Iowa Department of Transportation

MINUTES
OF
IOWA D.O.T. SPECIFICATION COMMITTEE MEETING

July 10, 2008

Members Present:	Daniel Harness, Secretary	Specifications Section
	Roger Bierbaum	Office of Contracts
	Bruce Kuehl	District 6-District Construction
	John Smythe	Office of Construction
	Jim Berger	Office of Materials
	Doug McDonald	District 1-Marshalltown RCE
	Dan Redmond	District 4-District Materials
Members Not Present:	John Adam	Statewide Operations Bureau
	Tom Reis, Chair	Specifications Section
	Gary Novey	Office of Bridges & Structures
	Larry Jesse	Office of Local Systems
	Mike Kennerly	Office of Design
	Troy Jerman	Office of Traffic & Safety
Advisory Members Present:	Lisa Rold	FHWA
	Larry Stevens	SUDAS
Others Present:	Deanna Maifield	Office of Design
	Dan Eckert	Dickinson County
	J.D. King	Fayette County
	Donna Buchwald	Local Systems
	Charles Marker	Cass County
	Paul Assman	Crawford County
	Dan Davis	Fremont County
	Jeff Schmitt	Office of Construction
	John Hinrichsen	Office of Materials
	Scott Schram	Office of Materials

Daniel Harness, Assistant Specifications Engineer, opened the meeting. Items 1 through 4 were discussed in accordance with the July 3, 2008 agenda. Item 5 was brought up by the Office of Materials in order to resolve a discussion carried over from the June 10, 2008 meeting. Item 6 was brought up by the Office of Design to discuss acceptance of crash cushions.

1. Article 2103.02, Application (Fuel Adjustment).

The Office of Contracts requested a change to include consideration for shrinkage for embankment-in-place.

2. Article 2310.02, A, Concrete (PCC Overlay).

The Office of Materials requested a change to clarify whether fly ash is allowed.

3. Article 2547.04, Method of Measurement (Temporary Stream Access).
Article 2547.05, Basis of Payment (Temporary Stream Access).

The Office of Contracts requested a change to the payment provisions for Temporary Stream Access to address concerns subsequent to the June 12, 2008 AGCI Business Practice Meeting.

4. DS-01XXX, Developmental Specifications for Hot Mix Asphalt Mixtures.

The Office of Materials requested a new Developmental Specification to modify Section 2303 of the Standard Specifications to implement QMA-2 revisions on selected projects.

5. Product Use on Projects.

At the June 12, 2008 Specification Committee meeting, the question was raised during the discussion of Item 4 regarding whether or not a product could be used on a project if it had not received approval before the letting, but was approved after the letting. The response at that time was the Contractor would have to wait until projects are up for bid at the next letting to use the product unless a mutual benefit work order was processed to allow the product. Subsequent to the June 12th meeting, the Office of Materials noted that once a product is approved, it can be used on any active project regardless of letting date. It was noted that fabricators must still be approved prior to the letting.

The Offices of Contracts, Construction, and Materials, and the Specifications Section discussed the issue further, but came to no conclusive answer. The Office of Materials asked the Specifications Committee for their guidance. The Committee determined that if a product is approved for use, it should be allowed on an active project whether or not it was approved before the project's letting. The Committee also determined that Materials I.M. 204 needs clarify when a product may be used so that if a contractor decides to use a product that has been submitted for approval, but has not yet received approval, they do so at their own risk. Additional language needs to be included in Materials I.M. 204 emphasizing that the Department will not accelerate their approval process for products so a contractor can use it on a particular project.

6. Crash Cushion Approval.

The Office of Design explained they have encountered a situation where a crash cushion has been approved for use by the FHWA, but it can only be used in certain locations. The Office of Design explained that they prefer the crash cushion not be used at all by the Department. They explained that construction staging could result in the crash cushion being used inappropriately. They wanted to know if there is a way that even if a particular crash cushion has FHWA approval, the Department may exclude it from the approved list. The Office of Construction explained that there would need to be language in the Specifications that explains the conditions that would exclude a crash cushion from being approved for use. The Specifications Section will work with the Offices of Design and Construction to develop the language.

SPECIFICATION REVISION SUBMITTAL FORM

Submitted by: Roger Bierbaum	**Office:** Contracts	**Item 1**
Submittal Date: June 17, 2008	**Proposed Effective Date:** April 2009 GS	
Article No.: 2103.02 **Title:** Application (Fuel Adjustment)	**Other:**	

Specification Committee Action: Approved as is.

Deferred:	**Not Approved:**	**Approved Date:** 7/10/08	**Effective Date:** 4/21/09

Specification Committee Approved Text: See Specification Section Recommended Text.

Comments: The Office of Contracts explained that the fuel adjustment factor is based on the excavation cut quantity, whereas embankment-in-place is a fill quantity, thus affected by shrinkage. The AGCI asked that the Department consider a shrinkage factor for fuel adjustment for Embankment-in-Place.

The Office of Construction asked if the 50,000 cubic yard limit that is currently in place will apply to embankment-in-place. The Office of Contracts confirmed that it would.

Specification Section Recommended Text:

2103.02, Application.

Replace the second sentence and add a third sentence to the first paragraph:

A fuel usage factor of 0.20 gallon per cubic yard (1.0 L/m^3) will be used for all excavation items of work covered by this specification. A fuel usage factor of 0.27 gallon per cubic yard (1.3 L/m^3) will be used for Embankment-In-Place (non-dredge material).

Comments:

Member's Requested Change: (Do not use '**Track Changes**', or '**Mark-Up**'. Use ~~**Strikeout**~~ and **Highlight**.)

2103.02 APPLICATION.

Fuel adjustment will be applied to all Class 10, 12, and 13 Excavation, Embankment-In-Place (non-dredge material), Selected Backfill Material, and Topsoil which is work of the contract. A fuel usage factor of 0.20 gallon per cubic yard (1.0 L/m^3) will be used for all Excavation items of work covered by this specification. A fuel usage factor of 0.27 gallon per cubic yard (1.3 L/m^3) will be used for Embankment-In-Place (non-dredge material).

Fuel adjustment will also be applied to Embankment-In-Place (dredge material). The fuel usage will be based on billed gallons (liters) of fuel used.

Reason for Revision: AGC presented a concern at the June 12, 2008 Business Practice Meeting that our fuel adjustment specification does not consider shrinkage for embankment-in-place.

County or City Input Needed (X one)	**Yes**	**No**
Comments:		
Industry Input Needed (X one)	**Yes** X	**No**

Industry Notified:	**Yes** X	**No**	**Industry Concurrence:**	**Yes** X	**No**
Comments:					

SPECIFICATION REVISION SUBMITTAL FORM

Submitted by: Jim Berger	**Office:** Materials	**Item 2**
Submittal Date: 2008.06.26	**Proposed Effective Date:** April 2009	
Article No.: 2310.02 **Title:** Materials **(**PCC Overlay)	**Other:**	

Specification Committee Action: Approved as is.

Deferred:	**Not Approved:**	**Approved Date:** 7/10/08	**Effective Date:** 4/21/09

Specification Committee Approved Text: See Specification Section Recommended Text.

Comments: None.

Specification Section Recommended Text:

2310.02, A, Concrete.

Add as the second sentence of the first paragraph:
Allowable substitutions shall be in accordance with Article 2301.04.

Comments:

Member's Requested Change (Redline/Strikeout):

2310.02 MATERIALS.

A. Concrete.
Class C concrete shall be used for PCC Overlays as specified in Materials I.M. 529, except a C-3WR or C-4WR mix design shall be required for Bonded Overlays. Allowable substitutions shall be in accordance with Article 2301.04.

Reason for Revision:

County or City Input Needed (X one)	**Yes**	**No**

Comments:

Industry Input Needed (X one)			**Yes**	**No**	
Industry Notified:	**Yes** X	**No**	**Industry Concurrence:**	**Yes** X	**No**

Comments: Although 2310 already refers to 2301, there is confusion whether fly ash is allowed. 2310 has been rewritten since the 2001 book. Earlier references were to C-4WR and C-4WR-C mixes. The "-C" has not typically been in specifications as it is just a designation from IM 529 noting that Class C fly ash was used in the mix. (a "-F" means F ash was used and a "-S" means slag was used). Later versions included the language "with or without fly ash substitution". Apparently, they are looking at earlier versions, then looking at newer versions and noting fly ash is not mentioned. The intent was to require the 3 (55% coarse) or 4 (50% coarse) mix number and not the high sand mixes which are higher shrinkage.

SPECIFICATION REVISION SUBMITTAL FORM

Submitted by: Roger Bierbaum	**Office:** Contracts	**Item 3**
Submittal Date: June 13, 2008	**Proposed Effective Date:** April 2009 GS	
Section No.: 2547 **Title:** Temporary Stream Access	**Other:**	

Specification Committee Action: Committee approved Option 2 - Incidental Option.

Deferred:	**Not Approved:**	**Approved Date:** 7/10/08	**Effective Date:** 4/21/09

Specification Committee Approved Text:

2547.04, Method of Measurement.

Delete the title and entire article:

~~**2547.04 Method of Measurement.**~~

~~Temporary stream access will not be measured separately but will be considered as a lump sum.~~

2547.05, Basis of Payment.

Replace the title and entire article:

2547.0~~5~~4 Method of Measurement and Basis of Payment.

~~For Temporary Stream Access, the Contractor will be paid the lump sum contract price. This payment shall be considered full compensation for furnishing all material, labor, and equipment and for the performance of all work necessary for the construction, maintenance, use and removal of temporary stream access, reshaping, and stabilizing; all in accordance with the contract documents.~~

Temporary Stream Accesses ~~installed by the Contractor but not included in the contract documents for payment~~ shall be considered incidental to Mobilization.

~~Seventy-five percent of the lump sum contract price will be paid when the Contractor has installed the Temporary Stream Access. The remaining 25% will be paid when the Temporary Stream Access has been removed, and the area reshaped and stabilized.~~

Comments: Crawford County expressed their desire to follow Option 2. Adair County noted if AGC was agreeable, they would also like to follow Option 2. The Office of Local Systems noted several counties have expressed their desire to eliminate the bid item. The Office of Contracts pointed out that the AGCI's preference is to have a bid item, however they would accept eliminating the bid item. The AGCI does not want a bid item that applies some times, but not at other times. The Office of Construction expressed their support for Option 2. The Committee agreed to go with Option 2.

Specification Section Recommended Text:

Comments:

Member's Requested Change: **(Do not use 'Track Changes', or 'Mark-Up'. Use ~~Strikeout~~ and Highlight.)**

Option 1 – Always Pay Item

2547.04 METHOD OF MEASUREMENT.
Temporary stream access will not be measured separately but will be considered as a lump sum.

2547.05 BASIS OF PAYMENT.
For Temporary Stream Access, the Contractor will be paid the lump sum contract price. This payment shall be considered full compensation for furnishing all material, labor, and equipment and for the performance of all work necessary for the construction, maintenance, use and removal of temporary stream access, reshaping, and stabilizing; all in accordance with the contract documents, or providing whatever efforts the contractor takes to complete the work so Temporary Stream Access is not needed.

When an item for Temporary Stream Access is included in the contract, the item will be paid regardless of whatever efforts the contractor takes to complete the work. Temporary stream accesses installed by the Contractor but not included in the contract documents for payment shall be considered incidental to Mobilization.

Seventy-five percent of the lump sum contract price will be paid when the Contractor has installed the Temporary Stream Access. The remaining 25% will be paid when the Temporary Stream Access has been removed, and the area reshaped and stabilized or the need for the temporary stream access is no longer needed.

Option 2 – Incidental Option

~~**2547.04 METHOD OF MEASUREMENT.**~~
~~Temporary stream access will not be measured separately but will be considered as a lump sum.~~

2547.05 BASIS OF PAYMENT.
~~For Temporary Stream Access, the Contractor will be paid the lump sum contract price. This payment shall be considered full compensation for furnishing all material, labor, and equipment and for the performance of all work necessary for the construction, maintenance, use and removal of temporary stream access, reshaping, and stabilizing; all in accordance with the contract documents.~~

Temporary stream accesses installed by the ~~Contractor but not included in the contract documents for payment~~ shall be considered incidental to Mobilization.

~~Seventy-five percent of the lump sum contract price will be paid when the Contractor has installed the Temporary Stream Access. The remaining 25% will be paid when the Temporary Stream Access has been removed, and the area reshaped and stabilized.~~

Reason for Revision: Conditions change between the time the contractor bids a project and the work is done. Sometimes conditions (e.g. flooding) make a stream crossing impossible. A project engineer could delete this item if no stream crossing was installed even if the contractor has additional costs by bringing in additional equipment. Therefore contractors will unbalance their bids (e.g. bid this item for a penny) so they are not hurt if this item is deleted.

County or City Input Needed (X one)			**Yes**	**No**	
Comments:					
Industry Input Needed (X one)			**Yes** X	**No**	
Industry Notified:	**Yes** X	**No**	**Industry Concurrence:**	**Yes** X	**No**
Comments: This item is a result of an item on the AGC Business Practice Meeting held on June 12, 2008. Contractors requested this item always be paid if it is a contract item, or alternatively we should eliminate this item. Their preference is to have the item so all bidders recognize the cost of access the work at streams.					

SPECIFICATION REVISION SUBMITTAL FORM

Submitted by: Jim Berger / Dan Redmond	**Office:** Materials	**Item 4**
Submittal Date: 6-24-2008	**Proposed Effective Date:** 11-19-2008	
Section No.: 2303 **Title:** Hot Mix Asphalt Mixtures	**Other:** New Developmental Specification	

Specification Committee Action: Approved with changes as noted

Deferred:	**Not Approved:**	**Approved Date:**	**Effective Date:** 11/18/08

Specification Committee Approved Text: See attached DRAFT DS.

