ~~0.1~~ *0.01*%. Rounding will be in accordance with 109.01(a).

401.17 Shoulder Corrugations

Shoulder corrugations shall be in accordance with 606.

401.18 Pavement Smoothness

The pavement smoothness will be accepted by means of a profilograph, a 16 ft (4.9 m) long straightedge, or a 10 ft (3 m) long straightedge.

The profilograph shall be used where all of the following conditions are met:

(a) the design speed is greater than 45 mph (70 km/h),

(b) the pavement lanes are full width and 0.1 mi (0.16 km) or longer, and

(c) the HMA is placed on a milled surface or the total combined planned lay rate of surface, intermediate, and base is 385 lb/syd (210 kg/m2) or greater.

If a pay item, Profilograph, HMA, is included in the contract and the above conditions are met, the Contractor shall furnish, calibrate, and operate an approved profilograph in accordance with ITM 912. The profilogram produced shall become the property of the Department. The profilograph shall remain the property of the Contractor. When a profilograph, HMA, is not included as a pay item, and the above conditions are met, the Department will furnish, calibrate, and operate the profilograph or the Department will develop a change order in accordance with 109.05 to include profilograph, HMA as a pay item.

Within the limits of a smoothness section where the posted speed is ~~40~~ *45* mph (65 km/h) or less, smoothness of that section may be measured by a profilograph or a 16 ft (4.9 m) long straightedge. The Contractor shall notify the Engineer of the selected process prior to placement of the HMA. Smoothness pay adjustments are only applicable when measured by a profilograph.

The 16 ft (4.9 m) long straightedge *is used to check longitudinal profile and* shall be used on *all* overlays where the profilograph is not specified. *For contracts that include a profilograph pay item,* ~~T~~*t*he 16 ft (4.9 m) long straightedge shall be used on all *shoulders, on all* full width pavement lanes shorter than 0.1 mi (0.16 km) *in length*, on tapers, within 50 ft (15 m) of a reinforced concrete bridge approach, and within 50 ft (15 m) of an existing pavement, which is being joined.

The 10 ft (3 m) long straightedge shall be used *to check* ~~for~~ transverse slopes *across travel lanes and shoulders*, approaches, and crossovers.

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All wavelike irregularities and abrupt changes in profile caused by paving operations shall be corrected.

Each finished course of base and intermediate shall be subject to approval. The pavement smoothness shall be checked on any new intermediate course located immediately below a surface course and the surface course at the locations as designated in ITM 912.

If grinding of the intermediate course is used for pavement smoothness corrections, the grinding shall not precede the surface placement by more than 30 calendar days if open to traffic.

When the 16 ft (4.9 m) straightedge is used on a surface course, the pavement variations shall be corrected to 1/4 in. (6 mm) or less. When the 10 ft (3 m) straightedge is used, the pavement variations shall be corrected to 1/8 in. (3 mm) or less.

When the profilograph is being used on a surface course, in addition to the requirements for the profile index, all areas having a high or low point deviation in excess of 0.3 in. (8 mm) shall be corrected. Courses underlying the surface courses that are exposed by corrective actions shall be milled to 1 1/2 in. (38 mm) and replaced with the same type surface materials. The initial profile index shall be determined prior to any corrective action. The final profile index *for each section requiring corrective action* will be determined after all corrective action *within that section* has been completed.

When the profilograph is being used on an intermediate course, all areas having a high or low point deviation in excess of 0.3 in. (8 mm) shall be corrected. *After corrective action is taken on an intermediate course, a 16 ft (4.9 m) straightedge may be used to verify the adequacy of the corrective action.* When the 16 ft (4.9 mm) or 10 ft (3 m) straightedge is being used on an intermediate course, all areas having a high or low point deviation in excess of 1/4 in. (6 mm) shall be corrected.

401.19 Pay Factors

(a) Dense Graded Mixture ≥ One Lot

Pay factors (PF) are calculated for binder content, air voids at N_{des}, VMA at N_{des} and in-place density (%Gmm). The Percent Within Limits (PWL) for each lot will be determined in accordance with ITM 588. The appropriate pay factor for each property is calculated as follows:

Estimated Percent Within Limits (PWL) greater than 90:

$$PF = (105.00-0.50 \times (100.00-PWL))/100$$

Estimated PWL greater than or equal to 50 and equal to or less than 90:

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$$PF = (100.00 - 0.000020072 \times (100.00 - PWL)^{3.5877})/100$$

If the Lot PWL for any one of the properties is less than 50 or a sublot has an air void content less than 1.0% or greater than 7.0%, the lot will be referred to the Office of Materials Management for adjudication as a failed material in accordance with normal Department practice as listed in 105.03.

Binder content, air voids, VMA, and in-place density (%Gmm) PF values will be reported to the nearest 0.01. Rounding will be in accordance with 109.01(a).

A composite pay factor for each lot based on test results for mixture properties and density is determined by a weighted formula as follows:

$$Lot\ PF = 0.20(PF_{BINDER}) + 0.35(PF_{VOIDS}) + 0.10(PF_{VMA}) + 0.35\ (PF_{DENSITY})$$

where:

$Lot\ PF$	=	*Lot Composite Pay Factor for Mixture and Density*
PF_{BINDER}	=	*Lot Pay Factor for Binder Content*
PF_{VOIDS}	=	*Lot Pay Factor for Air Voids at* N_{des}
PF_{VMA}	=	*Lot Pay Factor for VMA at* N_{des}
$PF_{DENSITY}$	=	*Lot Pay Factor for In-Place Density (%Gmm)*

The lot quality assurance adjustment for mixture properties and density is calculated as follows.

$$q = L \times U \times (Lot\ PF - 1.00)/MAF$$

where:

q	=	*quality assurance adjustment for mixture properties and density of the lot*
L	=	*Lot quantity*
U	=	*Unit price for the material, $/TON ($/Mg)*
$Lot\ PF$	=	*Lot Pay Factor*

Lot test results for binder content, air voids, VMA, and density will be used to determine the Lot Pay Factors.

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The specification limits for binder content, air voids at N_{des}, VMA at N_{des}, and density will be as follows:

SPECIFICATION LIMITS				
Mixture				
	*LSL**		*USL***	
Binder Content, %	*- 0.40 from JMF*		*+ 0.40 from JMF*	
Air Voids (Va) at Ndes, %	*2.60*		*5.40*	
Voids In Mineral Aggregate at Ndes, %	*Greater Of*		*Lesser Of*	
	Spec-0.50	*JMF-1.20*	*Spec +2.00*	*JMF+ 1.20*
Density				
	LSL		*USL*	
Roadway Core Density (% Gmm), %	*91.00*		*Not Applicable*	

* *LSL, Lower Specification Limit*
** *USL, Upper Specification Limit*

(b) Dense Graded Mixture < One Lot and Open Graded Mixture

A composite pay factor for each sublot based on test results for mixture properties and density is determined in a weighted formula as follows:

$$SCPF = 0.20(PF_{BINDER}) + 0.35(PF_{VOIDS}) + 0.10(PF_{VMA}) + 0.35(PF_{DENSITY})$$

where:

SCPF = Sublot Composite Pay Factor for Mixture and Density
PF_{BINDER} = Sublot Pay Factor for Binder Content
PF_{VOIDS} = Sublot Pay Factor for Air Voids at N_{des}
PF_{VMA} = Sublot Pay Factor for VMA at N_{des}
$PF_{DENSITY}$ = Sublot Pay Factor for Density

If the SCPF for a sublot is less than 0.85, the ~~Materials and Tests Division~~ *Office of Materials Management* will evaluate the pavement. If the Contractor is not required to remove the mixture, quality assurance adjustments of the lot will be assessed or other corrective actions taken as determined by the ~~Materials and Tests Division~~ *Office of Materials Management*.

The sublot quality assurance adjustment for mixture properties and density is calculated as follows.

$$q = L \times U \times (SCPF - 1.00)/MAF$$

where:

q = quality assurance adjustment for the sublot
L = sublot quantity
U = unit price for the material $/TON ($/Mg)
SCPF =sublot composite pay factor

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~~(a) Mixture~~

Sublot test results for mixture properties will be assigned pay factors in accordance with the following.

