Iowa Department of Transportation

MINUTES
OF
IOWA DOT SPECIFICATION COMMITTEE MEETING

May 13, 2004

Members Present:	John Adam, Director	Statewide Operations Bureau
	Tom Reis, Chair	Specifications Section
	Jim Berger	Office of Materials
	Roger Bierbaum	Office of Contracts
	Larry Jesse	Office of Local Systems
	Bruce Kuehl	District 6-Construction Office
	Doug McDonald	RCE - Marshalltown
	Keith Norris	District 2-Materials Office
	Gary Novey	Office of Bridges and Structures
Members Not Present:	Bruce Brakke	Maintenance
	Troy Jerman	Traffic & Safety
	Mike Kennerly	Office of Design
	Jim Rost	Location & Environment
	John Smythe	Construction
From FHWA:	None	
Others Present:	Donna Buchwald, Secretary	Specifications Section
	Dave Berryhill	Office of Design
	Mike Heitzman	Materials
	Tom Jacobson	Construction
	Jeff Schmitt	Construction

Tom Reis, Specifications Engineer, opened the meeting. The following items were discussed in accordance with the May 6, 2004 agenda:

1. Article 2301.19, B, Cold Weather Protection.

The Office of Construction requested a change to Article 2301.19 that may allow for earlier removal of cold weather protection for PCC pavement.

2. Section 2303, Hot Mix Asphalt Mixtures

The Offices of Construction and Materials requested approval of a general rewrite of Section 2303 that will clarify and update the specifications based on current practices.

3. Section 2316, Pavement Smoothness.

The Office of Materials requested several changes to Section 2316 that will clarify the intent of the smoothness specifications.

4. Article 2415.01, Description (Curb Removal)

The Office of Materials requested a change to Article 2415.01 that will update an ASTM reference in the specifications.

5. Section 2502, Subdrains.

The Office of Construction requested several changes to Section 2502 that will clarify the intent of the specifications for marking the outlets of subdrains with steel posts.

6. Section 2510, Removal of Pavement.

The Specification Section requested several changes to Section 2510 that will clarify its intent.

7. Article 2513.09, Tolerances (Concrete Barrier)

The Office of Materials requested a change to Article 2513.09 that will add back in a table of acceptable tolerances for concrete barrier that was omitted from the 2001 Specification Manual.

SPECIFICATION REVISION SUBMITTAL FORM

Submitted by: John Smythe/Kevin Merryman	**Office:** Construction	**Item 1**
Submittal Date: April 2004	**Proposed Effective Date:** October 19, 2004	
Article No.: 2301.19, B **Title:** Curing and Protection of Pavement	**Other:**	

Specification Committee Action:

Deferred:	**Not Approved:**	**Approved Date:** 5-13-04	**Effective Date:** 10-19-04

Specification Committee Approved Text: See Specification Section Recommended Text.

Comments: No comments.

Specification Section Recommended Text:

2301.19, B, Cold Weather Protection

Replace the table:

Night Temperature Forecast	Type of Protection[(1)]
35°F to 32°F (2°C to 0°C)	One layer of burlap for concrete.
31°F to 25°F (-1°C to -4°C)	Two layers of burlap or one layer of plastic on one layer of burlap.
Below 25°F (-4°C)	Four layers of burlap between layers of 4 mil (100 µm) plastic or equivalent commercial insulating material approved by the Engineer.*

(1) The protection shall remain until one of the following conditions is met:

a. The pavement is 5 calendar days old.
b. Opening strength is attained.
c. Forecasted low temperatures exceed 35°F (2°C) for the next 48 hours.
d. Forecasted high temperatures exceed 55°F (13°C) for the next 24 hours and subgrade temperatures are above 40°F (4°C).

Comments:

Member's Requested Change (Redline/Strikeout):

B. Cold Weather Protection.
All concrete pavement, including exposed edges of the slab, shall be cured according to Article 2301.19, A, prior to applying protection. In addition, concrete less than 36 hours old shall be protected as follows, and payment will be made as provided in Article 2301.35.

Night Temperature Forecast	Type of Protection
35°F to 32°F (2°C to 0°C)	One layer of burlap for concrete.*
31°F to 25°F (-1°C to -4°C)	Two layers of burlap or one layer of plastic on one layer of burlap.*
Below 25°F (-4°C)	Four layers of burlap between layers of 4 mil (100 µm) plastic or equivalent commercial insulating material approved by the Engineer.*

*This protection shall remain until one of the following conditions is met:

d. The pavement is 5 calendar days old.
e. Opening strength is attained.
f. Forecasted low temperatures exceed 35°F (2°C) for the next 48 hours.
g. Forecasted high temperatures exceed 55°F (13°C) for the next 24 hours and subgrade temperatures are above 40°F (4°C).