Comments: The Office of Materials gave an overview of the changes. Most notable is Quality Index for density will be based on field voids and maximum specific gravity (G_{mm}) rather than field density versus laboratory density. Another change is implementation of incentives/disincentives for laboratory voids. In addition, the Department will run ignition oven samples for gradation and compare to the Contractor's cold feed gradation sample.

The Office Construction asked if there would be price adjustments if gradations are out of the limits. The Office of Materials explained that there aren't price adjustments associated with gradations. There will continue to be price adjustments for smoothness and film thickness. Price adjustments will be implemented for laboratory voids and field voids. Other price adjustments are being eliminated since film thickness and voids are considered the most important criteria. The tolerances given for cold gradations are intended for quality control only.

The Office of Construction asked if the second paragraph of Article DS-01XXX.01 regarding Small HMA Paving Quantities is necessary since the DS is intended to be applied to bid items in excess of 1000 tons. The Office of Materials pointed out that it is possible there may be a HMA bid item, for example base course, that is less than 1000 tons even though the intermediate and surface courses are each in excess of 1000 tons. The Committee decided the paragraph should stay in.

The Office of Design pointed out the first sentence of the fourth paragraph of Article DS-01XXX.01 does not make it clear the Developmental Specification is to apply to HMA items in excess of 1000 tons, not to contracts with items in excess of 1000 tons. The Office of Contracts also pointed out this same sentence implies there is another specification for Quality Management- Asphalt (QMA) that should apply. The Office of Materials explained that QMA is actually part of the DS, so the language regarding QMA should be eliminated from the sentence. The Committee agreed the first sentence of the fourth paragraph should be reworded, "This specification shall apply to HMA bid items greater than 1000 tons."

The Office of Contracts pointed out it is not clear if the third paragraph of Article DS-01XXX.01 applies only to projects with less than 1000 tons or if it applies regardless of the number of tons. The Committee agreed the third paragraph should be moved above the second paragraph.

The Office of Construction questioned the use of the word "defective" in the seventh paragraph of Article DS-01XXX.04, C, 1. They felt the use of the word "defective" implies the work is to be removed and replaced. They asked if this is the intent. The Office of Materials commented that decision would be made by the Engineer. The Office of Construction suggested using the word "deficient," which would allow the work to remain in place if the Engineer chooses. District 4 Materials suggested "deficient or unacceptable". The Specifications Section reviewed the definition of Defective Work in Article 1101.03. Unacceptable Work (Defective Work) is defined as: "Work not in reasonably close conformance with the contract requirements and ordered to be removed and replaced." Since it is the intent that the Engineer may decide whether or not the work is to be removed and replaced, the Specifications Section agrees with using "deficient or unacceptable".

District 6 Construction noted that the English and metric tables for source and plant inspection are different. They asked if they should be the same. The Office of Materials noted the metric table is correct. The English table should be changed to match the metric table.					
Specification Section Recommended Text: See attached Draft DS.					
Comments: Who will be the Controller?					
Member's Requested Change: **(Do not use 'Track Changes', or 'Mark-Up'. Use ~~Strikeout~~ and Highlight.)** See Attachment					
Reason for Revision: Modification to 2303, IM 511 and IM 204 Appendix F to support implementation of QMA-2 revisions for use on selected Iowa DOT pilot projects during the 2009 construction season.					
County or City Input Needed (X one)			**Yes**	**No** X	
Comments: Local Agencies are represented on Task Group					
Industry Input Needed (X one)			**Yes**	**No** X	
Industry Notified:	**Yes** X	**No**	**Industry Concurrence:**	**Yes** X	**No**
Comments: Approved by Task Group Subcommittee to the QMA Steering Committee					

DRAFT DS-01XXX
(New)

Iowa Department of Transportation

DEVELOPMENTAL SPECIFICATIONS
FOR
HOT MIX ASPHALT MIXTURES

Effective Date
November 18, 2008

THE STANDARD SPECIFICATIONS, SERIES 2001, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE DEVELOPMENTAL SPECIFICATIONS AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

Replace all of Section 2303 of the Standard Specifications with the following:

01XXX.01 DESCRIPTION.
This work shall consist of mixture design, production, placement, and compaction of HMA using proper quality control practices for the construction of surface, intermediate, or base course on a prepared subbase, base, or pavement, to the proper dimensions specified in the contract documents.

The Contractor shall be responsible for all aspects of the project, provide quality control management and testing, and maintain the quality characteristics specified.

Supplemental Specifications for Quality Control Program for Small HMA Paving Quantities shall apply for HMA bid items with 1000 tons (1000 Mg) or less.

~~The Contractor shall be responsible for all aspects of the project, provide quality control management and testing, and maintain the quality characteristics specified.~~

~~Quality Management - Asphalt (QM-A)~~ This specification shall apply to ~~contracts with~~ HMA bid items greater than 1000 tons (1000 Mg) ~~quantities of 5000 (5000 Mg) or greater and all Interstate contracts~~. The Contractor shall follow the procedures and meet the criteria established in Article DS-01XXX.02, Section 2521 of the Standard Specifications, ~~and~~ Materials I.M. 510, and ~~511~~ Appendix A of this specification.

~~For contracts with less than 5000 tons (5000 Mg) quality control will be the responsibility of the Engineer. The Contractor shall be responsible for the mix design. This does not change the mix requirements from gyratory to Marshall, unless specified in the contract documents.~~

01XXX.02 MATERIALS AND EQUIPMENT.
Materials used in these mixtures shall meet the following requirements:

A. Asphalt Binder.
The Performance Graded asphalt binder, PG XX -XX, will be specified in the contract documents to meet the climate, traffic, and pavement conditions. The asphalt binder shall meet the requirements of Section 4137 of the Standard Specifications.

B. Aggregates.

1. Individual Aggregates.
Virgin mineral aggregate shall meet the following requirements:

VIRGIN MINERAL AGGREGATES

Mixture	Aggregate Type	Aggregate Requirements
Base	Type B	Section 4127 of the Standard Specifications
Intermediate and Surface	Type B	Section 4127 of the Standard Specifications
Intermediate and Surface	Type A	Section 4127 of the Standard Specifications

When frictional classification of the coarse aggregate is required, the contract documents will specify the friction level and location. The friction aggregate shall be furnished from sources identified in Materials I.M. T203.

For friction classification L-2, at least 80% of the combined aggregate retained on the No. 4 (4.75 mm) sieve shall be Type 4 or better friction aggregate; and at least 25% of the combined aggregate retained on the No. 4 (4.75 mm) sieve shall be Type 2 or better friction aggregate.

For friction classification L-3, at least 80% of the combined aggregate retained on the No. 4 (4.75 mm) sieve shall be Type 4 or better friction aggregate; and at least 45% of the combined aggregate retained on the No. 4 (4.75 mm) sieve shall be Type 3 or better friction aggregate. If Type 2 is used in place of Type 3, the minimum shall be 30% of the combined aggregate retained on the No. 4 (4.75 mm) sieve.

For friction classification L-4, at least 50% of the combined aggregate retained on the No. 4 (4.75 mm) sieve shall be Type 4 or better friction aggregate.

2. Blended Aggregates.
The blended aggregates shall meet the combined aggregate requirements in Materials I.M. 510.

When mixtures include RAP, the blended mineral aggregate gradation shall be a mixture of extracted RAP aggregate combined with virgin aggregate.

C. Recycled Asphalt Pavement.

1. Designated RAP.
When RAP is taken from a project, or is furnished by the Contracting Authority, the contract documents will indicate quantity of RAP expected to be available. The Contractor is responsible for salvaging this material unless otherwise specified in the contract documents. The RAP not used shall be incorporated into other parts of the project or placed in active stockpiles as directed in the contract documents.

The Contracting Authority will test samples of this material. For mix design purposes, the amount of asphalt binder in the RAP will be based on extraction tests. The Contractor shall designate the exact proportions of RAP material in the hot mix within the allowable range.

When the work is completed, the Contractor shall return unused material to the stockpile or other designated location, rebuild the stockpile, and restore the area, in accordance with Article 1104.08 of the Standard Specifications.

Test information, if known, will be included in the contract documents.

2. Certified RAP
The RAP shall be from a known source and of the proper quality for the intended use, with no material added from other sources during the time in stockpile. The Contractor shall certify to this

before use. RAP from not more than two known sources at a time will be allowed.

Certified RAP may be used in the base and intermediate course of mixes for which the RAP aggregate qualifies. RAP may also be used in surface courses when authorized by the Engineer. Not more than 30% of the asphalt binder in a final surface course mixture shall come from the RAP.

A certified RAP stockpile shall be sealed or protected in accordance with Materials I.M. 505.

3. Unclassified RAP.
Up to 10% of unclassified RAP may be incorporated into intermediate mixes for under 3,000,000 ESALs and all base mixes with the following safeguards:

a. Unclassified RAP shall not be used in surface courses.

b. Unclassified RAP shall not be used in intermediate or base mixtures containing designated or certified RAP.

c. The Engineer will inspect the unclassified RAP stockpile visually for uniformity. Unclassified RAP stockpiles containing concrete chunks, grass, dirt, wood, metal, coal tar, or other foreign or environmentally restricted materials shall not be used, unless approved by the Engineer. If foreign material is discovered in any unclassified stockpile, the Engineer may stop the continued use of the pile.

d. Representative samples will be taken by the Engineer. These samples are to be tested for gradation and asphalt content.

e. No credit will be given for crushed particles.

f. Stockpiles, when used, shall be worked in such a manner that the materials removed are representative of a cross section of the pile as approved by the Engineer.

D. Hot Mix Asphalt Mixture.
The surface course is the upper lift for a wearing surface of a designated thickness. The intermediate course is the next lower lift or lifts of a designated thickness. Leveling, strengthening, and wedge courses shall be of the intermediate course mixture. The base course is the lift or lifts placed on a prepared subgrade or subbase.

The job mix formula (JMF) is the percentage of each material, including the asphalt binder, to be used in the HMA mixture. The JMF gradation shall be within the control points specified for the particular mixture designated and shall establish a single percentage of aggregate passing each required sieve size.

If the asphalt binder demand for the combination of aggregates submitted for an acceptable mix design exceeds the basic asphalt binder content by more than 0.75%, the mix design will include an economic evaluation prepared by the Contractor. This evaluation will be based on past job mix history, possible aggregate proportion changes, and aggregate availability and haul costs for any changes or substitutions considered.

The basic asphalt binder content is the historical, nominal mixture asphalt binder content, expressed as percent by weight (mass) of the asphalt binder in the total mixture. The following values, based on mixture size and type, shall apply.

		BASIC ASPHALT BINDER CONTENT (%)			
Size	Aggregate Type	1 inch (25 mm)	3/4 inch (19 mm)	1/2 inch (12.5 mm)	3/8 inch (9.5 mm)

Intermediate and Surface	Type A	4.75	5.50	6.00	6.00
Intermediate and Surface	Type B	5.25	5.75	6.00	6.25
Base	Type B	5.25	6.00	6.00	6.25

The HMA mixture designed shall meet gyratory design and mixture criteria corresponding to the design level specified in the contract documents. The Engineer may approve the substitution of any mixture which meets requirements for a higher mixture than specified in the contract documents at no additional cost to the Contracting Authority. Shoulders placed as a separate operation shall be HMA 1,000,000 ESAL base mixture. For outside shoulders on Interstate projects, the Contractor has the option to substitute the mainline intermediate or surface mixture for a specified base mixture at the Contractor's expense.

The Contractor shall prepare gyratory HMA mixture designs for all base, intermediate, and surface mixtures. The gyratory design procedure used shall follow the procedure outlined in Materials I.M. 510. The gyratory mixture designs submitted shall comply with Materials I.M. 510.

The gyratory compactor used for design and field control shall meet the AASHTO protocol for Superpave gyratory compactors. Compactors for which compliance with this protocol is pending may be used at the discretion of the District Materials Engineer.

E. Other Materials.

1. Tack Coat.
Tack coat may be SS-1, SS-1H, CSS-1, or CSS-1H. Mixing of CSS and SS grades will not be permitted. RC-70 and MC-70 may also be used after October 1, at the Contractor's option.

2. Anti-strip Agent.

On Primary highways designed for over 10,000,000 ESALs and all Interstate highways, if 25% or more of the plus No. 4 (4.75 mm) (virgin and RAP) aggregate is gravel, quartzite, granite, trap rock, steel slag, or other siliceous aggregate (not a limestone or dolomite), anti-strip agent will be required in the affected mixture unless the minimum requirements for moisture sensitivity are met.

On all other Primary highways, if 25% or more of the plus No. 4 (4.75 mm) (virgin and RAP) aggregates or more than 40% of the total (virgin and RAP) aggregates is quartzite, granite, or other siliceous aggregates (not limestone or dolomite) which is obtained by crushing from ledge rock, anti-strip agent will be required in the affected mixtures requiring Type A aggregate unless the minimum requirements for moisture sensitivity are met.

Anti-strip agent will not be required for base repair, patching, or temporary pavement.

When anti-strip agent is required based on aggregate source, the Contractor may arrange for moisture sensitivity evaluation of the proposed HMA mixture design according to AASHTO T 283, "Resistance of Compacted Bituminous Mixture to Moisture-Induced Damage." When results of this evaluation on mixtures without anti-strip agent indicate the minimum requirements for moisture sensitivity of 80% tensile strength ratio (TSR) with visual confirmation are met, anti-strip agent will not be required. Confirmation of AASHTO T 283 test results will be completed by the Central Materials Laboratory during the initial production and placement of the mix. The Contactor will be subject to the provisions of Section 1105 of the Standard Specifications for mixture placed without anti-strip agent prior to completion of the AASHTO T 283 confirmation testing.