BINDER CONTENT		
DENSE GRADED	OPEN GRADED	PAY FACTOR
Deviation from JMF (± %)	Deviation from JMF (± %)	Pay Factor
≤ 0.2	≤ 0.2	1.05
0.3	0.3	1.04
0.4	0.4	1.02
0.5	0.5	1.00
0.6	0.6	0.90
0.7	0.7	0.80
0.8	0.8	0.60
0.9	0.9	0.30
1.0	1.0	0.00
> 1.0	> 1.0	Submitted to the ~~Materials and Tests Division~~ *Office of Materials Management**
* Test results will be considered and adjudicated as a failed material in accordance with normal Department practice as listed in 105.03.		

VMA		
DENSE GRADED	OPEN GRADED	PAY FACTOR
Deviation from JMF (± %)	Deviation from JMF (± %)	Pay Factor
≤ 0.5		1.05
> 0.5 and ≤ 1.0	All	1.00
> 1.0 and ≤ 1.5		0.90
>1.5 and ≤ 2.0		0.70
> 2.0 and ≤ 2.5		0.30
> 2.5		Submitted to the ~~Materials and Tests Division~~ *Office of Materials Management**
* Test results will be considered and adjudicated as a failed material in accordance with normal Department practice as listed in 105.03.		

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AIR VOIDS		
DENSE GRADED	OPEN GRADED	PAY FACTOR
Deviation from JMF (± %)	Deviation from JMF (± %)	Pay Factor
≤ 0.5	≤ 1.0	1.05
> 0.5 and ≤ 1.0	> 1.0 and ≤ 3.0	1.00
1.1	3.1	0.98
1.2	3.2	0.96
1.3	3.3	0.94
1.4	3.4	0.92
1.5	3.5	0.90
1.6	3.6	0.84
1.7	3.7	0.78
1.8	3.8	0.72
1.9	3.9	0.66
2.0	4.0	0.60
> 2.0	> 4.0	Submitted to the ~~Materials and Tests Division~~ *Office of Materials Management**

* Test results will be considered and adjudicated as a failed material in accordance with normal Department practice as listed in 105.03.

For mixtures produced during a plant's adjustment period, pay factors based on the JMF with the above tolerances will be used to compute quality assurance adjustments.

~~(b) Density~~

Sublot test results for density will be assigned pay factors in accordance with the following.

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DENSITY		
Percentages are based on %MSG	Pay Factors – Percent	
Dense Graded	Open Graded	
≥ 97.0		Submitted to the ~~Materials and Tests Division~~ *Office of Materials Management**
95.6 - 96.9		1.05 - 0.01 for each 0.1% above 95.5
94.0 - 95.5		1.05
93.1 - 93.9		1.00 + 0.005 for each 0.1% above 93.0
92.0 - 93.0	84.0	1.00
91.0 - 91.9		1.00 - 0.005 for each 0.1% below 92.0
90.0 - 90.9		0.95 - 0.010 for each 0.1% below 91.0
89.0 - 89.9		0.85 - 0.030 for each 0.1% below 90.0
≤ 88.9		Submitted to the ~~Materials and Tests Division~~ *Office of Materials Management**
* Test results will be considered and adjudicated as a failed material in accordance with normal Department practice as listed in 105.03.		

The pay factors ~~shall~~ *will* be rounded to the nearest 0.01.

(c) Smoothness

When the pavement smoothness is tested with a profilograph, payment will be based on a zero blanking band on the final profile index in accordance with the following table. A Quality Assurance Pay Factor, PFs, for smoothness will apply to the planned typical section including the aggregate base, and the HMA base, intermediate, and surface courses. The quality assurance adjustment for each section will include the total area of each pavement lane excluding shoulders for 0.1 mi (0.16 km) long section represented by the profile index calculated by the following formula.

~~$q_s = (PF_s - 1.00) \sum_{i-1}^{n} \left(A \times \frac{S}{T} \times U \right)$~~

$$q_s = (PF_s - 1.00) \sum_{i=1}^{n} \left(A \times \frac{S}{T} \times U \right)$$

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where:

q_s = quality assurance adjustment for smoothness for one section
PF_s = pay factor for smoothness
n = number of layers
A = area of the section, syd (m^2)
S = planned spread rate for material, lb/syd (kg/m^2)
T = conversion factor: 2000 lb/ton (1000 kg/Mg)
U = unit price for the material, $/ton ($/Mg)

The quality assurance adjustment for smoothness, Qs, for the contract will be the total of the quality assurance adjustments for smoothness, qs, on each section by the following formula.

$$Q_s = \sum q_s$$

ADJUSTMENT FOR SMOOTHNESS ($PI_{0.0}$) ZERO BLANKING BAND	
Design Speed Greater Than 45 mph (70 km/hr)	
Profile Index in./0.1 mi. (mm per 0.16 km)	Pay Factor
Over 0.00 to 1.20 in. (Over 0 to 30 mm)	1.06
Over 1.20 to 1.40 in. (Over 30 to 35 mm)	1.05
Over 1.40 to 1.60 in. (Over 35 to 40 mm)	1.04
Over 1.60 to 1.80 in. (Over 40 to 45 mm)	1.03
Over 1.80 to 2.00 in. (Over 45 to 50 mm)	1.02
Over 2.00 to 2.40 in. (Over 50 to 60 mm)	1.01
Over 2.40 to 3.20 in. (Over 60 to 80 mm)	1.00
Over 3.20 to 3.40 in. (Over 80 to 85 mm)	0.96
All pavement with a profile index ($PI_{0.0}$) greater than 3.40 in. (85 mm) shall be corrected to 3.40 in. (85 mm).	

Quality assurance pay factors greater than 1.00 will be applicable only to the initial measured profile index, prior to any corrective work. *Regardless of the pay factor tabulated above, quality assurance pay factors for individual sections that require corrective action for high or low points in excess of 0.3 in. (8 mm) will not be greater*

than 1.00. Quality assurance pay factors of 1.00 or less will be applied to pavement sections where corrective work has been completed.

The total quality assurance adjustments ~~is to be~~ calculated as follows:

$$Q = Q_s + (\sum q)$$

where

Q = total quality assurance adjustment
Q_s = quality assurance adjustment for smoothness
q = *lot or* sublot quality assurance adjustment

401.20 Appeals

If the QC test results do not agree with the acceptance test results, a request, along with the QC test results, may be made in writing for additional testing. The appeal sample will be analyzed in a lab different than the lab that analyzed the original sample when requested by the Contractor. Additional testing may be requested for one or more of the following tests: MSG, BSG of the gyratory specimens, binder content, or BSG of the density cores. The request for the appeal for MSG, BSG of gyratory specimens, binder content or BSG of the density cores shall be submitted within seven calendar days of receipt of the Department's written results for that *the lot accepted under 401.19(a) or the* sublot *accepted under 401.19(b)*. The sublot and specific test(s) shall be specified at the time of the appeal request. Only one appeal request per *lot for mixture accepted under 401.19(a) or* sublot *for mixture accepted under 401.19(b)* is permitted. Upon approval of the appeal, the Engineer will perform additional testing as follows.

The backup or new sample(s) will be tested in accordance with the applicable test method for the test requested.

(a) MSG

The backup MSG sample will be dried in accordance with ITM 572 and tested in accordance with AASHTO T 209, Section 9.5.1.

(b) BSG of the Gyratory Specimen

New gyratory specimens will be prepared and tested in accordance with AASHTO T 312 from the backup sample.

(c) Binder Content

The backup binder content sample will be prepared and tested in accordance with the test method that was used for acceptance *or as directed by the Engineer*.

(d) BSG of the Density Core

Additional cores shall be taken within seven calendar days unless otherwise directed. Additional core locations will be determined by adding 1.0 ft (0.3 m) longitudinally of the cores tested using the same transverse offset. The appeal density cores will be *dried in accordance with ITM 572 and* tested in accordance with AASHTO T 166, *Method A*.

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400-R-553, CONTINUED.

The appeal results will replace all previous test result(s) for acceptance of mixture in accordance with 401.09 and density in accordance with 401.16. The results will be furnished to the Contractor.