When a liquid anti-strip additive or aggregate treatment is used, confirmation of the AASHTO T 283 test results will be completed by the Central Materials Laboratory during the initial production and placement of the mix. The Contractor will be subject to the provisions of Section 1105 of the

Standard Specifications for mixture placed with liquid anti-strip additive or aggregate treatment prior to completion of the AASHTO T 283 confirmation testing.

One of the following anti-strip agents shall be used.

a. Hydrated Lime.
Hydrated lime shall meet the requirements of AASHTO M 303, Type I. Section 4193 of the Standard Specifications shall not apply. Hydrated lime will not be considered part of the aggregate when determining the job mix formula and the filler/bitumen ratio.

b. Liquid Anti-strip Additives.
Liquid anti-strip additives blended into the asphalt binder shall be approved for each JMF. The approval will be based on the following conditions:

1) Asphalt binder supplier shall provide test results that the additive does not negatively impact the asphalt binder properties, including short term and long term aged properties.

2) The AASHTO T 283 test is required and must satisfy 80% TSR when compared to the dry strength of specimens prepared with asphalt binder not containing the anti-strip additive. The design shall establish the optimum additive rate.

3) A change in the source of asphalt binder or aggregates will require a re-evaluation of the AASHTO T 283 test. When there is a significant change in the aggregate proportions, the Engineer may require a re-evaluation of the AASHTO T 283 test.

c. Polymer-based Liquid Aggregate Treatments.
Polymer-based liquid aggregate treatments shall be approved for each JMF. The approval will be based on the following conditions:

1) The AASHTO T 283 test is required and shall satisfy 80% TSR when compared to the dry strength of specimens prepared with and without the aggregate treatment. The design shall establish the optimum additive rate.

2) A change in the source of asphalt binder or aggregates will require a re-evaluation of the AASHTO T 283 test.

3. Sand for Tack Coats.
Sand shall meet requirements of Section 4109 of the Standard Specifications, Gradation No. 1.

4. Fabric Reinforcement.
Fabric reinforcement shall meet requirements of Article 4196.01, D, of the Standard Specifications.

F. Equipment
The Contractor shall provide sufficient equipment of the various types required to produce, place, and compact each layer of HMA mixture as specified.

Equipment shall meet requirements of Section 2001 of the Standard Specifications with the following modifications:

1. Plant Calibration.
Each plant scale and metering system shall be calibrated before work on a contract begins. Calibration equipment shall meet the manufacturer's guidelines and Materials I.M. 508. The Engineer may waive calibration of permanent plant scales when a satisfactory operational history is available. The Engineer may require any scale or metering system to be recalibrated if operations indicate it is necessary. Calibration data shall be available at the plant.

Each aggregate feed shall be calibrated throughout an operating range wide enough to cover the proportion of that material required in the JMF. A new calibration shall be made each time there is a change in size or source of any aggregate being used.

For continuous and drum mixing plants, the asphalt binder metering pump shall be calibrated at the operating temperature and with the outlet under pressure equal to that occurring in normal operations.

2. Paver.
Article 2001.19 of the Standard Specifications shall apply. Spreaders, as described in Article 2001.13, D, of the Standard Specifications may be used to place paved shoulders. Spreaders used to place the final lift of paved shoulders shall meet additional requirements of Article 2001.19 of the Standard Specifications.

3. Rollers.
For initial and intermediate rolling, self-propelled, steel tired, pneumatic tired, or vibratory rollers meeting requirements of Article 2001.05, B, C, or F, of the Standard Specifications shall be used. Their weight (mass) or tire pressure may be adjusted when justified by conditions.

For finish rolling, self propelled, steel tired rollers or vibratory rollers in the static mode meeting requirements of Article 2001.05, B, or F, of the Standard Specifications shall be used.

4. Scales.
Article 2001.07, B, of the Standard Specifications shall apply to all paving operations regardless of the method of measurement.

01XXX.03 CONSTRUCTION.

A. Maintenance of the Subgrade and Subbase.
The Contractor is responsible for the maintenance of the completed subgrade and subbase to the required density, true cross section, and smooth condition, prior to and during subsequent construction activities. If rutting or any other damage occurs to the subgrade or subbase as a result of hauling operations, the Contractor shall immediately repair the subgrade and subbase, and such repair will include, if necessary, removal and replacement at the Contractor's expense.

Should traffic by others authorized to do work on the project be specifically permitted by the Engineer to use loads which exceed the Contractor's established limit, the Contracting Authority will pay repair costs for repairs directed by the Engineer.

B. Preparation of Existing Surfaces.

1. Cleaning.
The existing surface shall be cleaned and prepared in accordance with Article 2212.04, A, of the Standard Specifications.

2. Tack Coats.
Tack coats shall be applied when the entire surface area on which the coat is to be applied is free of moisture. They shall not be applied when the temperature on the surface being covered is less than 25°F (-4°C).

The Contractor shall place a tack coat to form a continuous, uniform film on the area to be covered. Unless otherwise directed, the tack coat shall be spread at an undiluted rate of 0.02 to 0.05 gallon per square yard (0.1 to 0.2 L/m^2). The tack coat emulsion may be diluted with water to improve application.

Tack coat shall be adequately cured prior to placement of the HMA to assure bond to the underlying surface and avoid damage of the HMA being placed. If the tack coat surface becomes dirty from weather or traffic, the surface shall be thoroughly cleaned and, if necessary, retacked. A light application of sand cover may also be required, but this is anticipated only for excessive application rates, breakdowns, and short sections remaining at the end of a day's run.

On highways being constructed under traffic, safety and convenience to the public without soiling their vehicles shall be a controlling factor. Tack coat applications shall be limited in length, to minimize inconvenience to the public. They shall be kept within the hot mixture placing work area that is controlled by flaggers at each end, and shall be planned so that they will be covered with hot mixture when the work area is opened to traffic at the end of the day's work.

The vertical face of exposed, longitudinal joints shall be tacked as a separate operation, before the adjoining lift is placed, at a rate from 0.10 to 0.15 gallon per square yard (0.5 to 0.7 L/m^2). The vertical surfaces of all fixtures, curbs, bridges, or cold mixture with which the hot mixture will come in contact shall be lightly painted or sprayed to facilitate a tight joint with the fresh mixture.

3. Fabric Reinforcement.
When fabric reinforcement is required, the locations will be designated in the contract documents. Fabric shall not be placed on a wet or damp surface or when the road surface is less than 50°F (10°C). Fiberglass fabric shall be applied only with an adhesive recommended by the manufacturer. Fabrics with an adhesive backing shall be placed in accordance with the manufacturer's recommendations.

Other fabrics shall be placed with a heavy coat of the asphalt binder grade used in the HMA applied at a rate of 0.20 to 0.25 gallons per square yard (0.9 to 1.1 L/m^2) and at a temperature between 295°F and 315°F (145°C and 160°C).

The fabric reinforcement shall be placed in accordance with the contract documents (full width or individual crack or joint treatment). The fabric shall be placed immediately following the adhesive or asphalt binder placement under the fabric. Placement may be by hand or by a mechanical method specifically designed for this purpose. Precautions shall be taken to avoid wrinkles in the fabric and to insure that air bubbles are removed without breaking the fabric. Wrinkles or folds which cannot be removed by brushing shall be cut and lapped to provide a smooth surface.

Additional adhesive or asphalt binder may be required to produce a tight, bonded surface. When applied full lane width, the minimum transverse and longitudinal lap shall be 12 inches (300 mm).

The Contractor shall avoid application of the tack coat over longitudinally placed fabric. Traffic shall not be allowed over the fabric during placement and during curing of the adhesive material to avoid damage to the fabric. A light application of HMA mix material may be hand sprinkled on the fabric to prevent damage from necessary equipment traffic.

Fabric that is damaged or soiled prior to HMA overlay shall be repaired at no additional cost, when directed by the Engineer. Sanding, at no additional cost, may also be required by the Engineer during this period.

C. Handling, Production, and Delivery.

1. Hot Mix Asphalt Plant Operation.
The plant operation shall comply with the following requirements:

a. Handling Mineral Aggregate and RAP.
The various aggregate products used shall be kept separate, and adequate provisions shall be made to prevent intermingling. Stockpiling and processing shall be handled in a manner that will ensure uniform incorporation of the aggregate into the mix.

The various aggregates shall be separately fed by feeders to the cold elevator in their proper proportions and at a rate to permit correct and uniform temperature control of heating and drying operations.

b. Handling Asphalt Binder.
The asphalt binder shall be brought to a temperature of 260°F to 330°F (125°C to 165°C) before being measured for mixing with the aggregates. The temperature between these limits may be further regulated according to the characteristics of the mixture, method of proportioning, and viscosity of the asphalt binder. Modified asphalt binder ~~should~~ shall be heated according to the supplier's recommendations.

c. Handling Anti-strip Agents.

1) Hydrated Lime.
The lime shall be accurately proportioned by a method acceptable to the Engineer.

a) Added to a Drum Mixer.
The hydrated lime shall be added at the rate of 0.75% by weight (mass) of the total aggregate (virgin and RAP) for Interstate and Primary projects. The hydrated lime shall be added to a drum mixer by one of the following methods:

(1) Added to the virgin aggregate on the primary feed belt, as a lime water slurry.

(2) Thoroughly mixed with the total combined aggregate if the aggregate contains at least 3% total moisture.

(3) Added to the Type 2 or Type 3 virgin aggregate in a moist condition, and then mixed with the total combined virgin aggregate.

Alternative methods for mixing must be reviewed and approved by the Engineer. Hydrated lime shall not be introduced directly into a drum mixer by blowing or auguring.

b) Added to a Batch Plant.
Hydrated lime shall be added at the rate of 0.5% by weight (mass) of total aggregate (virgin and RAP) for Interstate and Primary projects. It shall be introduced to a batch plant by one of the following methods:

(1) Placed on the recycle belt which leads directly into the weigh hopper.

(2) Added directly into the pugmill.

(3) Added directly into the hot aggregate elevator into the hot aggregate stream. In any case, the lime must be introduced prior to the start of the dry mix cycle.

c) Added to the Aggregate Stockpile.
Hydrated lime shall be added at a rate established by the AASHTO T 283 test. The hydrated lime shall be added to the source aggregates defined in Article DS-01XXX.02, E, 2, thoroughly mixed with sufficient moisture to achieve aggregate coating, and then placed in the stockpile.

When either method b or c above for a batch plant is used, the hydrated lime will be considered part of the JMF.

2) Liquid.

When liquid anti-strip additives are used, the equipment used to store, measure, and blend the additive with the asphalt binder shall comply with the anti-strip supplier's recommended practice. The additive may be injected into the asphalt binder by the asphalt supplier or the Contractor. If the Contractor elects to add the liquid anti-strip additive, the Contractor assumes the material certification responsibilities of the asphalt binder supplier. The shipping ticket shall report the type and amount of additive and the time of injection. The asphalt supplier shall provide the Contractor and Engineer with the shelf life criteria defining when the anti-strip additive maintains its effectiveness. Binder that has exceeded the shelf life criteria shall not be used.

When polymer-based liquid aggregate treatment is used, the Contractor shall comply with the manufacturer's current recommended specifications and guidelines.

d. Production of Hot Mix Asphalt Mixtures.

The exact proportions of the various materials shall be regulated within the limits specified so as to produce a satisfactory bituminous coating and mixture. The aggregates shall first be mixed dry, then the asphalt binder shall be added. In batch plants, the asphalt binder shall be added in an evenly spread sheet over the full length of the mixer box. In continuous plants, the asphalt binder shall be sprayed evenly into the aggregate by a positive pressure spray within the first 30% of the length of the mixer box. In drum mixing plants, the asphalt binder shall be sprayed evenly into the aggregate by a positive pressure spray. Coating aids may be added, subject to approval of the Engineer.

The mixer shall be operated so that the mixture is of consistently uniform temperature and, as discharged from the mixer, will not vary more than 20°F (11°C). The temperature of the mixtures shall not exceed 330°F (165°C) unless approved by the Engineer.

The rate of production shall not exceed the manufacturer's rated capacity of the mixer and shall provide uniform coating. Dry mixing time for batch mixers shall be not less than 5 seconds. Wet mixing time for batch mixers shall be not less than 25 seconds. For continuous mixers, the mixing time shall be at least 30 seconds.

All handling and manipulation of the hot mixture from the mixer to the final spread on the road shall be controlled so that a uniform composition is maintained and segregation of coarser particles is minimized. The segregation shall be minimized to the extent that it cannot be visibly observed in the compacted surface. The Contractor shall only apply approved release agents to trucks and equipment as specified in Article 2001.01 of the Standard Specifications.

The mixture temperature shall be sufficient to allow for the specified compaction and density to be attained. HMA shall not be discharged into the paver hopper when its temperature is less than 245°F (120°C) for a nominal layer thickness of 1 1/2 inches (40 mm) or less and 225°F (110°C) for a nominal layer thickness of more than 1 1/2 inches (40 mm). Except for an unavoidable delay or breakdown, delivery of hot HMA to any individual spreading unit shall be continuous and uniform and at a rate sufficient to provide as continuous an operation of the spreading unit as practical. The paver hopper shall, at all times, be kept sufficiently full to prevent non-uniform flow of the mixture to the screed.

D. Placement.

The surface of each layer shall be cleaned in accordance with Article 2212.04, A, of the Standard Specifications and, if necessary, retacked to provide bond with the succeeding course. If bumps or other significant irregularities appear or are evident in the intermediate course or other lower course, they are to be corrected before the final lift is placed.

HMA mixtures shall not be placed on a wet or damp surface and shall not be placed when the temperature of the road surface is less than shown in the table below. The Engineer may further limit placement if, in the Engineer's judgment, other conditions are detrimental to quality work. HMA

mixtures shall not be placed after November 15, except with approval of the Engineer.

ALL BASE AND INTERMEDIATE COURSE LIFTS OF HMA MIXTURES

Nominal Thickness - inches (mm)	Road Surface Temperature, °F (°C)
1 1/2 (40)	40 (4)
2 - 3 (~~60~~ 50-80)	35 (2)
Over 3 (Over 80)	25 (-4)

ALL SURFACE COURSE LIFTS OF HMA MIXTURES

Nominal Thickness - inches (mm)	Road Surface Temperature, °F (°C)
1 (30)	50 (10)
1 1/2 (40)	45 (7)
2 and greater (50 and greater)	40 (4)

When placing the mixture, the forward speed of the finishing machine shall be at a rate to provide a continuous uniform operation with the least amount of stopping.

A wire or string line shall be used to guide the finishing machine and to maintain alignment. Edge alignment irregularities shall be corrected by hand methods immediately after they occur.

The contract documents will show the total thickness to be placed. Spreading of the mixture shall be at such a rate that, when compacted, the layer(s) will be substantially of the thickness and dimensions required to produce the required thickness. The minimum layer thickness shall be based on the following:

Design Mix Size - inches (mm)	Minimum Lift Thickness - inches (mm)
3/8 (9.5)	1 (25)
1/2 (12.5)	1 1/2 (40)
3/4 (19)	2 (50)
1 (25)	3 (75)

The compacted thickness of the top layer shall not be greater than 3 inches (75 mm). This restriction shall not apply to HMA shoulders. The maximum compacted thickness of lower layers may exceed 4 inches (100 mm) if it is demonstrated that the thicker layers have satisfactory density. The riding characteristics of the thicker layers shall be within reasonably close conformance to that expected from a 3 inch (75 mm) layer. Each layer shall be completed to full width before succeeding layers are placed.

While operating on the road surface, use of kerosene, distillate, other petroleum fractions, or other solvents, for cleaning hand tools or for spraying the paver hopper will not be permitted. Containers of cleaning solution shall not be carried on or near the paver. When a solvent is used, the paver shall not be used for at least 5 hours after this cleaning. The Contractor shall be responsible for collecting and removing all cleaning materials and cleaning residue from the project and plant site. The cleaning material and residue shall become the property of the Contractor.

Whenever practicable, all mixtures shall be spread by a finishing machine. Irregular areas may be spread by hand methods. The hot mixture shall be spread uniformly to the desired depth with hot shovels and rakes. Loads shall not be dumped faster than they can be spread properly. Workers shall not stand on the loose mixture while spreading. After spreading, the hot mixture shall be carefully smoothed to remove all segregated coarse aggregate and rake marks. Rakes and lutes used for hand spreading and smoothing shall be of the type designed for use on HMA mixtures.

Unless stated elsewhere in the contract documents when placing two adjacent lanes, not more than 1 day of normal plant production shall be paved in a lane before the adjacent lane(s) is paved. The adjacent lane shall be placed to match the first lane during the next day of plant production. The Contractor shall not spread more mixture than can be compacted in the specified working hours of the same working day. At the close of each working day, the roadbed shall be free of any construction equipment.

Prior to opening a lane to traffic, fillets or full width granular shoulders shall be placed in accordance with Article 2121.07, B, of the Standard Specifications. The material shall be placed adjacent to and equal in thickness to the resurfacing. Fillet removal shall be incidental to the HMA mixture.

E. Compaction.
Each layer shall be promptly and thoroughly compacted. Mechanical tampers shall be used for areas inaccessible to the rollers.

The overall rolling procedure and compactive effort shall produce a surface free of ridges, marks, or bumps and shall be subject to approval of the Engineer.

There are two classes of compaction, Class I and Class II. Class I compaction is intended for use on Interstate highways, and most Primary and Secondary highways. Class II compaction is intended for paved shoulders, temporary crossovers, onsite detours, and for other situations where Class I is not specified.

For Class I compaction, the roadway field voids ~~density (percent of laboratory density)~~ will be based on the theoretical maximum specific gravity (G_{mm}) ~~density~~ obtained from the Quality Control Program for that day's mixture.

1. Class I Compaction.
Class I Compaction shall be used for base, intermediate, and surface courses for traffic lanes, ramps, and loops.

~~**a. Class IA Compaction.**~~
~~Class IA compaction shall be used for intermediate and surface courses for the traffic lanes of Interstate highways, including Interstate-to-Interstate ramps, and Primary highways as specified. Compaction shall be a minimum of 96% of laboratory density. The average air void level of the roadway density specimens shall not exceed 8.0%.~~

~~**b. Class IB Compaction.**~~
~~Class IB compaction shall be used for all Interstate and Primary bases. Class IB will also be required on Primary travel lanes intermediate and surface courses, and ramps connecting to Interstate and Primary highways when Class IA compaction is not specified. Compaction shall be to a minimum of 95% of laboratory density. The average air void level of the roadway density specimens shall not exceed 8.0%.~~

~~**c. Class IC Compaction.**~~
~~Class IC compaction shall be used for HMA base widening, shoulder resurfacing when specified, traffic lanes of Secondary highways and any other traffic lanes when Class IA and IB are not specified. Compaction shall be a minimum of 94% of laboratory density. The average air void level of the roadway density specimens shall not exceed 8.0%.~~

~~d~~2. Test Strip Construction for Class I~~A and IB~~ Compaction.
A test strip will be required at the start of intermediate course placement on Interstate highways, including Interstate-to-Interstate ramps. Test strips will be required prior to the start of the surface course placement on Interstate and Primary highways and ramps connecting to Interstate and Primary highways. The Contractor may elect to construct a test strip at the start of other HMA mixture bid items. These test strips shall be established at the preconstruction conference.

~~For Class IA compaction at the start of intermediate course placement and for Class IA and Class IB compaction prior to the start of surface course placement, t~~The Contractor shall construct a test strip for the purpose of evaluating properties of the HMA mixtures and for identifying an effective rolling pattern. ~~For multiple lifts using the same mix requiring Class IA compaction, when the thickness of the second lift varies from the first lift by 1 1/2 inches (40~~

~~mm) or more, a test strip for the second lift shall be performed.~~ When the contract documents specify both intermediate and surface courses, a surface course test strip shall be placed in lieu of intermediate mix in a section of intermediate course prior to actual surface course placement. The test strip shall be applied to each mixture with more than a single days placement ~~with a plan quantity of at least 3000 tons (3000 Mg)~~.

The quantity of HMA mixture subject to the test strip shall be limited to a half day's estimated production. This quantity shall be pre-established with the engineer. ~~The quantity of HMA mixture subject to Class IA compaction, produced and placed for test strip production, will be limited to 750 tons (750 Mg) for lift thicknesses of 2 inches (50 mm) or less, and 1000 tons (1000 Mg) for lift thicknesses greater than 2 inches (50 mm). After test strip placement, further mixing and laydown operations will be suspended until the laboratory test results of the plant produced mixture and core densities are available.~~

Only one test strip will be allowed for each mixture. At the direction of the Engineer, additional test strips may be required if a complying HMA mixture or rolling pattern was not established.

Procedures and documentation to be followed during construction of the test strip shall allow the Engineer and the Contractor to confirm mixture design properties and effectiveness of compaction procedures.

The test strip production control shall meet the requirements of Article DS-01XXX.04, B, 2. ~~The number of density core samples obtained for the test strip will be increased by one and the low core result will not be used in the Quality Index (Q.I.) density formula for payment for the test strip quantity.~~ The test strip will be an independent lot. The determination of sublots for testing shall meet the requirements of Article DS-01XXX.04, B, 1.

~~23~~. Class II Compaction.
For all rollers, the initial contact with the hot mixture shall be made by the power driven wheels or roll.

The initial rolling shall be done at a temperature so the mixture will compact without excessive distortion. Except on longitudinal joints and super-elevated curves, rolling with the initial roller shall begin at the outer edges of the pavement, and each successive pass shall progress inward toward the center line. Each reverse trip shall lap all but 4 to 6 inches (100 to 150 mm) of the previous track. When reversing direction, the initial roller shall stop at an angle with the longitudinal direction.

Following the initial rolling, the layer shall be given an intermediate rolling with a pneumatic tired roller before the temperature falls below 225°F (110°C). The intermediate roller shall cover the entire area not less than six times. A finish, steel tired roller shall be used to smooth out all marks and roughness in the surface.

Mechanical tampers or other approved compaction methods shall be used for areas inaccessible to the rollers.

F. Joints and Runouts.
Longitudinal joints for courses on resurfacing projects shall be constructed directly above the longitudinal joint in the existing pavement. The offset distance between longitudinal joints in succeeding courses of full depth HMA paving shall be not more than 3 inches (75 mm). The spreading of hot mixtures along longitudinal joints shall be adjusted to secure complete joint closure and full compression of the mixture with a smooth surface and joint after compaction.

Transverse construction joints in succeeding courses shall be separated by not less than 6 feet (1.6 m). The use of wood or metal headers to form the edge of the joint during rolling of the fresh mixture will not be permitted. The header shall be sawed to a straight line at right angles to the center

line so that a full thickness vertical edge will be provided before continuing paving. The Contractor shall provide a 10 foot (3 m) straightedge for checking transverse construction joints for smoothness. Variations in the surface at transverse construction joints, as indicated by the straightedge, shall be corrected by hand methods before compaction.

When a transverse construction joint is open to traffic, a temporary runout of 10 feet (3 m) in length per 1 inch (25 mm) of lift thickness shall be installed. Suitable paper or burlap should be used under the taper to prevent adhesion. Sand, dirt, or wood shall not be used for this purpose.

When required to end paving for winter shutdown, runouts shall be located adjacent to each other. A winter shutdown runout of 25 feet (8 m) in length per 1 inch (25 mm) of lift thickness shall be installed.

For temporary runouts open to traffic for periods greater than 4 weeks and winter shutdown runouts, the Contractor may reduce the amount of top size aggregate in the transition taper. The temporary runouts and winter shutdown runouts shall be removed before commencement of paving. Runout removal shall be incidental to the HMA mixture.

G. Miscellaneous Operations.

1. Leveling and Strengthening Courses.
The contract documents will show the thickness of the courses to be placed. Strengthening and leveling courses will be placed as indicated in the contract documents. These courses shall be of the same mixture specified for the base or intermediate course.

When the width of any strengthening or leveling layer is 8 feet (2.4 m) or more, the layer shall be spread by a finishing machine.

Leveling courses shall be compacted using Class II compaction procedures, except all passes shall be made with a pneumatic roller.

2. Wedge Courses.
Wedge courses used to secure desired super-elevation of curves shall be constructed of the base or intermediate mixture, and when possible, shall be spread by a finishing machine. In placing wedge course, the maximum thickness of individual layers, when compacted, shall not exceed 3 inches (75 mm), and care shall be used to avoid crushing the coarse aggregate. Wedge courses shall be placed to the full width of pavement.

On curves which require the placement of wedge courses, the Contractor will be required to stage the shoulder construction on the super elevated curves. After completion of each day's wedge placement operations and prior to suspending construction activities for that day, a full width shoulder shall be constructed on the high side up to the elevation of the completed wedge course. All necessary staging of shoulder construction will be considered incidental to shoulder construction.

3. Fixtures in the Pavement Surface.
All utility accesses, intakes, or other fixtures encountered within the area to be covered by HMA shall be adjusted to conform to the final adjacent finished surface. Unless otherwise indicated in the plans, the Contractor shall have the option of adjusting fixtures between placement of the surface course and the layer preceding the surface course, or adjusting the fixture after placement of the surface course using a composite patch or PCC patch.

PCC and HMA patch material shall conform to the requirements of Section 2529 of the Standard Specifications. Patches shall be of sufficient size to accommodate the structure being adjusted.

Patches shall be square in shape and oriented diagonally to the direction of traffic flow. Elevation of the adjusted fixture and patch shall not be higher than or more than 1/4 inch (6 mm) below that

of the surrounding pavement surface.

4. Fillets for Intersecting Roads and Driveways.
When fillets are designated in the contract documents for driveways to homesteads and commercial establishments and at intersecting roads, the surface adjacent to the pavement being surfaced shall be shaped, cleaned of loose material, and tack coated. On this coated surface, the hot mixture shall be placed and compacted in layers equal to the adjacent layer and extended from the edge of pavement as shown in the plans. Fillets at intersecting roads shall be placed and compacted at the same time as the adjacent layer. Entrance fillets that are 8 feet (2.4 m) or wider may be placed as a separate operation. Paving of fillets 8 feet (2.4 m) or more in width shall be with a self propelled finishing machine described in Article 2001.19 of the Standard Specifications. The Engineer may approve other equipment for placement of fillets, based on a demonstration of satisfactory results.

5. Stop sign Rumble Strips.
If the plans include the bid item Rumble Strip Panel (In Full Depth Patch), Section 2529 of the Standard Specifications shall apply. To meet the requirements of placing Stop Sign Rumble Strips before opening roadway sections to traffic, the Contractor may construct temporary rumble strip panels meeting the final pattern and location of the Stop Sign Rumble Strip indicated in the plans.

6. Paved HMA Shoulders.
Compaction of paved HMA shoulders shall be accomplished using one of the following methods:

a. Class II compaction (Article DS-01XXX.03, E, 3),

b. Rolling pattern established during the first day of shoulder placement to achieve Class I~~C~~ compaction (Article DS-01XXX.03, E, 1), or

c. Same rolling pattern established for mainline lanes, as determined by density coring.