401.21 Method of Measurement

HMA mixtures will be measured by the ton (megagram) of the type specified, in accordance with 109.01(b). The measured quantity will be divided by the MAF to determine the pay quantity.

Milled shoulder corrugations will be measured in accordance with 606.02.

401.22 Basis of Payment

The accepted quantities for this work will be paid for at the contract unit price per ton (megagram) for QC/QA-HMA, of the type specified, complete in place.

Payment for furnishing, calibrating, and operating the profilograph, and furnishing profile information will be made at the contract lump sum price for profilograph, HMA.

Adjustments to the contract payment with respect to mixture, density, and smoothness for mixture produced will be included in a quality assurance adjustment pay item in accordance with 109.05.1.

Milled shoulder corrugations will be paid for in accordance with 606.03.

Payment will be made under:

Pay Item	**Pay Unit Symbol**
Profilograph, HMA	LS
QC/QA-HMA, _____, _____, _____, _____mm (ESAL[1])(PG[2])(Course[3])(Mix[4])	TON (Mg)

(1) ESAL Category as defined in 401.04
(2) Number represents the high temperature binder grade. Low temperature grades are -22.
(3) Surface, Intermediate, or Base
(4) Mixture Designation

Preparation of surfaces to be overlaid shall be included in the cost of other pay items.

Coring and refilling of the core holes shall be included in the cost of other pay items within this section.

No payment will be made for additional anti-stripping additives, appeal coring or traffic control expenditures related to coring operations.

REVISED RECURRING SPECIAL PROVISION

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Corrections for pavement smoothness shall be included in the cost of other pay items within this section.

The price for Profilograph, HMA will be full compensation regardless of how often the profilograph is used or how many profilograms are produced.

If QC/QA-HMA intermediate over QC/QA-HMA base mixtures are specified, QC/QA-HMA intermediate mixture may be permitted as a substitute for the QC/QA-HMA intermediate and QC/QA-HMA base mixtures upon a written request by the Contractor. The request for the substitution shall be prepared in advance of the work. A computation will be made in order to obtain a unit price for the QC/QA-HMA intermediate mixture. The quantity and amount for QC/QA-HMA intermediate mixture shall equal the sum of the contract quantities and amounts shown for QC/QA-HMA intermediate and QC/QA-HMA base mixtures. The unit price for QC/QA-HMA intermediate mixture shall be equal to the sum of contract amounts divided by the sum of contract quantities. Payment for the QC/QA-HMA intermediate mixture will be made at the unit price per ton (megagram) for QC/QA-HMA intermediate mixture. No payment will be made for additional work or costs which may result due to this change.

SECTION 402, AFTER LINE 39a, INSERT AS FOLLOWS:

Mixture Type	Type A	Type B	Type C	Type D
Design ESAL	200,000	2,000,000	9,000,000	11,000,000
Surface	9.5 mm	9.5 mm	9.5 mm	9.5 mm
	12.5 mm	*12.5 mm*	*12.5 mm*	*12.5 mm*
Surface – PG Binder	64-22	64-22	70-22	70-22
Intermediate	*12.5 mm*	*12.5 mm*	*12.5 mm*	*12.5 mm*
	19.0 mm	19.0 mm	19.0 mm	19.0 mm
Intermediate – PG Binder	64-22	64-22	64-22	70-22
Base	*19.0 mm*	*19.0 mm*	*19.0 mm*	*19.0 mm*
	25.0 mm	25.0 mm	25.0 mm	25.0 mm
Base – PG Binder	64-22	64-22	64-22	64-22

HMA may be produced as warm-mix asphalt (WMA) by using a water-injection foaming device for temporary HMA mixtures and type A, B and C mixtures. The DMF shall list the minimum plant discharge temperature for HMA and WMA as applicable to the mixture.

SECTION 402, LINE 52, DELETE AND INSERT AS FOLLOWS:

The MAF equals the Gmm from the mixture design divided by the following: 2.465 for 9.5 mm mixtures and 2.500 for 12.5 mm, 19.0 mm, and 25.0 mm mixtures. If the MAF calculation results in a value where $0.980 \leq MAF \leq 1.020$, then the MAF shall be considered to be 1.000. ~~If the calculated MAF is outside of the above range, then the actual calculated value shall be used.~~ *If the MAF is greater than 1.020, the calculated MAF value shall have 0.020 subtracted from the value. If the MAF is less than 0.980, the calculated MAF value shall have 0.020 added to the value.*

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SECTION 402, BEGIN LINE 118, DELETE AND INSERT AS FOLLOWS:

~~Recycled materials may be used in all mixtures except type C and type D surface mixtures.~~ *A maximum of 15.0% RAP or 3.0% ARS by weight (mass) of the total mixture may be used in type C and D surface mixtures. The RAP provided the recycled material is for the type C and D surface mixtures shall be 100% passing the 3/8 in. (9.5 mm) sieve and 95% to 100% passing the No. 4 (4.75 mm) sieve.*

A maximum of 25.0% RAP or 5.0% ARS by weight (mass) of the total mixture may be used in WMA for temporary HMA mixtures and type A, B and C mixtures except type C surface mixtures.

SECTION 402, BEGIN LINE 125, DELETE AND INSERT AS FOLLOWS:

~~The binder low temperature classification for mixtures containing greater than 15.0% and up to 25.0% RAP shall be -28°C, and the binder high temperature classification may be reduced by 6°C.~~ *Mixtures containing 15.0% or less RAP shall use the same grade of binder as specified. The binder for mixtures containing greater than 15.0% and up to 25.0% RAP shall be reduced by one temperature classification, 6°C, for both the upper and lower temperature classifications.*

SECTION 402, BEGIN LINE 204, DELETE AND INSERT AS FOLLOWS:

Planned HMA courses greater than ~~165 lb/syd (90 kg/m^2)~~ *220 lb/syd (120 kg/m^2)* placed under traffic shall be brought up even with each adjacent lane at the end of each work day. Planned HMA courses less than or equal to ~~165 lb/syd (90 kg/m^2)~~ *220 lb/syd (120 kg/m^2)* shall be brought forward concurrently, within practical limits, limiting the work in one lane to not more than one work day of production before moving back to bring forward the adjacent lane. Traffic shall not be allowed on open graded mixtures.

SECTION 402, LINE 346, INSERT AS FOLLOWS:

The Engineer will determine the bulk specific gravity of the cores in accordance with AASHTO T 166, *Method A*. The maximum specific gravity will be determined in accordance with AASHTO T 209, *Section 9.5.1*. Density shall not be less than 92.0%.

SECTION 406, BEGIN LINE 9, INSERT AS FOLLOWS:

406.02 Materials

The type and grade of asphalt material shall be in accordance with the following:

Asphalt Emulsion, AE-T, AE-PMT, *SS-1h*.....902.01(b)
PG Asphalt Binder, PG 64-22.....902.01(a)

SECTION 410, BEGIN LINE 19, DELETE AND INSERT AS FOLLOWS:

410.03 Materials

Materials shall be in accordance with the following:

Asphalt Materials
PG Binder, PG 76-22, PG 70-22.....902.01(a)
Coarse Aggregates, Class AS.....904
~~Stabilizing Additive .....AASHTO MP 8~~

REVISED RECURRING SPECIAL PROVISION

400-R-553, CONTINUED.

Fibers ..... *AASHTO M 325*
Fine Aggregates (sand, mineral filler) 904

SECTION 410, BEGIN LINE 44, DELETE AND INSERT AS FOLLOWS:

410.05 SMA Mix Design

The DMF shall be determined for each mixture from a SMA mix design by a design laboratory selected from the Department's list of approved Mix Design Laboratories. A SMA mixture shall be designed in accordance with ~~the respective AASHTO references as listed below~~ *AASHTO M 325 and R* ~~35~~ *46*.