Shoulder area will not be included in calculations for the pay factor for field voids ~~density price adjustment~~ on mainline. Shoulder area may be subject to price adjustment for failure to adhere to the established roller pattern.

01XXX.04 QUALITY ASSURANCE PROGRAM.

A. Mix Design - Job Mix Formula.
The JMF for each mixture shall be the responsibility of the Contractor.

The Contractor shall submit completed JMF using the computer format of Form 956 to the materials laboratory designated by the Contracting Authority for approval. The Contractor shall submit supporting documentation demonstrating the design process was followed and how the recommended JMF was determined, including an economic evaluation when required. Documentation shall include trial and final proposed aggregate proportions (Form 955) and corresponding gyratory data. The Contractor shall also submit sufficient loose mixture and individual material samples for approval of the design.

The JMF shall be prepared by personnel who are Iowa DOT certified in bituminous mix design.

If the JMF is not satisfactory, the Contractor shall submit another JMF for review. An approved JMF will be required prior to beginning plant production. The Contractor will be charged $1000 for each JMF approval requested and performed which exceeds two per mix size, type, and proposal item on any individual project or group of tied projects.

B. Plant Production.

The Contractor shall perform the sampling and testing to provide the quality control of the mixture during plant production. Certified Plant Inspection as described in Section 2521 of the Standard Specifications will be required on all HMA plant production. All personnel performing production quality control testing shall be certified by the Department.

Easy and safe access shall be provided to the location in the plant where samples are to be taken.

A "significant mix change" is defined as a single occurrence of an aggregate interchange of greater than 5%, a single occurrence of an asphalt content change greater than 0.2%, or any deletion or introduction of a new material into the mix.

1. Sampling and Testing.

The Contractor shall submit a testing plan prior to the preconstruction meeting. The testing plan shall meet the requirements of Materials I.M. 511, Appendix D

Asphalt binder shall be sampled and tested to verify the quality of the binder grade. Asphalt binder samples shall be taken, at random times, as directed and witnessed by the Engineer in accordance with Materials I.M. 204.

Aggregate gradation control shall be based on cold feed gradation.

Aggregate quality control samples shall be taken, at random times, ~~as directed and witnessed by the Engineer~~ in accordance with Materials I.M. 204 ~~and secured in accordance with I.M. 511 to determine that materials are being proportioned in accordance with the specifications~~. A minimum of one aggregate gradation shall be taken for each day's production that exceeds 100 tons (Mg). The Contractor may elect to have a predetermined quality control plan that indicates a higher testing frequency. This testing plan shall be pre-approved by the Engineer. If there is more than one gradation in a day, the gradations shall be averaged for compliance measurements of the daily lot.

On the first day's production of each mix, the Contractor and Engineer shall split a cold feed sample. The Engineer will determine the need for a correction factor for the cold feed gradation based on the Engineer's cold feed gradation and ignition oven results. The Engineer may require additional cold feed split samples to evaluate the need or value of a correction factor for the cold feed gradation and ignition oven gradation.

Aggregate gradations transported by the Contractor for determining the ignition oven correction factor shall be secured in accordance with Appendix A of this specification.

The hot HMA mixture shall be sampled, at random locations, as directed and witnessed by the Engineer, in accordance with Materials I.M. 322 and secured in accordance with ~~Materials I.M. 511~~ Appendix A of this specification.

The Contractor shall provide the Engineer assistance with material sampling for verification testing. When the Engineer notifies the Contractor that a sample shall be taken, the Contractor shall initiate sampling within 15 minutes ~~obtain the sample within 15 minutes~~. The sampling should normally be completed within 30 minutes.

Each day's production of a mix design shall be considered a lot. The number of sublots will be determined by the days estimated tonnage for each mix placed as given in Table DS-01XXX.04-1.

Table DS-01XXX.04-1: Uncompacted Mixture Sublot Size

Estimated Tons (Mg)	Number of Sublots
101-500	1
501-1250	2
1251-2000	3

2001-4500	4
Over 4500	5

~~When the anticipated quantity for the day is 2000 tons (2000 Mg) or more, that day's production shall be divided into four sublots, the first sublot of each day shall be the first 500 tons (500 Mg) produced. The remaining anticipated quantity for the day shall be divided into three sublots of equal size.~~

~~When the anticipated mix design quantity for the day is less than 2000 tons (2000 Mg), the first daily sublot shall be the first 500 tons (500 Mg) produced. Additional daily sublots of 750 tons (750 Mg) each will be established for mix production exceeding the first 500 tons (500 Mg).~~

~~The maximum number of paired hot HMA mixture samples required for acceptance of a lot day's production will not exceed four.~~

Paired samples shall not be taken from the first 100 tons (100 Mg) of mix produced each day or the first 100 tons (100 Mg) of mix following a significant mix change.

The Contractor shall test the quality control sample of each production paired sample as follows:

Two gyratory specimens shall be prepared and compacted in accordance with Materials I.M. 325G and the results averaged to determine sample results.

Density shall be determined for each specimen in accordance with Materials I.M. 321.

The Contractor's field quality control laboratory compaction shall be used for field density control. The laboratory density for field control will be the bulk specific gravity of compacted mixture (G_{mb}) at N_{design}. Bulk specific gravity at N_{design} will be determined by compacting specimens to N_{max} and back calculating the bulk specific gravity at N_{design}.

The Theoretical Maximum Specific Gravity of the uncompacted mixture shall be determined in accordance with Materials I.M. 350 or other test methods recognized by AASHTO or ASTM.

The laboratory air voids shall be determined in accordance with Materials I.M. 501.

When liquid anti-strip additives are used, the Contractor shall satisfy one of the following methods to regulate the quantity of additive.

a. The Contractor shall present Certification that the equipment used to measure and blend the liquid anti-strip additive meets the anti-strip supplier's recommended practice, that the equipment is directly tied to the asphalt binder supply system, and that the equipment has been calibrated to the equipment manufacturer's guidelines.

b. The Contractor shall test the binder to measure the quantity of liquid anti-strip additive in the binder every 5000 tons (5000 Mg) of HMA production. The supplier's test method shall be approved by the Engineer prior to use of the test.

c. The Contractor shall run AASHTO T 283 during production. If the Contractor is unable to certify or test for the presence and quality, the Contractor shall run AASHTO T 283 each 10,000 tons (10,000 Mg) of production to measure the effectiveness of the additive. The test results shall satisfy 80% TSR when compared to the dry strength of specimens prepared with asphalt binder containing the anti-strip additive.

2. Production Control.
After the JMF is established, the combined aggregate furnished for the project, the quantity of asphalt binder and laboratory air voids should consistently conform to the JMF, as target values,

and shall be controlled within the production tolerances given in Table 2. Plant production must be controlled such that the plant produced HMA mixture will meet mixture design criteria for Air Voids and VMA at N_{design} gyrations of the gyratory compactor within the test tolerances given in the table. The slope of the gyratory compaction curve of plant produced material shall be monitored and variations in excess of ±0.40 of the mixture design gyratory compaction curve slope may indicate potential problems with uniformity of the mixture.

The gyratory mix design gradation control points for the size mixture designated in the project plans will not apply to plant production control.

Table DS-01XXX.04-2 - Production Tolerances

MEASURED CHARACTERISTIC	TARGET VALUE (%)	SPECIFICATION TOLERANCE (%)(1)
Cold feed gradation No. 4 (4.75 mm) and larger sieves	by JMF	± 7.0
Cold feed gradation No. 8 (2.36 mm)	by JMF	± 5.0
Cold feed gradation No. 30 (600 µm)	by JMF	± 4.0
Cold feed gradation No. 200 (75 µm)	by JMF	± 2.0 (2)
Daily asphalt binder content	by JMF	± 0.3
~~Field laboratory air voids~~	~~4.0 (3)~~	~~-0.5/+1.0 (4)~~
VMA ~~(5)~~(3)	by JMF	± 1.0 ~~(6)~~(4)

(1) - Based on single test unless otherwise noted.
(2) - The filler/bitumen ratio of the plant produced mixture will be maintained between 0.6 and 1.4.
~~(3) – Unless otherwise specified.~~
~~(4) – Based on the moving average of four test values.~~
~~(5)~~(3) - Restricted to an asphalt film thickness as specified for the level of HMA mixture.
~~(6)~~(4) - Based on the daily lot average.

The Contractor shall strive for the target value of the percent air void and asphalt binder by adjusting gradation and asphalt binder content.

The Contractor shall produce a mixture of uniform composition conforming to the JMF. If, during production, the Contractor determines from quality control testing that adjustments are necessary to the JMF to achieve the specified properties, adjustments to the JMF target gradation and asphalt binder content values may be made.

If the average daily gradation for a mixture bid item is outside the production tolerances, the Contractor shall notify the Engineer. The Contractor can request a gradation target change if other production tolerances and mixture requirements of Materials I.M. 510 Appendix A are acceptable. If the production tolerances and mixture requirements are not being met, a JMF change will be required.

If the filler/bitumen ratio exceeds the limits listed in Table DS-01XXX.04-2 the Contractor shall make a mixture change to the JMF at the start of the next day's production for that mixture.

Adjustments to the JMF aggregate proportions and asphalt binder content shall be made as a result of the interactive process between the Contractor and the Engineer. The Contractor's adjustment recommendations shall prevail, provided all specifications and established mix design criteria are being met for plant production.

The voids in the mineral aggregate (VMA) and estimated film thickness shall be measured for specification compliance every day of HMA production.

Quality control charts in accordance with ~~Materials I.M. 511~~ Appendix A of this specification shall be available and kept current showing both individual test results and moving average values. Moving averages shall be based on four consecutive test results. ~~Moving averages may only restart in the event of a mandatory plant shutdown for failure to maintain the average within the production tolerance.~~ Control charts shall include a target value and specification tolerances.

Laboratory voids for individual tests shall be calculated according to Materials I.M. 501, using the individual density and individual maximum specific gravity determined for each sample. The moving average of laboratory voids shall be the average of the last four individual laboratory voids.

The Contractor shall monitor the test results and to make mix adjustments, when appropriate, to keep the mixture near the target values. The Contractor shall notify the Engineer whenever the process approaches a specification tolerance limit. ~~One moving average point for laboratory air voids outside the specification tolerance limit shall be cause to cease operations. The Contractor shall assume the responsibility to cease operations, including not incorporating produced material which has not been placed. The process shall not be started again until the Contractor notifies the Engineer of the corrective action proposed.~~

C. Construction.

1. Field Voids ~~Density~~ for Class I Compaction.

Density samples to determine field voids shall be taken from the compacted mixture and tested not later than the next working day following placement and compaction.

A lot shall be considered as one layer of one mixture placed during a day's operation. The Engineer may approve classifying multiple layers of construction placed during a single day as a lot provided only one mixture was used.

The Engineer may waive sampling for density provided compaction has been thorough and effective in the following situations:

1. when the day's operation is not more than 2500 square yards (2500 m^2),

2. when the day's operation is not more than 500 tons (500 Mg),

3. when the mixture is being placed in irregular areas, or

4. when placing wedge or strengthening courses.

Eight ~~D~~density samples shall be taken and will be tested for each lot in accordance with Materials I.M. 204. The length laid in each lot will be divided into approximately equal sublots and one sample shall be obtained at a random location, as directed and witnessed by the Engineer in each sublot.

If a sample is damaged or measures less than 70% or more than 150% of the intended thickness, an alternate sampling location will be determined and used. Samples shall not be taken less than 1 foot (300 mm) from the edge of a given pass of the placing equipment, from run-outs, or from day's work joints or structures.

The percent within limit (PWL) will be determined as defined in Materials I.M. 501. The PWL shall be determined with an upper specification limit (USL) of 8.5% voids.

If the PWL falls below 50.0, the Engineer may declare the lot or parts of the lot deficient or unacceptable.

~~The quality index for density of each lot shall be determined by the following formula:~~

$$QIDensity = \frac{(Average\ Gmb)Field\ Lot - ((\%\ Density)Specified \times (Average\ G_{mb})\ Lab\ Lot)}{(Standard\ Deviation_{Gmb})\ Field\ Lot}$$

~~where QIDensity = Quality Index for density~~

~~G_{mb} = bulk Specific Gravity of the mixture~~

~~When the quality index falls below 0.00, the Engineer may declare the lot or parts of the lot defective.~~

If the PWL is less than 75.0, the lot of cores for field voids may be checked for outliers. An outlier shall be determined using the procedures described in Materials I.M. 501 with 2.0 standard deviations as the measure. Only one core may be considered an outlier in a lot. The PWL shall be revised using the remaining seven field density values if an outlier is found. The larger of the original or revised PWL shall be used to determine the Contractor's pay factor.

~~If one of the density test values from a lot an outlier, identified in accordance with the procedure described in Materials I.M. 501, the outlier value shall not be used to determine the quality index. The quality index shall be determined using the remaining density test values.~~

If only one laboratory density value is obtained that day, combine that value with the next day's test results to evaluate both days' production. If two or more laboratory density values are obtained that day, then the average of those tests alone shall be used. If a significant mix change has been made, only the appropriate laboratory density values should be used with the corresponding density cores.

2. Laboratory Voids

The target laboratory voids shall be as listed in Materials I.M. 510 Appendix A unless otherwise specified in the contract documents.

If there are less than 8 sublots for the mixture bid item, the pay factor shall be determined using the absolute average deviation (AAD) procedure described in Materials I.M. 501. The Contractor may elect to have a predetermined quality control plan that indicates a higher testing frequency. This testing plan shall be pre-approved by the Engineer.