~~Standard Practice for Designing~~
~~Stone Matrix Asphalt (SMA).....AASHTO MP 8~~

~~Standard Practice for Mixture Conditioning~~
~~of Hot-Mix Asphalt (HMA).....AASHTO R 30~~

~~Standard Specification for Designing~~
~~Stone Matrix Asphalt (SMA).....AASHTO MP 8~~

~~Determining the Plastic Limit and Plasticity~~
~~Index of Soils.....AASHTO T 90~~

~~Maximum Specific Gravity and Density of~~
~~Bituminous Paving Mixtures.....AASHTO T 209~~

~~Resistance of Compacted Asphalt Mixture~~
~~to Moisture Induced Damage.....AASHTO T 283~~

~~Determination of Draindown Characteristics~~
~~in Uncompacted Asphalt Mixtures.....AASHTO T 305~~

~~Method for Preparing and Determining the Density~~
~~of Hot Mix Asphalt (HMA) Specimens by~~
~~Means of the Superpave Gyratory~~
~~Compactor.....AASHTO T 312~~

~~Method for Viscosity Determination of~~
~~Asphalt Binder Using Rotational~~
~~Viscometer.....AASHTO T 316~~

SECTION 410, LINE 84, INSERT AS FOLLOWS:

The optimum binder and aggregate gradation content shall produce 4.0% air voids. The maximum specific gravity of the uncompacted mixture shall be determined in accordance with AASHTO T 209, *Section 9.5.1*. The percent draindown for SMA surface mixture shall not exceed 0.30% in accordance with AASHTO T 305.

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SECTION 410, LINE 89, DELETE AND INSERT AS FOLLOWS

The MAF equals the Gmm from the mixture design divided by the following: 2.465 for 9.5 mm mixtures and 2.500 for 12.5 mm, 19.0 mm, and 25.0 mm mixtures. If the MAF calculation results in a value where $0.980 \leq MAF \leq 1.020$, then the MAF shall be considered to be 1.000. ~~If the calculated MAF is outside of the above range, then the actual calculated value shall be used.~~ *If the MAF is greater than 1.020, the calculated MAF value shall have 0.020 subtracted from the value. If the MAF is less than 0.980, the calculated MAF value shall have 0.020 added to the value. The MAF does not apply to OG mixtures.*

SECTION 410, BEGIN LINE 121, DELETE AND INSERT AS FOLLOWS:

410.06 Recycled Materials

~~Mainline surface shall not contain recycled materials.~~ *Recycled materials may consist of reclaimed asphalt pavement, RAP, or asphalt roofing shingles, ARS, or a blend of both. RAP shall be the product resulting from the cold milling or crushing of an existing HMA pavement. The recycled material shall be 100% passing the 3/8 in. (9.5 mm) sieve and 95% to 100% passing the No. 4 (4.75 mm) sieve when entering the HMA plant. ARS shall consist of waste from a shingle manufacturing facility. No tear-off materials from roofs will be allowed. ARS shall be stockpiled separately from other materials.*

Recycled materials may be used as a substitute for a portion of the new materials required to produce mainline surface. When only RAP is used in the mixture, the RAP shall not exceed 15.0% by weight (mass) of the total mixture. When only ARS is used in the mixture, the ARS shall not exceed 3.0% by weight (mass) of the total mixture. For substitution or use, 1.0% of ARS is considered equal to 5.0% RAP. The percentages of recycled materials shall be as specified on the DMF.

The combined aggregate properties of a mixture with recycled materials shall be determined in accordance with ITM 584 and shall be in accordance with 904. Gradations of the combined aggregates shall be in accordance with 410.05.

Mixtures containing RAP shall use the same grade of binder as specified.

SECTION 410, BEGIN LINE 136, DELETE AS FOLLOWS:

410.09 Acceptance of Mixtures

Acceptance of mixtures for binder content, ~~moisture,~~ and gradation for each lot will be based on tests performed by the Engineer. The Engineer will randomly select the location(s) within each sublot for sampling in accordance with ITM 802. *An acceptance sample will consist of one plate sample at the random location. A backup sample will consist of one plate sample located 2 ft (0.6 m) towards the center of the mat from the acceptance sample.*

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Samples from each location shall be obtained from each sublot from the pavement in accordance with ITM 580. *The Engineer will take immediate possession of the samples.*

A maximum specific gravity sample and a binder content and gradation sample will be obtained from the plate sample in accordance with ITM 587. The binder content will be determined in accordance with ITM 586 or ITM 571 as directed by the Engineer and the gradation will be determined in accordance with AASHTO T 30. The maximum specific gravity will be determined in accordance with AASHTO T 209, Section 9.5.1. ~~The second sample shall be located from the random sample by offsetting 1 ft (0.3 m) transversely towards the center of the mat and will be used for the moisture sample~~. The test results of the sublots will be averaged and shall meet the requirements for tolerances from the JMF for each sieve and binder content.

~~The maximum percent of moisture in the mixture shall not exceed 0.10 from plate samples.~~

SECTION 410, LINE 170, DELETE AS FOLLOWS:

Single test values and averages will be reported to the nearest 0.1% ~~except moisture will be reported to the nearest 0.01%~~. Rounding will be in accordance with 109.01(a).

SECTION 410, BEGIN LINE 240, DELETE AND INSERT AS FOLLOWS:

Planned SMA courses greater than ~~165 lb/syd (90 kg/m^2)~~ *220 lb/syd (120 kg/m^2)* placed under traffic, shall be brought up even with each adjacent lane at the end of each work day. Planned SMA courses less than or equal to ~~165 lb/syd (90 kg/m^2)~~ *220 lb/syd (120 kg/m^2)* shall be brought forward concurrently, within practical limits, limiting the work in one lane to not more than one work day of production before moving back to bring forward the adjacent lane.

SECTION 410, LINE 313, INSERT AS FOLLOWS:

The density of the mixture will be expressed as the percentage of maximum specific gravity (%MSG) obtained by dividing the average bulk specific gravity by the maximum specific gravity for the sublot, times 100. *Samples for the bulk specific gravity and maximum specific gravity will be dried in accordance with ITM 572.* The Engineer will determine the BSG of the cores in accordance with AASHTO T 166, *Method A.* The maximum specific gravity will be determined in accordance with AASHTO T 209, *Section 9.5.1.* ~~from plant produced materials prepared in accordance with ITM 572.~~ The target value for density of SMA mixtures of each sublot shall be 93.0%.

The Engineer will determine the bulk specific gravity of the cores in accordance with AASHTO T 166, Method A. The maximum specific gravity will be determined in accordance with AASHTO T 209, Section 9.5.1. Density shall not be less than 92.0%.

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SECTION 410, BEGIN LINE 404, DELETE AND INSERT AS FOLLOWS:

410.20 Appeals

If the QC test results do not agree with the acceptance test results, a request, along with the QC test results, may be made in writing for additional testing. ~~The basis of the appeal shall include applicable QC test results showing acceptable quality results and shall be submitted within seven calendar days of receipt of the Department's written results for that sublot. Acceptable QC test results are defined as QC test results resulting in less pay adjustment to the contract than that determined by the Department. If an appeal is granted, appeal cores shall be taken within seven calendar days after written notification unless otherwise directed. Within one work day of appeal coring operations the Contractor shall clean, dry, and refill the core holes with SMA or HMA surface materials.~~ *Additional testing may ~~be requested for~~ one or more of the following tests: binder content, gradation, or MSG of the mixture samples and bulk specific gravity of the density cores. The appeal request shall be submitted within seven calendar days of receipt of the Department's written results for that sublot. The request for the appeal for MSG, BSG of the density cores or binder content and gradation shall be submitted within seven calendar days of receipt of the Department's written results for that sublot. The sublot and specific tests shall be specified at the time of the appeal request. Only one appeal request per sublot is permitted. Upon approval of the appeal, the Engineer will perform additional testing.*

~~The results of the appeal cores will replace the initial test results for a sublot(s) or lot and be used as the basis for acceptance.~~ *The appeal results will replace all previous test results for acceptance of mixture in accordance with 410.09 and density in accordance with 410.16. The results will be furnished to the Contractor. The backup mixture samples or density cores will be tested in accordance with the following:*

(a) ~~Mixture~~ *MSG*

~~Upon approval for the additional testing, the Contractor shall take cores in accordance with ITM 580. The core location will be within 1.0 ft (0.3 m) longitudinally of the sample tested using the same transverse offset.~~ *The backup maximum specific gravity sample will be dried in accordance with ITM 572 and tested in accordance with AASHTO T 209, section 9.5.1.*

(b) Binder Content and Gradation

The backup binder content and gradation sample will be prepared and tested in accordance with the test methods that were used for acceptance.

REVISED RECURRING SPECIAL PROVISION

400-R-553, CONTINUED.

~~(b)~~ ***(c) BSG of the*** **Density** ***Core***

Cores shall be taken within seven calendar days unless otherwise directed. Additional core locations will be determined by adding 1.0 ft (0.3 m) longitudinally of the cores tested using the same transverse offset. ~~Each sublot density will be calculated using the average bulk specific gravity of the cores obtained for that sublot and the average MSG of the lot.~~ *The cores will be dried in accordance with ITM 572 and tested in accordance with AASHTO T 166, Method A. The Contractor shall clean, dry, and refill the core holes with SMA or HMA surface materials within one work day of the coring operations.*

SECTION 902, LINE 16, DELETE AND INSERT AS FOLLOWS:

1. Lots and Sublots

A binder lot for each grade of PG binder will be one week of HMA production. Lots will be further subdivided into sublots for each *calendar day* ~~twelve hour period when~~ *that* HMA is produced ~~within a calendar day. A lot will contain one to fourteen sublots~~.

2. Sampling

~~Each sample~~ *An acceptance sample and backup sample* shall be taken from the asphalt delivery system at the HMA plant. ~~Each sample~~ *The two samples* will represent a sublot. *A copy of a load ticket identifying the binder source shall be submitted with the sublot samples. The Engineer will take immediate possession of the samples.* ~~The Department will randomly select one sublot from each lot in accordance with ITM 802 for either complete or partial testing. If the sublot selected is in compliance, the lot will be accepted. If the sublot is not in compliance, the material will be adjudicated as a failed material in accordance with 105.03.~~

3. PG Binder Testing

The Department will randomly select one sublot from each lot in accordance with ITM 802 for either complete or partial testing in accordance with AASHTO M 320. Complete PG binder testing will consist of RTFO DSR and PAV BBR testing. Partial PG binder testing will consist of RTFO DSR testing. Rotational viscosity and flashpoint tests are not required. If the sublot selected is in accordance with the specifications, the lot will be accepted. If the selected sublot is not in accordance with the specifications, the material will be adjudicated as a failed material in accordance with 105.03.

~~PG binder testing will be performed on completed PG binder lots and will consist of either complete or partial testing. Complete PG binder testing consists of RTFO-DSR and PAV-BBR testing. Complete PG binder testing will be performed on the first sublot of the first lot of production for each grade of material for each supplier, per plant, and then randomly once every ten lots. Partial PG binder testing consists of RTFO-DSR testing on a random sublot of each lot. Lots and/or sublots to be tested will be selected in accordance with Section 3.0 of ITM 802. Random lots designated for complete testing will be selected upon the delivery of the first lot. Rotational viscosity and flashpoint tests are not required for complete or partial testing.~~

REVISED RECURRING SPECIAL PROVISION

400-R-553, CONTINUED.

~~If the test results from the complete or the partial testing are in accordance with the specifications, the entire lot of PG material is considered to be acceptable.~~

~~If the test results from a complete test are not in accordance with the specifications, the results will be reported to the DMTE and the Department's Asphalt Engineer. The DMTE will prepare a failed materials report in accordance with 105.03, and the next PG binder lot will be selected for complete testing.~~

~~If the test results from the partial test are not in accordance with the specifications, the Department's laboratory will initiate a PAV-BBR test on the same sublot. The test results will be reported to the DMTE and the Department's Asphalt Engineer. The DMTE will prepare a failed material report in accordance with 105.03, and the next PG binder lot will be selected for complete testing.~~

~~For any PG binder lot having test results not complying with the specifications, the remaining samples for that lot and all the backup samples will be held for 60 days from the date written notification is provided for possible appeal testing. After 60 days, all samples will be discarded. PG binder samples and backups for lots meeting specifications will be discarded promptly.~~

~~The Department's Asphalt Engineer will review the supplier's ASC program and the appropriate DMTE will review the Certified HMA Producer's QCP for compliance for all failing complete test results.~~

4. Appeals

If the Contractor does not agree with the acceptance test results for the lot, a request may be made in writing for additional testing. The appeal shall be submitted within ~~30~~ *15* calendar days of receipt of the Department's written results. The basis of the appeal shall include complete AASHTO M 320 test results for the specific sublot in question ~~plus test values from all other sublots for the parameters being disputed~~. *The appeal results will replace all previous test results for acceptance of the lot.*

~~If an appeal is accepted, the Department will randomly select two additional sublot samples if available from the lot in question. The additional sublot samples if available and the backup sample will be tested in an AASHTO accredited laboratory for the failing test parameters. The backup and additional test results for each test will be averaged. The average value for each test will be considered the final lot value. The Contractor will be notified in writing of the additional test results, the final lot values, and the appeal conclusions.~~

~~If the appeal is not accepted, the Department will respond to the Contractor stating the grounds for the denial.~~

REVISED RECURRING SPECIAL PROVISION

400-R-553, CONTINUED.

SECTION 902, AFTER LINE 122, INSERT AS FOLLOWS:

SS-1h is a slow setting, hard penetration type, intended for tack coats.

The requirements for asphalt emulsions shall be in accordance with the following:

Characteristic [1] [2]	AASHTO Test Method	RS-2	HFRS-2	AE-90	AE-90S	AE-T	*SS-1h*	AE-150	AE-150L	AE-PL	AE-PMT [6]	AE-PMP [6]
Test on Emulsion												
Viscosity, Saybolt Furol at 25°C, min.	~~T 72~~*T 59*			50			*20*	50				20+
Viscosity, Saybolt Furol at 25°C, max.	~~T 72~~*T 59*					100	*100*		100	115	100	
Viscosity, Saybolt Furol at 50°C, min.	~~T 72~~*T 59*	75	75		50			75				
Viscosity, Saybolt Furol at 50°C, max.	~~T 72~~*T 59*	400	400					300				
Demulsibility w/35 mL, 0.02N CaC12, %, min.	T 59	50	50		30							
Demulsibility w/50 mL, 0.10N CaC12, %, min.	T 59			75		75					25+	25+
Oil Distillate by Distillation, mL/100 g Emul [3]	T 59	4.0	4.0	4.0	3.0	4.0	*4.0*	7.0	7.0	3.0	3.0	3.0
Residue by Distillation, %, min.	T 59	68	68	68	65 [5]	54	*57*	68	60	30		
Residue by Distillation, % max.	T 59					62			65			
Sieve Test, %, max.	T 59	0.10	0.10	0.10	0.10	0.10	*0.10*	0.10	0.10	0.10	0.10	0.10
Penetrating Ability, mm, min.	902.02(w)									6		
Stone Coating Test, %	902.02(t)3a			90				90	90			
Settlement, %, max.	T 59	5	5	5								
Storage Stability, %, max.	T 59				1							
Asphalt Content by Distillation at 204°C, %, min.											54	45
Asphalt Content by Distillation at 204°C, %, max.											62	
Tests on Residue												
Penetration (0.1 mm) at 25°C, 100g, 5 s, min. [4]	T 49	100	100	100	90	50	*40*				50	300+
Penetration (0.1 mm) at 25°C, 100g, 5 s, max. [4]	T 49	200	200	200	150	200	*90*				200	
Penetration (0.1 mm) at 25°C, 50g, 5 s, min. [4]	T 49							100	100			
Penetration (0.1 mm) at 25°C, 50g, 5 s, max. [4]	T 49							300	300			
Ductility at 25°C, mm, min.	T 51	400	400	400		400	*400*					
Solubility in Org. Sol., %, min.	T 44	97.5	97.5	97.5	97.5	97.5	*97.5*	97.5	97.5	97.5	97.5	97.5
Float Test at 50°C, s, max. [4]	T 50											
Float Test at 60°C, s, min. [4]	T 50		1200	1200	1200	1200		1200	1200			
Force Ratio	T 300				0.3							
Elastic Recovery, at 4°C	T 301				58							
Polymer Content by Infrared											1.5+	1.5+

Notes:
(1) Broken samples or samples more than 10 days old will not be tested.
(2) Combined percentage of the residue and oil distillate by distillation shall be at least 70% (note the different units – ml for oil and % for residue).
(3) Oil distillate shall be in accordance with ASTM D 396, table 1, grade no. 1
(4) The Engineer may waive the test.
(5) Maximum temperature to be held for 15 minutes 200 ± 5°C.
(6) Asphalt shall be polymerized prior to emulsification.