The PWL shall be determined as defined in Materials I.M. 501 for each weekly lot. The PWL shall be determined using the specification limits of -1.0% and +1.0% voids from the target laboratory voids. The beginning of the lot shall be predetermined between the Engineer and Contractor. If a weekly lot has less than 8 sublots, it shall be included in the following weekly lot. If the last lot has less than 8 sublots, it shall be included in the preceding weekly lot and a new PWL shall be determined.

~~2~~3. Thickness.

The thickness of the completed course will be measured to the nearest 1/8 inch (3 mm), exclusive of seal coat, by measurement of cores. All areas of uniform and similar thickness and width for the project will be divided into lots.

The frequency specified for taking density samples from the surface lift will be used when measuring for completed thickness. However, samples that may not be tested for voids ~~density~~ because they are less than 70% of the intended thickness shall be used for thickness, and in these particular instances, the additional samples of sufficient thickness that are used for density tests shall not be measured for thickness. Thickness samples will be taken full depth of the completed course, and after measurement, the density samples for the top layer shall be removed by the Contractor from the core. If any of the measurements for a lot is less than the designated thickness, the quality index for thickness of that lot will be determined by the following formula:

(English)

$$QI_{Thickness} = \text{Average Thickness}_{Measured} - (\text{Thickness}_{Plan} - 0.5)$$

$$\text{Maximum Thickness}_{Measured} - \text{Minimum Thickness}_{Measured}$$

(Metric)

$$QI_{Thickness} = \frac{\text{Average Thickness}_{Measured} - (\text{Thickness}_{Plan} - 12.7)}{\text{Maximum Thickness}_{Measured} - \text{Minimum Thickness}_{Measured}}$$

When the day's operation is 2500 square yards (2500 m^2) or less, or the mixture is being placed in irregular areas or next to structures, the Engineer may waive sampling for thickness provided there is reasonable assurance that the pavement conforms to the required thickness. When the quality index falls below 0.00, the Engineer may declare the lot or parts of the lot defective.

~~3~~4. Smoothness.
Section 2317 of the Standard Specifications shall apply to all HMA surface mixture bid items of a Primary project if any individual HMA mixture bid item is 1000 tons (1000 Mg) or greater or 5000 square yards (4200 m^2) or greater. Section 2316 of the Standard Specifications shall apply to all other Primary projects with a surface course and when specifically required for other projects.

D. Sampling and Testing.
The Contractor shall maintain and calibrate the quality control testing equipment with prescribed procedures. Sampling and testing shall conform to specified procedures as listed in the applicable Materials I.M. and Specifications. When the results from a Contractor's quality control lab are used as part of product acceptance, the lab shall be qualified.

All quality control samples and field lab gyratory specimens used for acceptance shall be identified, stored, and retained by the Contractor until the lot is accepted. The Contracting Authority will prescribe the method of securing the identity and integrity of the verification samples in accordance with ~~Materials I.M. 511~~ Appendix A of this specification. All verification samples shall be stored by the Contractor for the Contracting Authority until delivery to the Contracting Authority's lab.

All samples shall be identified by a system approved by the Engineer.

1. Individual Materials and Loose Mixture.
All samples of asphalt binder, aggregate, and tack coat material, shall be identified, secured, and promptly delivered to the appropriate laboratory, as designated by the Engineer.

Paired samples of loose HMA mixture shall be taken in accordance with Materials I.M. 322, each box of the pair weighing at least 30 pounds (14 kg). The Contractor's quality control tests for mixture properties shall be conducted on representative portions of the mix, from the quality control sample of each sublot.

Samples shall be split for specimen preparation in accordance with Materials I.M. 357.

Paired sampling may also be accomplished by taking a bulk sample and immediately splitting the sample in accordance with Materials I.M. 322 on the grade.

All test results and calculations shall be recorded and documented on data sheets approved by the Contracting Authority. Specific test results shall be recorded on the Daily Plant Report provided by the Contracting Authority. The Daily Plant Report shall also include a description of quality control actions taken (adjustment of cold feed percentages, changes in JMF, etc.). The Contractor shall FAX, or deliver by other method approved by the Engineer, the Daily Plant Report to the Engineer and designated laboratory daily. A copy of the electronic file containing project information generated during the progress of the work shall be furnished to the Engineer at project completion.

When sampling for AASHTO T 283, the Contractor shall obtain a 50 pound (25 kg) sample in accordance with Materials I.M. 322. The Engineer will select, at random, the sample location. The

Contractor shall split the sample and deliver half to the Central Materials Laboratory.

2. Compacted Pavement Cores.
The Contractor shall cut and trim samples under the direction of and witnessed by the Engineer for tests of density, thickness, or composition, by sawing with a power driven masonry saw or by drilling a minimum 4 inch nominal diameter core. The surfaces shall be restored by the Contractor the same day. The core holes shall be dried, filled with the same type of material, and the material properly compacted. Pavement core samples will be identified, taken possession of by the Engineer, and delivered to the Contractor's quality control field laboratory.

The Engineer may either:

- Transport the cores directly to the lab, or
- Secure the cores and allow the Contractor to transport the cores to the lab.

The compacted HMA pavement will be tested in a timely manner by the Engineer's personnel who are Iowa DOT Certified to perform the test.

~~The minimum number of cores taken shall be in accordance with Materials I.M. 204, Appendix F.~~

The core locations will be determined by the Engineer.

The cores shall be prepared and tested in accordance with Materials I.M. 320, 321, and 337.

3. Verification and Independent Assurance Testing.
The Contractor's quality control test results ~~from paired samples~~ will be validated by the Engineer's verification test results on a regular basis using guidelines and tolerances set forth in Materials I.M. 216 and ~~511~~ Appendix A of this specification.

If the Engineer's verification test results validate the Contractor's test results, the Contractor's results will be used for material acceptance. Disputes between the Contractor's and Engineer's test results will be resolved in accordance with ~~Materials I.M. 511~~ Appendix A of this specification.

The Engineer will select, at random, one or more of the daily hot mix production verification samples. Some or all of the samples selected will be tested in the materials laboratory designated by the Engineer. The Engineer will use the verification test results to determine if the Contractor's test results can be used for acceptance.

The Engineer will test each lot of cores. These will be tested at the Contractor's field quality control laboratory. Cores may also be tested by the Contractor, but the Contractor's test results will not be used for material acceptance.

All personnel and laboratories performing tests used in the acceptance of material shall participate in the statewide Independent Assurance Program in accordance with Materials I.M. 208.

01XXX.05 METHOD OF MEASUREMENT.

A. Hot Mix Asphalt Mixture.

1. Measurement by Weight (Mass).
When measurement is by weight (mass), the quantity of Hot Mix Asphalt Mixture of the type specified will be expressed in tons (megagrams) and determined from the weight (mass) of individual loads, including fillets, measured to the nearest 0.01 tons (0.01 Mg).

Loads may be weighed in trucks, weigh hoppers, or from the weight (mass) from batch plants

computed by count of batches in each truck and batch weight (mass). Article 2001.07 of the Standard Specifications applies. The weights (mass) of various loads shall be segregated into the quantities for each pay item.

2. Measurement by Area.
When payment is based on square yards (square meters), the quantity of Hot Mix Asphalt Mixture of the type specified, will be the quantity shown in the contract documents to the nearest 0.1 square yard (0.1 m^2).

When constructing shoulders on a basis of payment of square yards (square meters), inspection of the profile and elevation will be based on the completed work relative to the pavement edge; the Contractor shall be responsible for the profile and elevation of the subgrade and for thickness.

If the Contractor chooses to place intermediate or surface mixture in lieu of base for the outside shoulders, the quantity will be calculated from the pavement and shoulder template, or when placed as a separate operation, from scale tickets. If the substitute mixture placed on the shoulder is for an intermediate course fillet only, the quantity in the fillet shall be included for payment in the quantity placed in the adjacent intermediate course.

Removal of fillets shall be incidental to the contract unit price for the mixture.

B. Asphalt Binder.
The amount of asphalt binder used from batch plants, continuous plants, or drum mixing plants, shall be by stick measurement in the Contractor's storage tank or by in-line flow meter reading, in accordance with Article 2001.07, B, of the Standard Specifications. The asphalt binder quantity added to the storage tank shall be computed from a supplier certified transport ticket accompanying each load. The quantity of asphalt binder not used in the work will be deducted.

When the quantity of asphalt binder in a batch is measured by weight (mass) and is separately identified by automatic or semi-automatic printout, the Engineer may compute from this printout the quantity of asphalt binder used.

By mutual agreement, this method may be modified when small quantities or intermittent operations are involved.

The Engineer will calculate and exclude the quantity of asphalt binder used in mixtures in excess of the tolerance specified in Article DS-01XXX.04, B, 2.

When payment for HMA is based on area, the quantity of asphalt binder used will not be measured separately for payment.

C. Recycled Asphalt Pavement.
The quantity of asphalt binder in RAP, which is incorporated into the mix, will be calculated in tons (megagrams) of asphalt binder in the RAP, based on an assumed asphalt binder content of 5% of the dry RAP weight (mass).

The quantity of asphalt binder in RAP, which is incorporated into the mix, will be included in the quantity of asphalt binder used.

The quantity of asphalt binder in unclassified RAP will not be measured for payment.

D. Anti-strip Agent.
Anti-strip agent incorporated in HMA mixtures will not be measured separately. The quantity will be based on tons (megagrams) of HMA mixture with anti-strip agent added.

E. Tack Coat.

Tack Coat shall be considered incidental to HMA, and will not be measured separately.

F. Fabric Reinforcement.
The quantity of Fabric Reinforcement, in square yards (square meters), to the nearest 0.1 square yard (0.1 m^2), will be the quantity shown in the contract documents.

G. Adjustment of Fixtures.
The Engineer will count the number of fixtures adjusted to the finished grade.

H. Hot Mix Asphalt Pavement Samples.
HMA Pavement Samples of any finished pavement furnished according to Article DS-01XXX.04 D, or required elsewhere in the contract documents, will not be individually counted for payment.

01XXX.06 BASIS OF PAYMENT.
The costs of designing, producing, placing, and testing bituminous mixtures and the cost of furnishing and equipping the QM-A field laboratory shall not be paid for separately, but shall be included in the contract unit price for the HMA mixes used. The application of tack coat, and sand cover aggregate are incidental and will not be paid for separately. Any pollution control testing shall be at the Contractor's expense. The installation of temporary Stop Sign Rumble Strips will not be paid for separately, but shall be considered incidental to the price bid for the HMA course for which it is applied.

A. Hot Mix Asphalt Mixture.
The Contractor will be paid the contract unit price for Hot Mix Asphalt Mixture of the type specified per ton (megagram) or square yard (square meter).

Surface course test strip placement in an intermediate lift will be paid for at the contract unit price for Hot Mix Asphalt Mixture, Surface Course, per ton (megagram).

Payment will be adjusted by the following ~~percentages~~ Pay Factor for the ~~quality index~~ field voids and laboratory voids density determined for the lot.

~~Quality Index (Density) 7 Samples~~ [1]	~~Percent of Full Payment~~
~~Greater than 0.72~~	~~100~~
~~0.40 to 0.72~~	~~95~~
~~0.00 to 0.39~~	~~85~~
~~Less than 0.00~~	~~75 maximum~~

~~[1] Or 6 samples and 1 outlier. Only one outlier will be allowed.~~

The unit price for HMA mixture shall be multiplied by the Pay Factor. The pay factor shall be rounded to 3 decimal places for payment.

1. Laboratory Voids.
Payment when PWL is used for acceptance.

PWL	Pay Factor
100.0 to 95.1	0.0060×PWL+0.430
95.0 to 80.0	1.000
50.0 to 79.9	0.008333×PWL+0.3333
Less than 50.0	0.750 maximum

When the PWL is less than 50.0, the Engineer may declare the lot or parts of the lot deficient or unacceptable.

Payment when AAD is used for acceptance.

AAD from Target Air Void	Pay Factor
0.0 to 1.0	1.000
1.1 to 1.5	0.900
1.6 to 2.0	0.750

Over 2.0	0.500 maximum

When the AAD is more than 2.0, the Engineer may declare the lot or parts of the lot deficient or unacceptable.

2. Field Voids.
Payment when PWL is used for acceptance.

PWL	Pay Factor
100 to 90.1	0.003×PWL+0.730
75.0 to 90.0	1.000
50.0 to 74.9	0.010×PWL+0.250
Less then 50.0	0.750 maximum

When the PWL is less than 50.0, the Engineer may declare the lot or parts of the lot deficient or unacceptable.

Payment when a test strip is constructed.

Average Field Void	Pay Factor
8.5 or Less	1.000
8.6 to 9.0	0.900
9.1 to 9.5	0.750
Over 9.5	0.500 maximum

When the Average Field Voids in a test strip exceed 9.5 percent air, the Engineer may declare the lot or parts of the lot deficient or unacceptable.

When the basis of payment is by area, payment will be further adjusted by the appropriate percentage according to the quality index for thickness determined for that lot and the following table:

Quality Index (Thickness) ~~7~~8 Samples	Percent of Payment (Previously Adjusted for Density)
Greater than 0.34	100
0.14 to 0.34	95
0.00 to 0.13	85
Less than 0.00	75 maximum

Courses for which quality index (thickness) is not determined because of size or shape, and courses which are found to be deficient in average width, will be paid for according to Article 1105.04 of the Standard Specifications.

When liquid anti-strip agent is used and production quality control testing for AASHTO T 283 is required, the payment for HMA will be adjusted according to the following table:

Percent TSR	Percent of Full
Greater than 79	100
79 to 70	90
Less than 70	75 maximum

B. Asphalt Binder.
For the number of tons (megagrams) of asphalt binder used in the work, measured as provided in Article DS-01XXX.05, B, the Contractor will be paid the contract unit price per ton (megagram).