SECTION 904, AFTER LINE 128, INSERT AS FOLLOWS:

The fine aggregate angularity value shall not apply to OG mixtures.

REVISED RECURRING SPECIAL PROVISION

400-R-553, CONTINUED.

Other sections containing specific cross references:

Recurring Special Provisions affected:

400-R-553

Standard Sheets affected:

Motion: M
Second: M
Ayes:
Nays:

Action: Passed as submitted; revised

___ 20__ Standard Specifications Book

___ Create RSP (No. _____)
Effective _____Letting
RSP Sunset Date: _____

___ Revise RSP (No. _____)
Effective _____Letting
RSP Sunset Date: _____

Standard Drawing Effective _____

___ Create RPD (No. _____)
Effective _____Letting
___ Technical Advisory

GIFE Update Req'd.? Y___ N___
By - Addition or Revision

Frequency Manual Update Req'd? Y___ N___
By - Addition or Revision

Withdrawn ____

Received FHWA Approval? ____

400-R-XXX HMA PROVISIONS
(Adopted 04-16-09)
NOTE: This RSP refers to the 2010 Standard Specifications

The Standard Specifications are revised as follows:

SECTION 401, BEGIN LINE 40, INSERT AS FOLLOWS:

ESAL CATEGORY	ESAL
1	< 300,000
2	300,000 to < 3,000,000
3	3,000,000 to < 10,000,000
4	10,000,000 to < 30,000,000
5	≥ 30,000,000

QC/QA HMA may be produced as warm-mix asphalt (WMA) by using a water-injection foaming device for ESAL category 1, 2 and 3 mixtures. The DMF shall list the minimum plant discharge temperature for HMA and WMA as applicable to the mixture.

SECTION 401, BEGIN LINE 135, INSERT AS FOLLOWS:

A maximum of 15.0% RAP or 3.0% ARS by weight (mass) of the total mixture may be used in ESAL category 3, 4, or 5 surface mixtures and open graded mixtures. The *RAP* recycled material for the ESAL category 3, 4, or 5 surface mixtures shall be 100% passing the 3/8 in. (9.5 mm) sieve and 95 to 100% passing the No. 4 (4.75 mm) sieve.

A maximum of 25.0% RAP or 5.0% ARS by weight (mass) of the total mixture may be used in WMA for ESAL category 1, 2 and 3 mixtures except ESAL category 3 surface mixtures.

SECTION 401, BEGIN LINE 158, INSERT AS FOLLOWS

401.08 Job Mix Formula

A job mix formula, JMF, shall be developed by a certified HMA producer. A JMF used in the current or previous calendar year that was developed to N_{des} will be allowed. The mixture compaction temperature shall be 300 ± 9°F (150 ± 5°C) for dense graded mixtures and 260 ± 9°F (125 ± 5°C) for open graded mixtures. The JMF *shall list the minimum plant discharge temperature for HMA and WMA as applicable to the mixture.* The JMF for each mixture shall be submitted to the Engineer and shall use the same MAF as the DMF.

SECTION 401, BEGIN LINE 493, INSERT AS FOLLOWS:

If the Lot PWL for any one of the properties is less than 50 or a sublot has an air void content less than 1.0*% or greater than 7.0*%, the lot will be referred to the Office of Materials Management for adjudication as a failed material in accordance with normal Department practice as listed in 105.03.

SECTION 401, BEGIN LINE 622, INSERT AS FOLLOWS:

401.20 Appeals

If the QC test results do not agree with the acceptance test results, a request, along with the QC test results, may be made in writing for additional testing. The appeal sample will be analyzed in a lab different than the lab that analyzed the original sample when requested by the Contractor. Additional testing may be requested for one or more of the following tests: MSG, BSG of the gyratory specimens, binder content, or BSG of the density cores. The request for the appeal for MSG, BSG of gyratory specimens, binder content or BSG of the density cores shall be submitted within seven calendar days of receipt of the Department's written results for that *the lot accepted under 401.19(a) or the* sublot *accepted under 401.19(b)*. The sublot and specific test(s) shall be specified at the time of the appeal request. Only one appeal request per *lot for mixture accepted under 401.19(a) or* sublot *for mixture accepted under 401.19(b)* is permitted. Upon approval of the appeal, the Engineer will perform additional testing as follows.

SECTION 402, AFTER LINE 40, INSERT AS FOLLOWS:

Mixture Type	Type A	Type B	Type C	Type D
Design ESAL	200,000	2,000,000	9,000,000	11,000,000
Surface	9.5 mm	9.5 mm	9.5 mm	9.5 mm
	12.5 mm	*12.5 mm*	*12.5 mm*	*12.5 mm*
Surface – PG Binder	64-22	64-22	70-22	70-22
Intermediate	*12.5 mm*	*12.5 mm*	*12.5 mm*	*12.5 mm*
	19.0 mm	19.0 mm	19.0 mm	19.0 mm
Intermediate – PG Binder	64-22	64-22	64-22	70-22
Base	*19.0 mm*	*19.0 mm*	*19.0 mm*	*19.0 mm*
	25.0 mm	25.0 mm	25.0 mm	25.0 mm
Base – PG Binder	64-22	64-22	64-22	64-22

HMA may be produced as warm-mix asphalt (WMA) by using a water-injection foaming device for temporary HMA mixtures and type A, B and C mixtures. The DMF shall list the minimum plant discharge temperature for HMA and WMA as applicable to the mixture.

SECTION 402, BEGIN LINE 119, INSERT AS FOLLOWS:

A maximum of 15.0% RAP or 3.0% ARS by weight (mass) of the total mixture may be used in type C and D surface mixtures. *The RAP* provided the recycled material is *for the type C and D surface mixtures shall be* 100% passing the 3/8 in. (9.5 mm) sieve and 95% to 100% passing the No. 4 (4.75 mm) sieve.

A maximum of 25.0% RAP or 5.0% ARS by weight (mass) of the total mixture may be used in WMA for temporary HMA mixtures and type A, B and C mixtures except type C surface mixtures.

SECTION 410, BEGIN LINE 44, DELETE AND INSERT AS FOLLOWS:

410.05 SMA Mix Design

The DMF shall be determined for each mixture from a SMA mix design by a design laboratory selected from the Department's list of approved Mix Design Laboratories. A SMA mixture shall be designed in accordance with AASHTO M 325 and R ~~35~~*46*.

SECTION 410, BEGIN LINE 406, INSERT AS FOLLOWS:

410.20 Appeals

If the QC test results do not agree with the acceptance test results, a request, along with the QC test results, may be made in writing for additional testing. Additional testing may be requested for one or more of the following tests: binder content, gradation, or MSG of the mixture samples and bulk specific gravity of the density cores. The appeal request shall be submitted within seven calendar days of receipt of the Department's written results for that sublot. The *request for the appeal for MSG, BSG of the density cores or binder content and gradation shall be submitted within seven calendar days of receipt of the Department's written results for that sublot. The* sublot and specific tests shall be specified at the time of the appeal request. Only one appeal request per sublot is permitted. Upon approval of the appeal, the Engineer will perform additional testing.