Payment for asphalt binder will be for all new asphalt binder and the asphalt binder in RAP salvaged from the project, the Contracting Authority owned stockpile, or certified Contractor owned stockpiles, which is incorporated in the mixture.

When scarification of asphalt material is required and is paid for on the basis of square yards (square meters) and no other use of the RAP is specified, the RAP shall become the property of the

Contractor, and the Contractor shall not be charged for the asphalt binder in that material.

When the basis of payment for HMA is in square yards (square meters), compensation for asphalt binder will be included in the contract unit price per square yard (square meter).

C. Recycled Asphalt Pavement.
RAP which is owned by the Contracting Authority will be made available to the Contractor for the recycled mixture at no cost to the Contractor other than loading, hauling, and processing as required for incorporation into the mix.

D. Anti-strip Agent.
When anti-strip agent is required according to Article DS-01XXX.02, E, 2, the incorporation of the anti-strip agent into the HMA mixture will be considered as extra work ordered by the Engineer. Payment will be made at the rate of $1.00 per ton (megagram) of HMA mixture in which the anti-strip agent is incorporated. This payment will be full compensation for designing, adding, and testing for anti-strip agent.

E. Fabric Reinforcement.
The Contractor will be paid the contract unit price for Fabric Reinforcement per square yard (square meter). This payment shall be full compensation for furnishing all materials, labor, and equipment necessary for installing the fabric as required, including the adhesive or heavy tack coat of asphalt binder used as the adhesive.

F. Adjustment of Fixtures.
For the number of fixtures adjusted to the finished grade line, the Contractor will be paid the contract unit price for each. If the contract contains no price for adjustment of fixtures, this work will be paid for as provided in Article 1109.03, B, of the Standard Specifications.

G. Hot Mix Asphalt Pavement Samples.
For cutting HMA pavement samples to determine density or thickness according to the specifications, when either of these is the responsibility of the Contractor, and elsewhere when required by the contract documents, the Contractor will be paid the lump sum contract price. This lump sum payment shall be full compensation for furnishing all such samples for all courses or items of work, and for delivery of samples as specified in Article DS-01XXX.04, D.

Appendix A

Replace Materials I.M. 511 and Materials I.M. 204 Appendix F with the following:

This ~~IM~~ appendix describes the Quality Control/Quality Assurance (QC/QA) procedures for monitoring and controlling plant-produced Hot Mix Asphalt (HMA) on Quality Management of Asphalt (QMA) projects. Because the plant-produced mixtures may not develop test characteristics that meet design criteria, each mixture shall be evaluated during plant production. The evaluation procedures outlined herein are to be carefully followed so that all mix characteristics will conform to the appropriate requirements.

REFERENCE DOCUMENTS

~~Standard Specification 2303 Hot Mix Asphalt~~
AASHTO R 9-90 Acceptance Sampling Plans for Highway Construction
Materials I.M. 204 Inspection of Construction Project Sampling & Testing
Materials I.M. 208 Materials Laboratory Qualification Program
Materials I.M. 216 Guidelines for Validating Test Results
Materials I.M. 301 Aggregate Sampling & Minimum Size of Samples for Sieve Analysis
Materials I.M. 302 Sieve Analysis of Aggregates
Materials I.M. 320 Method of Sampling Compacted Asphalt Mixtures
Materials I.M. 321 Method of Test for Compacted Density of Hot Mix Asphalt (HMA)(Displacement)
Materials I.M. 322 Sampling Uncompacted Hot Mix Asphalt
Materials I.M. 323 Method of Sampling Asphaltic Materials
Materials I.M. 325 Compacting Asphalt Concrete by the Marshall Method
Materials I.M. 325G Method of Test for Determining the Density of Hot Mix Asphalt (HMA) Using the Superpave Gyratory Compactor (SGC)
Materials I.M. 336 Reducing Aggregate Field Samples to Test Samples
Materials I.M. 337 Method to Determine Thickness of Completed Courses of Base, Subbase & Hot Mix Asphalt
Materials I.M. 338 Method of Test to Determine Asphalt Binder Content & Gradation of Hot Mix Asphalt (HMA) by the Ignition Method
Materials I.M. 350Method of Test for Determining the Maximum Specific Gravity of Hot Mix Asphalt (HMA) Mixtures
Materials I.M. 357 Hot Mix Asphalt (HMA) Mix Sample for Test Specimens
Materials I.M. 510 Method of Design of Hot Mix Asphalt Mixes

RESPONSIBILITIES

Materials I.M. 511 Appendix A contains an outline of the responsibilities required for all parties.

The Table of Responsibility, in Materials I.M. 511 Appendix A, is broken up into two main categories, Quality Action and Type of Project. The Type of Project is further broken down into two sub-categories, Certified Plant Inspection (CPI) and QMA, and projects with small quantities. The Quality Action is subdivided into the types of work needing to be performed. These areas are General, Asphalt Binder, Aggregate, Loose Hot Mix, Compacted Hot Mix and Revisions. The table is organized in a way to represent how the work would progress during a Hot Mix Asphalt paving operation.

Each Quality Action identifies the group responsible for ensuring the desired action is performed. The groups are the Contractor (CONTR), Resident Construction Office/Project Engineer (RCE), District Materials Office (DME), and the Central Materials Office (CTRL).

In accordance with Materials I.M. 205, the Contractor shall submit a Quality Control Plan to the Engineer prior to the preconstruction meeting. This plan shall include as a minimum the items mentioned in Materials I.M. 511 Appendix D.

In addition, there are certain levels of certification required to perform specific activities. Depending on the Quality Action, an individual might be required to be a HMA Sampler, Level I HMA, Level II HMA, Level I AGG, or a Level II AGG Certified Technician.

SAMPLING & TESTING

Samples of the combined aggregate, asphalt binder, and plant-produced mixture are obtained in accordance with Materials I.M. 204 and analyzed as soon as the operations of the plant stabilize.

Only the information obtained from random samples as directed and witnessed by the Engineer and validated by comparison to one or more of the paired samples tested by the Contracting Authority will be used for specification compliance ~~and included in the moving averages~~. Additional samples of aggregate and loose hot mix asphalt may be taken to provide better quality control. The results of testing done on additional samples will be for informational purposes only. Any proposed changes in the quality control and verification sampling/testing frequencies require the approval of the District Materials Engineer.

All testing done by the Contractor that is used as part of the acceptance decision shall be performed in qualified labs by certified technicians. On all QMA projects, the Level I HMA-Certified Technician is responsible for making sure that all samples are obtained according to the applicable Materials I.M.s. Samples of loose HMA and asphalt binder must be taken by someone with a minimum of a HMA Sampler Certification.

Samples taken for acceptance purposes shall be retained until the lot has been accepted.

A. ASPHALT BINDER

The procedure used in the sampling of asphalt binder is found in Materials I.M. 323. AASHTO procedures are used in the testing of asphalt binder. The frequencies for taking asphalt binder samples are found in Materials I.M. 204.

B. AGGREGATE

The procedure used in the sampling of aggregate is found in Materials I.M. 301. The procedures used in the testing of aggregate are found in Materials I.M. 336 and Materials I.M. 302. The frequencies for taking aggregate samples are found in Materials I.M. 204.

When results from one or more sieves of the specified gradation sample are outside the allowable gradation tolerances, the Engineer may direct and witness one additional aggregate sample or process one loose mix sample to include in the gradation acceptance decision.

C. LOOSE HOT MIX

The procedure used in the sampling of loose hot mix asphalt is found in Materials I.M. 322. The procedures used in the testing of loose hot mix asphalt are found in Materials I.M. 357, Materials I.M. 350, Materials I.M. 325G, and Materials I.M. 338. The frequencies for taking loose hot mix asphalt samples are found in Materials I.M. 204.

~~The first production sample~~ each day ~~shall be obtained within the first 500 tons (500 Mg) of mix produced. Subsequent daily samples will be obtained from the remaining daily production by dividing the anticipated production beyond the first 500 tons (500 Mg) into three sublots and randomly selecting a sampling point within each sub lot. When less than 2000 tons (2000 Mg) of mix is anticipated to be produced in a day, samples shall be obtained at a minimum rate of one per 750 tons (750 Mg), after the first 500 tons (500 Mg) is sampled. In both cases, samples shall not be taken within the first 100 tons (100 Mg) of production.~~ Table DS-01XXX.04-1 Uncompacted Mixture Sublot Size shall be used for determining the sublots unless otherwise approved by the Engineer. For the PWL analysis of lab voids, as determined in Materials I.M. 501, a week shall constitute a lot. If fewer than eight tests are run in a week, include those tests with the following week if available or the prior week if needed. If fewer than eight tests are available for the entire production of a bid item, use the AAD analysis in Materials I.M. 501. The specific ton or truckload to begin sampling shall be determined by the Engineer using a random number system. The production samples shall be obtained as directed and witnessed by the Engineer.

The laboratory density, G_{mb}, of each production sample will be determined by averaging the densities of the compacted specimens. Two Gyratory specimens are compacted to the specified number of gyrations. The number of gyrations or blows is specified in the project documents.

Laboratory voids, P_a, for each production sample will be determined from the results of laboratory density and the corresponding individual Rice, G_{mm}, results. ~~The moving average of lab voids will be~~

~~determined by averaging the last four individual lab void values. A separate moving average will be established for each Job Mix Formula (JMF).~~

The calibration of the Rice pycnometer shall be checked at the beginning of a project and anytime that a correlation problem occurs.

D. COMPACTED HOT MIX

The procedure used in the sampling of compacted hot mix asphalt is found in Materials I.M. 320. The procedures used in the testing of compacted hot mix asphalt are found in Materials I.M. 321 and Materials I.M. 337. The frequencies for taking compacted hot mix asphalt samples are found in Materials I.M. 204.

The Engineer will provide inspection staff to direct and witness the sampling and perform density measurement during time agreed between the Engineer and the Contractor. The Engineer should make every effort to meet the Contractor's schedule. Results must be determined and reported within the period of time specified in this Materials I.M.

The Engineer will transport the cores in accordance with Materials I.M. 320, or secure the cores for transport by the contractor. The Engineer and Contractor will determine that cores are not damaged. The Engineer will decide if a core is damaged prior to testing.

Field density will be based on the average of the eight ~~seven~~ density cores taken for each lot. The Quality Index (QI) for field voids ~~density~~ will be determined using the average field density compared to the average maximum theoretical specific gravity, G_{mm}, ~~lab density~~ obtained from samples, which correspond to the pavement from which the cores were taken. ~~Field voids will be determined using the field density and the average of the Rice test results of production samples.~~

The Quality Index is a statistical measure of the difference between the field density and the minimum required density. The index identifies and compensates for values falling outside the statistical norm (outliers). If the QI results in less than 100% pay, the calculations to identify outliers will be performed. If the calculations identify an outlier at least 2.00 ~~1.80~~ standard deviations from the mean, the outlier will be eliminated and a new QI calculated with the remaining cores. The new QI will be used to determine payment unless it results in a greater penalty. The Quality Index is based on AASHTO R 9-90. The equation~~s~~ used in the determination of the Quality Index are located in ~~IM 501~~ Article DS-01XXX.04, C, 3. Examples on how to calculate the QI as well as outliers are located in Materials I.M. 501.

VALIDATION

Validation is defined as the ability of two labs to achieve similar (statistically equivalent) test values on split or paired samples (split for aggregate samples and paired for HMA samples). When comparing the cold-feed gradation to the ignition oven extracted gradation, a correction factor to adjust the extracted gradation must be determined according to the procedure in Materials I.M. 501. Validation of the cold-feed gradation will be determined by comparing the cold-feed gradation and the corrected extracted gradation as shown on the comparison report for Cold-Feed & Ignition Oven in Materials I.M. 216 Appendix A. The correction factors will be established by comparing an Agency cold-feed sample to an Agency ignition oven extracted sample. To achieve or reestablish validation, a minimum of two consecutive test results must meet Materials I.M. 216 tolerances.

- When any of the following events occur, validation has not been achieved or maintained.
- The difference between test results on each of two consecutive split/paired samples exceeds the Materials I.M. 216 tolerance.
- The difference between test results on any two of three consecutive split/paired samples exceeds the Materials I.M. 216 tolerance.

The test results in a series of split/paired samples (minimum of 3 samples, normally no more than 5) are not variable and random (results are consistently higher or results are consistently lower) and the difference between each split/paired test result is greater than half of the Materials I.M. 216 tolerance.

Consecutive samples may be either validation samples tested sequentially with another lab or mix specific samples when other mixes are being tested for validation between the two labs. It may be necessary to examine validation of test results on consecutive samples of the same mix if more than one mix is being tested between the two labs. Validation problems sometimes only occur during testing of specific mix samples.

DISPUTE RESOLUTION

When validation is not achieved or maintained, the District Materials Engineer may apply the following actions as appropriate to resolve split/paired test result differences.

- Retest the same sample
- The District labs will test additional verification samples.
- The District Materials Engineer will review the sampling and testing procedures of both labs
- The District Materials Engineer will immediately test samples sent in by the Contractor without allowing cool down and reheating (hot-to-hot testing).
- Both labs will test samples using comparable reheat periods.
- The District Materials Engineer will establish a correction factor based on the reheat evaluation outlined in Materials I.M. 511 Appendix B.
- Both labs will test a sample that was taken and split by the Engineer.
- Both labs and a third laboratory designated by the Contracting Authority will test a sample split three ways. The 3rd lab for state projects will normally be the Central Materials Lab.
- The District Materials Engineer will establish a correction factor for the Contractor's gyratory compactor based on the procedure described in Materials I.M. 511 Appendix C. The correction factor for Gmb should not exceed 0.030.