SECTION 902, BEGIN LINE 87, DELETE AND INSERT AS FOLLOWS:

The requirements for asphalt emulsions shall be in accordance with the following:

Characteristic [1] [2]	AASHTO Test Method	RS-2	HFRS-2	AE-90	AE-90S	AE-T	*SS-1h*	AE-150	AE-150L	AE-PL	AE-PMT [6]	AE-PMP [6]
Test on Emulsion												
Viscosity, Saybolt Furol at 25°C, min.	~~T 72~~*T 59*			50			*20*	50				20+
Viscosity, Saybolt Furol at 25°C, max.	~~T 72~~*T 59*					100	*100*		100	115	100	
Viscosity, Saybolt Furol at 50°C, min.	~~T 72~~*T 59*	75	75		50			75				
Viscosity, Saybolt Furol at 50°C, max.	~~T 72~~*T 59*	400	400					300				
Demulsibility w/35 mL, 0.02N CaC12, %, min.	T 59	50	50		30							
Demulsibility w/50 mL, 0.10N CaC12, %, min.	T 59			75		75					25+	25+
Oil Distillate by Distillation, mL/100 g Emul [3]	T 59	4.0	4.0	4.0	3.0	4.0	*4.0*	7.0	7.0	3.0	3.0	3.0
Residue by Distillation, %, min.	T 59	68	68	68	65 [5]	54	*57*	68	60	30		
Residue by Distillation, % max.	T 59					62			65			
Sieve Test, %, max.	T 59	0.10	0.10	0.10	0.10	0.10	*0.10*	0.10	0.10	0.10	0.10	0.10
Penetrating Ability, mm, min.	902.02(w)									6		
Stone Coating Test, %	902.02(t)3a			90				90	90			
Settlement, %, max.	T 59	5	5	5								
Storage Stability, %, max.	T 59				1							
Asphalt Content by Distillation at 204°C, %, min.											54	45
Asphalt Content by Distillation at 204°C, %, max.											62	
Tests on Residue												
Penetration (0.1 mm) at 25°C, 100g, 5 s, min. [4]	T 49	100	100	100	90	50	*40*				50	300+
Penetration (0.1 mm) at 25°C, 100g, 5 s, max. [4]	T 49	200	200	200	150	200	*90*				200	
Penetration (0.1 mm) at 25°C, 50g, 5 s, min. [4]	T 49							100	100			
Penetration (0.1 mm) at 25°C, 50g, 5 s, max. [4]	T 49							300	300			
Ductility at 25°C, mm, min.	T 51	400	400	400		400	*400*					
Solubility in Org. Sol., %, min.	T 44	97.5	97.5	97.5	97.5	97.5	*97.5*	97.5	97.5	97.5	97.5	97.5
Float Test at 50°C, s, max. [4]	T 50											
Float Test at 60°C, s, min. [4]	T 50		1200	1200	1200	1200		1200	1200			
Force Ratio	T 300				0.3							
Elastic Recovery, at 4°C	T 301				58							
Polymer Content by Infrared											1.5+	1.5+

Notes:
(1) Broken samples or samples more than 10 days old will not be tested.
(2) Combined percentage of the residue and oil distillate by distillation shall be at least 70% (note the different units – ml for oil and % for residue).
(3) Oil distillate shall be in accordance with ASTM D 396, table 1, grade no. 1
(4) The Engineer may waive the test.
(5) Maximum temperature to be held for 15 minutes 200 ± 5°C.
(6) Asphalt shall be polymerized prior to emulsification.

PROPOSAL TO STANDARDS COMMITTEE

PROBLEM(S) ENCOUNTERED: IDEM as a part of the Section 401 permitting process is now requiring culverts to be sumped in order to allow for uninterrupted movement of stream bed material through the culverts.

PROPOSED SOLUTION: Revise the standard drawings for three-sided concrete culvert scour protection to allow for passage of natural stream bed material as required by IDEM. Standard drawings 714-CCSP-02, 714-CCSP-03, and 714-CCSP-05 show the proposed changes. Standard drawings 714-CCSP-01 and 714-CCSP-04 will need to be revised to reflect the changes on the other drawings upon passage of this item. The proposed revisions will result in less excavation and a reduction in the amount of riprap required. The reduction in excavation and riprap will have a side benefit of a cost reduction for INDOT.

APPLICABLE STANDARD SPECIFICATIONS: None

APPLICABLE STANDARD DRAWINGS: 714-CCSP-01, 714-CCSP-02, 714-CCSP-03, 714-CCSP-04, and 714-CCSP-05.

APPLICABLE DESIGN MANUAL SECTION: Chapter 31 "Culverts"

APPLICABLE SECTION OF GIFE: None

Submitted By: Anne Rearick

Title: Manager, Office of Structural Services

Organization: INDOT

Phone Number: 317-232-5152

Date: 1-23-09

Item No. 03 04/16/09 (2010 SS)
Ms. Rearick
Date: 04/16/09

REVISION TO STANDARD DRAWINGS

714-CCSP-02 THREE SIDED CONCRETE CULVERT SCOUR PROTECTION
714-CCSP-03 THREE SIDED CONCRETE CULVERT SCOUR PROTECTION
714-CCSP-05 THREE SIDED CONCRETE CULVERT SCOUR PROTECTION

Other sections containing specific cross references:

None

Recurring Special Provisions affected:

None

Standard Sheets affected:

714-CCSP-01
714-CCSP-02
714-CCSP-03
714-CCSP-04
714-CCSP-05

Motion: M
Second: M
Ayes:
Nays:

Action: Passed as submitted; revised

___ 20__ Standard Specifications Book

___ Create RSP (No. _____)
Effective _____Letting
RSP Sunset Date: _____

___ Revise RSP (No. _____)
Effective _____Letting
RSP Sunset Date: _____

Standard Drawing Effective _____

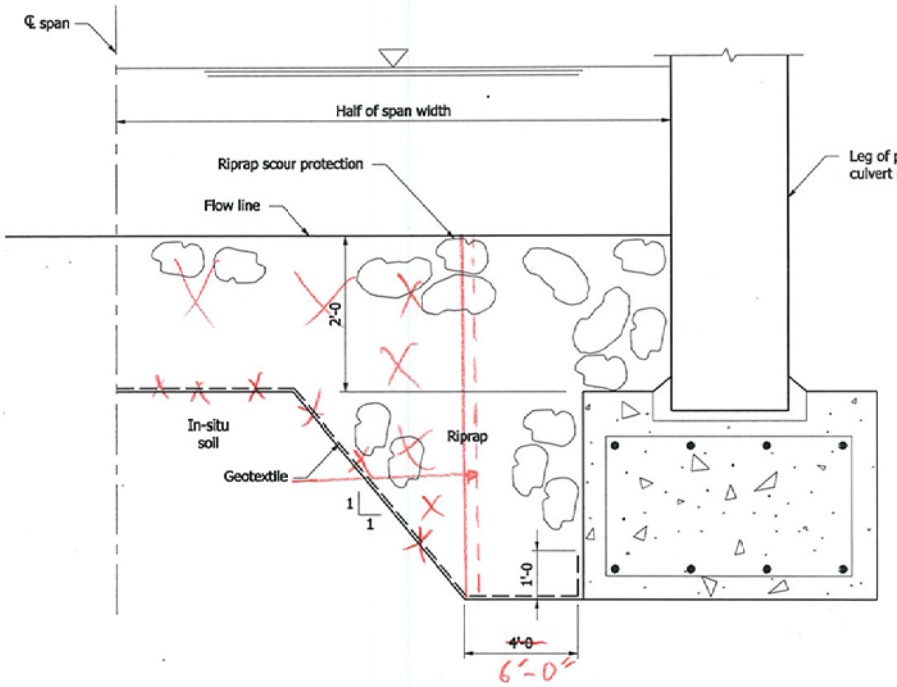
___ Create RPD (No. _____)
Effective _____Letting
___ Technical Advisory