Resolution decisions by the Iowa DOT Central Materials Laboratory will be final. During the period of production when validation cannot be achieved, the Engineer's test results will be used for acceptance of the lot. The use of the Engineer's test values for acceptance will be retroactive to the time when the first sample exceeded the validation tolerance. Similarly, when validation is regained, the use of the Contractor's test results for acceptance is retroactive to the first test used to reestablish validation.

- If validation cannot be achieved for aggregate gradation, the Engineer's test results will be used for the entire gradation and applied to any calculations involving the gradation for the entire lot.
- If validation cannot be achieved between the ignition oven extracted gradation and the Contractor's cold-feed gradation, the Agency will run cold-feed gradations for validation in place of the ignition oven.
- If validation cannot be achieved on loose hot mix tests for G_{mm} or G_{mb}, the Engineer's test results will be used for any calculations involving that particular test value for the entire lot.

PRODUCTION TOLERANCES

Production tolerances are listed in the specifications.

Variations between two consecutive test results in G_{mb} or G_{mm} of more than 0.030 shall be investigated promptly since these tests reflect significant changes in binder content, aggregate properties and/or gradation. In some cases variations may be attributed to segregation, thoroughness of mixing, sampling procedure, and changes in aggregate production.

REPORTING

For each production sample of loose HMA the Contractor will determine, report, and plot (per QMA specification), G_{mb}, G_{mm} and P_a. Binder content measurement by an approved method will be determined, reported, and plotted daily. Gradation will be determined, reported and plotted daily. The inter lab correlation reports shall be made available.

Test results are to be recorded and plotted in the computer programs provided by the Iowa DOT. Copies of the completed Daily HMA Plant Report (Form #800241) summarizing all test results including the field density QI shall be provided to the District Materials Engineer and the Engineer within ~~four~~ 4 hours of beginning operations on the next working day. Copies of computer files containing the project information shall be furnished to the Engineer on a CD upon project completion. An additional copy of the files shall be furnished to the DME on a CD.

ADJUSTING (TROUBLESHOOTING)

As stated in ~~Standard Specification~~ Section 2303 of the Standard Specifications, "The Contractor shall be responsible for all aspects of the project, provide Quality Control management and testing, and maintain the quality characteristics specified".

The Contractor is responsible for making changes, as necessary, to achieve target values specified on the JMF. These changes can include adjusting the proportions of aggregate and asphalt binder necessary to meet the JMF. If a change in the target gradation is desired, the Contractor ~~must~~ shall obtain approval of a new JMF from the District Materials Engineer. Changes in the target gradation cannot be set outside of the control points. The Contractor may change the target binder content to maintain the required mixture characteristics, provided the appropriate documentation and reporting is performed. All changes in proportions ~~must~~ shall be reported on the Daily HMA Plant Report (Form #800241).

The addition of new materials to the JMF may be approved by the District Materials Engineer without laboratory tests if the materials are produced from geologically comparable sources, do not constitute more than 15% ~~percent~~ of the total aggregate, meet quality requirements, and produce mixes that meet design criteria. When aggregates are introduced from sources that are not geologically comparable or otherwise differ significantly, complete laboratory mix design testing and approval is required.

Any time the moving average for laboratory voids falls outside the specification tolerance limit, the Contractor ~~must~~ shall cease operations. The Contractor assumes the responsibility to cease operations, including not incorporating produced material, which has not been placed. Production shall not be started again until the Contractor notifies the Engineer of the corrective action proposed.

Moving averages and the gyratory compaction slope assist in identifying potential problems before they arise. Watch the trends in the moving averages (approaching a specification limit) and the slope of the compaction curve. The slope of the compaction curve of plant-produced material shall be monitored and variations in excess of ± 0.40 of the mixture design gyratory compaction curve slope may indicate potential problems with uniformity of the mixture.

GUIDANCE TABLES

The tables below are intended to provide guidance on dealing with the most common problems, which arise during the production of HMA. The first table deals with problems, which can show up in the laboratory setting and the second table deals with problems, which can appear in the field.

The following example explains how to read the tables. Both tables are read downward. The shaded

regions are the items to be considered for adjusting purposes.

Lab Problem Table

The first step is to identify which lab problem is occurring. If “Low Voids” is the identified problem, move down the column to the “Step 1 Check”. Assuming the first check is to be made on the “Binder Content”, move down the column to “Step 2 If”. If the Binder Content is high proceed to “Step 3 Verify”. Each of the shaded items identified in the “Step 3 Verify” should be looked at before proceeding further. Assuming that the items in “Step 3 Verify” are on target, go to “Step 4 Do”. In this case, the action to be taken in “Step 4 Do” is to “Lower Binder” in the mix.

In all cases, the items in the “Step 3 Verify” are assumed to be within the allowable tolerances and won’t fall outside of allowable tolerances if the action in “Step 4 Do” is taken.

	LAB PROBLEM	Low Voids			High Voids			Low Film Thickness			High Film Thickness			Low VMA			High VMA		
Step 1-Check	Binder Content	■			■			■			■								
	Gradation		■			■			■			■		■	■		■	■	
	Aggr. SG (Gsb)			■			■									■			■
	Aggr. Absorption									■			■						
Step 2-If	Low Binder				■			■											
	High Binder	■									■								
	Low -200					■						■					■		
	High -200		■						■					■					
	Off JMF Target			■			■			■			■		■	■		■	■
Step 3-Verify	Filler Bitumen Ratio	■	■		■	■		■	■		■	■		■	■		■	■	
	Film Thickness	■	■		■	■								■	■		■	■	
	VMA	■	■		■	■													
	Field Compaction	■	■			■		■	■	■	■	■	■						
	Voids							■	■		■	■		■	■		■	■	
	Individual Aggr. Sources			■			■			■			■			■			■
Step 4-Do	Lower Binder	■									■								
	Increase Binder				■			■											
	Lower -200		■						■					■					
	Increase -200					■						■					■		
	Adjust Aggr. Proportions		■	■		■	■		■	■		■	■	■	■	■	■	■	■
	Recompute Volumetrics			■			■			■			■			■			■

Field Problem Table

The first step is to identify which field problem is occurring. If “High Field Voids” is the identified problem, move down the column to the “Step 1 Check”. Assuming the first check is to be made on the “Lab Voids”, move down the column to “Step 2 If”. If the Lab Voids are high proceed to “Step 3 Verify”. Each of the shaded items identified in the “Step 3 Verify” should be looked at before proceeding further. Assuming that the items in “Step 3 Verify” are on target, go to “Step 4 Do”. In this case the process of looking at the “Step 3 Verify” would lead to the Lab Problem Table and cause one of the actions for High Lab Voids to be used.

In all cases, the items in the “Step 3 Verify” are assumed to be within allowable tolerances and won’t fall outside of allowable tolerances if the action in “Step 4 Do” is taken.

	FIELD PROBLEM	Low Field Voids		High Field Voids		Tender Mix				Low Density Q.I.		Agglomerates	Uncoated Aggr.		Brown Rock			Stripping
Step 1-Check	Stockpiles											■						
	Aggr. Absorption														■			
	Binder Content												■			■		
	Lab Voids	■		■		■				■								
	Film Thickness						■											
	Mixing Time													■				
	Moisture in Mix							■										■
	Mix Temp at Plant		■		■												■	
	Mat Temp								■		■							
Step 2-If	Low	■			■	■					■		■	■		■		
	High		■	■			■		■						■		■	
	Yes							■				■						■
Step 3-Verify	Filler/Bitumen Ratio												■			■		
	Film Thickness												■			■		
	Voids												■			■		
	Field Compaction																■	
	Aggr. Breakdown		■		■													
	Individual Aggr. Sources		■		■										■			
	Moisture		■		■												■	
	Amount of Clay Binder											■						
	Go To Lab Problem Table	■		■		■	■			■								
Step 4-Do	Increase Binder												■			■		
	Lower Temp		■						■								■	
	Increase Temp				■						■							
	Cover Loads				■													
	Increase Aggr. Dryer Time							■										■
	Screen											■						
	Adjust Aggr. Proportions														■			
	Increase Wet Mixing Time													■				

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE & RELATED MATERIALS I.M.s	QUALITY CONTROL					INDEPENDENT ASSURANCE, & VERIFICATION S&T						REMARKS
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ. Note 1	SAMPLE SIZE	TEST BY	REPORT	
SOURCE INSPECTION														
Aggregates-Coarse (4127)		AS 209												
Aggregates-Fine (4127)		AS 209												
Hydrated Lime (4127)		AS 491.04												
Asphalt Binder		AS 437												
Emulsions & Cutbacks		AS 437												
Release Agent		AB 491.15												
PLANT INSPECTION														
Aggregates	Quality							V	DME	1/20,000 Ton	50 lb.	CTRL		
Combined Aggregate (4127)	Gradation		RCE/ CONTR	1/lot	IM 301	CONTR	800241	V IA	RCE/ CONTR	~~Sample 1/day, Test 1st day + 20%~~ Sample and Test 1st day Systems Approach*	IM 301	DME/RCE DME	IM 216 IM 216	DME may modify
	Moisture		CONTR	1 / half day	1000 gm	CONTR								Dryer Drum Plants Only

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CONTR-Contractor

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*A project approach may be applied at the discretion of the DME at the frequency of 1/project.
NOTE: RCE/CONTR indicates that the Contractor shall assist in the sampling at the direction of and witnessed by the ~~Project~~ Engineer.

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE & RELATED MATERIALS I.M.s	QUALITY CONTROL					INDEPENDENT ASSURANCE, & VERIFICATION S&T						REMARKS
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
PLANT INSPECTION														
Mineral Filler								V	DME	1/project	5 kg	DME	821278	
Asphalt Binder	DSR Quality	AS Cert D						V V IA	RCE/ CONTR DME	Sample 1/day Test 1st 3days + 1/week 1/20,000 T of Mix Systems Approach	4 oz tin 1 qt	DME CTRL		Log all shipments
Cutback		AS 329												Log all shipments
Emulsion	Residue	AS 360						V	RCE	1/project	1 qt	DME		Plastic bottle required
GRADE INSPECTION														
Uncompacted Mixture:	Lab Density & Lab Voids	321, 350 325G	RCE/ CONTR	As per ~~2303~~ Spec.	~~30~~ 40 lb	CONTR	800241	V IA	RCE/ CONTR	As per ~~2303~~ Spec Test 1/day Systems Approach	~~30~~ 40 lb	DME		~~May be adjusted by DME as per 2303~~
	Extracted Gradation	338, 331						V		Test 1st day + 20%				When ignition oven is used for gradation validation
Compacted Mixture	Density, Thickness & Voids	320, 321 337						V IA	RCE/ CONTR DME	Lot 1 lot/project*	~~7~~8/lot	RCE DME		
	Smoothness	341	CONTR	100%	100%	CONTR		V	DME	10%		DME		

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* A system approach may be applied at the discretion of the DME.

NOTE: A Verification sample for asphalt binder quality and aggregate quality not required under 2000 tons of mix.

NOTE: RCE/CONTR indicates that the Contractor shall assist in the sampling at the direction of and witnessed by the ~~Project~~ Engineer.

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			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ. Note 1	SAMPLE SIZE	TEST BY	REPORT	
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Aggregates-Coarse (4127)		AS 209												
Aggregates-Fine (4127)		AS 209												
Hydrated Lime (4127)		AS 491.04												
Asphalt Binder		AS 437												
Emulsions & Cutbacks		AS 437												
Release Agent		AS 491.15												
PLANT INSPECTION														
Aggregates	Quality							V	DME	1/20,000 Mg	22 kg	CTRL		
Combined Aggregate (4127)	Gradation		RCE/ CONTR	1/lot	IM 301	CONTR	800241	V IA	RCE/ CONTR	~~Sample 1/day, Test 1st day + 20%~~ Sample and Test 1st day Systems Approach*	IM 301	DME/RCE DME	IM 216 IM 216	DME may modify
	Moisture		CONTR	1/halfday	1000 gm	CONTR								Dryer Drum Plants Only

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			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
PLANT INSPECTION														
Mineral Filler								V	DME	1/project	5 kg	DME	821278	
Asphalt Binder	DSR Quality	AS Cert D						V V IA	RCE/ CONTR DME	Sample 1/day, Test 1st 3 days + 1/week 1/20,000 Mg of Mix Systems Approach	120 ml 1 L	DME CTRL		Log all shipments
Cutback	Quality Viscosity	AS 329												Log all shipments
Emulsion	Residue	AS 360						V	RCE	1/project	1 L	DME		Plastic bottle required
GRADE INSPECTION														
Uncompacted Mixture:	Lab Density & Lab Voids	321, 350 325G	RCE/ CONTR	As per ~~2303~~ Spec	~~14~~ 18 kg	CONTR	800241	V IA	RCE/ CONTR	As per ~~2303~~ Spec Test 1/day Systems Approach	~~14~~ 18 kg	DME		~~May be adjusted by DME as per 2303~~
	Extracted Gradation	338, 331						V		Test 1st day + 20%				When ignition oven is used for gradation validation
Compacted Mixture	Density Thickness Voids	320, 321 337						V IA	RCE/ CONTR DME	Lot 1 lot/project*	~~7~~8/lot	RCE DME		
	Smoothness	341	CONTR	100%	100%	CONTR		V	DME	10%		DME		

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* A system approach may be applied at the discretion of the DME.

NOTE: A Verification sample for asphalt binder quality and aggregate quality not required under 2000 Mg of mix.

NOTE: RCE/CONTR indicates that the ~~e~~Contractor shall assist in the sampling at the direction of and witnessed by the ~~project~~ eEngineer.