GIFE Update Req'd.? Y___ N___
By - Addition or Revision

Frequency Manual Update Req'd? Y___ N___
By - Addition or Revision

Withdrawn ____

Received FHWA Approval? ____



SECTION A-A

RIPRAP METHOD

≥20' Span width

INDIANA DEPARTMENT OF TRANSPORTATION

THREE SIDED CONCRETE CULVERT SCOUR PROTECTION

SEPTEMBER 2007

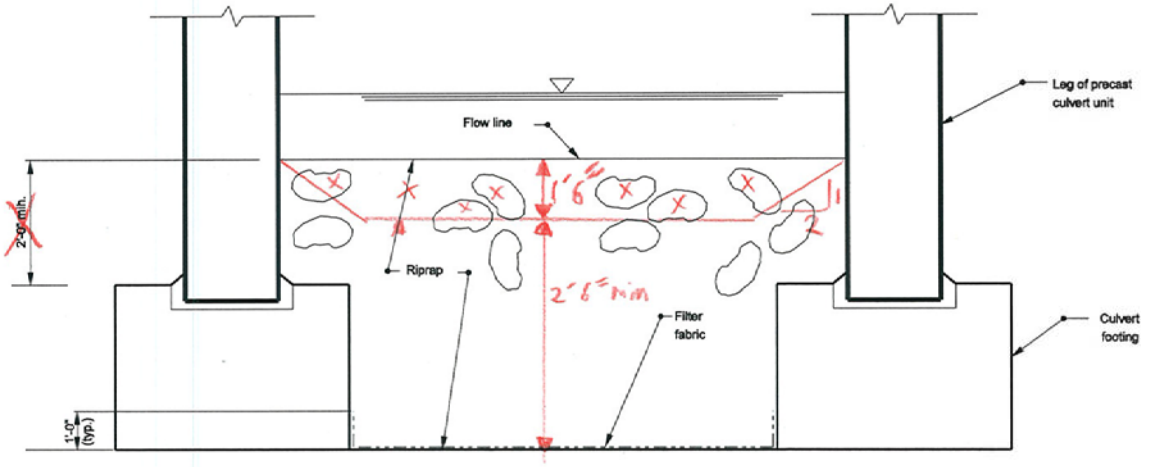
STANDARD DRAWING NO. E 714-CCSP-02

RICHARD L. VanCLEAVE REGISTERED No. 9750 STATE OF INDIANA PROFESSIONAL ENGINEER

DESIGN STANDARDS ENGINEER

/s/ Richard L. VanCleave 09/04/07
DESIGN STANDARDS ENGINEER DATE

/s/ Mark A. Miller 09/04/07
CHIEF HIGHWAY ENGINEER DATE



SECTION A-A

RIPRAP METHOD

For Span Width from 10'-0" to Less Than 20'-0"

INDIANA DEPARTMENT OF TRANSPORTATION

THREE SIDED CONCRETE CULVERT SCOUR PROTECTION

SEPTEMBER 2006

STANDARD DRAWING NO. E 714-CCSP-03

ANTHONY L. URMOVICH REGISTERED No. 18095 STATE OF Indiana PROFESSIONAL ENGINEER
DESIGN STANDARDS ENGINEER

/s/ Anthony L. Urmovich 9-01-06
DESIGN STANDARDS ENGINEER DATE

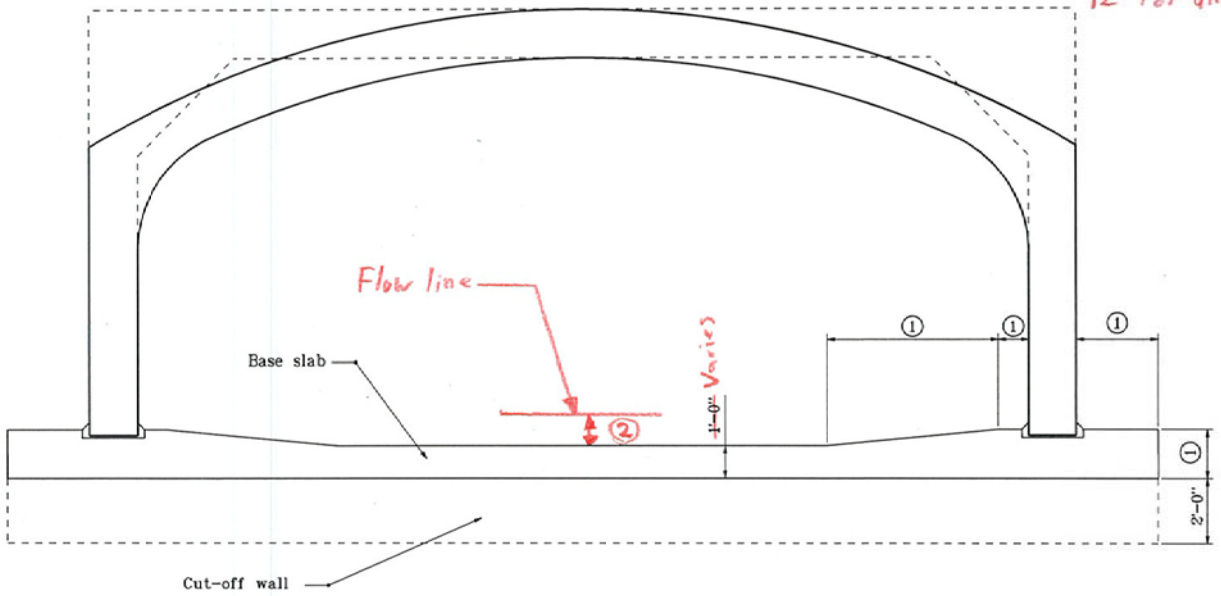
/s/ Donald W. Lucas 9-01-06
CHIEF HIGHWAY ENGINEER DATE

Source Sheet: NONE

NOTES:

(1) These dimensions vary, depending on the footing design, and are shown on the plans.

(2) 18" for sand bed streams
12" for all other bed materials



SECTION B-B

BASE SLAB METHOD

~~For Span Width of Less Than 10'-0"~~

INDIANA DEPARTMENT OF TRANSPORTATION

THREE SIDED CONCRETE CULVERT SCOUR PROTECTION

JANUARY 1999

STANDARD DRAWING NO. E 714-CCSP-05

ANTHONY L. UREMOVICH REGISTERED No. 18095 STATE OF INDIANA PROFESSIONAL ENGINEER

DESIGN STANDARDS ENGINEER

/s/ Anthony L. Uremovich 1-04-99
DESIGN STANDARDS ENGINEER DATE

/s/ Donald W. Lucas 1-04-99
CHIEF HIGHWAY ENGINEER DATE

Source Sheet: None

INDIANA DEPARTMENT OF TRANSPORTATION
DESIGN DIVISION
INDIANAPOLIS, INDIANA 46204-2249
INTER-DEPARTMENT COMMUNICATION

February 19, 2009

MEMORANDUM

TO: Anne M. Rearick
Structural Services Manager

FROM: Merril E. Dougherty
Hydraulics Supervisor

SUBJECT: Proposed Standard Drawing Revisions and Design Manual Culvert Policy Change to meet IDEM Culvert Sumping Requirement.

IDEM as part of the 401 permitting process has a requirement that culvert structures be sumped 20%. The proposed changes to the 3-sided concrete culvert standard drawings and the culvert sumping policy changes for Chapter 31 "Culverts" of the IDM have been reviewed by the hydraulics staff, OES and IDEM. The original 20% sumping requirement by IDEM was estimated to cost INDOT $1 million per year. This package reflects the changes I have proposed to the 3-sided culvert scour protection standards drawings to meet the IDEM requirement without any increase in structure size or cost. The sumping requirements for culverts with bottoms reflect the reduced requirements after discussions with IDEM. With these changes implemented it is roughly estimated that it will cost INDOT $300K to $400K per year. This is a significant reduction over the original requirement cost of $1M per year. Designers are currently left with out guidance for addressing the IDEM requirement so it is recommended that the standard drawing recommendation become effective ASAP. The design manual information should apply to projects that are submitted for Stage 1 review after June 1 2009. The information should be transmitted by a standards memorandum.

Thank you for your consideration of this item. If you have any questions please let me know.

MED

cc: file

31-3.04(07) Culvert Sumping

Sumping, for a circular or deformed pipe, or box structure, consists of placing the invert a specified depth below the flow line, so as to be in accordance with IDEM Water Quality Section 401 permit requirements. For a three-sided structure, this consists of treating the stream bed as shown on the INDOT *Standard Drawings*. No increase in rise will be required.

For a pipe or box structure, the required sump is shown in Figure 31-3A(1).

Structure Diameter or Span, *S* (ft)	Sump Required for Stream Bed of Sand (in.)	Sump Required for Stream Bed of Other Soil (in.)
< 4	6	3
$4 \leq S < 12$	12	6
$12 \leq S < 20$	18	12

CULVERT SUMP REQUIREMENT

Figure 31-3A(1)

If the sump shown in Figure 31-3A(1) exceeds 3 in., the structure diameter or rise must be increased by the sump value.

Where bedrock or consolidated till is present within the sump depth, the bedrock or till will be excavated such that the invert is placed 3 in. below the surface of the bedrock or till.