Paving operations shall be shut down in time to comply with protection requirements outlined above. In good weather, the header shall be placed at least 45 minutes before sunset. During cold weather, more time must be allowed for finishing and protection. All finishing and covering operations shall be performed prior to darkness. Temperature restrictions and protection requirements may be modified by the Engineer.

When the pavement is placed directly on natural subgrade, Section 2109, earth check dams shall be constructed immediately after passage of the slip forms or removal of the forms to prevent water from flowing along the edge of the pavement and undermining the slab. They shall not be spaced or be of a width to provide an approach over which a vehicle may be driven onto the pavement.

Reason for Revision: During late fall and early spring paving, situations arise in which overnight low temperatures require cold weather protection. Often this day or two of low temperatures is then followed by several days of warmer temperatures which should allow the pavement to be uncovered. However, current specification requirements do not allow cold weather protection to be removed until pavement is 5 calendar days old or opening strength is attained. The proposed change acknowledges that temperatures may increase after concrete placement, and allows for early removal of cold weather protection when certain temperature restrictions are met.

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

SPECIFICATION REVISION SUBMITTAL FORM

Submitted by: Jim Berger, John Smythe	**Office:** Materials, Construction	**Item 2**
Submittal Date: April 29, 2004	**Proposed Effective Date:** October 19, 2004	
Article No.: 2303 **Title:** Hot Mix Asphalt Mixtures	**Other:**	

Specification Committee Action:			
Deferred:	**Not Approved:**	**Approved Date:** 5-13-04	**Effective Date:** 10-19-04

Specification Committee Approved Text:

Section 2303. Hot Mix Asphalt Mixtures.

2303.01 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.

Quality Management - Asphalt (QM-A) shall apply to contracts with HMA quantities of 5000 tons (5000 Mg) or greater and all Interstate contracts. The Contractor shall follow the procedures and meet the criteria established in Article 2303.02, Section 2521, and Materials I.M. 510 and 511.

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.

2303.02 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.

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 4126(1) & 4127
Intermediate and Surface	Type B	Section 4126
Intermediate and Surface	Type A	Section 4127
(1)When the size of the mixture is not specified, 1/2 inch (12.5 mm) shall be used.		

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 ~~a~~ sources identified in Materials I.M. T203 ~~as having the specified frictional classification. The aggregate~~

~~retained on the No.4 (4.75 mm) sieve shall meet or exceed the following amount for each classification:~~.

~~FRICTION AGGREGATE CLASSIFICATION~~			
~~Friction Level~~	~~Type 2~~	~~Type 3~~	~~Type 4~~
~~L-2~~	~~25%~~		~~80%~~
~~L-3~~		~~45%(1)~~	~~80%~~
~~L-4~~			~~50%~~
~~(1) A minimum of 30% of Type 2 friction aggregate may be substituted for the Type 3 aggregate.~~			

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.
RAP shall be from a source designated in the contract documents, a certified stockpile, or unclassified RAP furnished by the Contractor subject to the following limitations:

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.

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 (%)					
Mixture Size	**Aggr. 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 ~~O~~on Interstate projects, the Contractor has the option to substitute ~~a Type A~~ the mainline intermediate or surface mixture for a specified ~~Type B~~ base mixture ~~for the outside shoulder~~ 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.

~~The HMA mixture designed shall meet gyratory design and mixture criteria corresponding to the size of the mixture and the 20 year design traffic level (ESALs) for the project or an appropriate design level as specified in the contract documents. Shoulders placed as a separate operation shall be designed for less than 300,000 ESALs.~~

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

On 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), hydrated lime will be required in the affected intermediate and surface course mixture.

On Primary highways other than Interstate 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, hydrated lime will be required in the affected mixtures requiring Type A aggregate.

Hydrated lime will not be required for base repair, patching, or temporary pavement.

When hydrated lime is required based on aggregate source, the Contractor may arrange for Superpave 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 indicate more than 80% tensile strength retained (TSR), hydrated lime will not be required. Confirmation of AASHTO T 283 test results will be completed by the Central Materials Laboratory during placement of the test strip.

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

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

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 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.

~~When the plant is completely assembled and before any mixture is produced,~~ ~~e~~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.

~~Each plant scale and metering system shall be calibrated before work on a contract begins. 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 curves shall be available in the plant laboratory.~~ ~~New calibration curves shall be made each time there is a change in size or source of any aggregate being used.~~ ~~On all plants,~~ ~~aggregate samples shall be taken in accordance with Materials I.M. 204 to determine that materials are being proportioned in accordance with the specifications.~~

2. Paver.
Article 2001.19 shall apply. ~~When placing paved shoulders, spreaders described in Article 2001.13, D, may be used for all but the top lift.~~ Spreaders, as described in Article 2001.13, D, 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.

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, 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, shall be used.

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

2303.03 CONSTRUCTION.

~~1~~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.

AB. ~~Surface~~ Preparation of Existing Surfaces.

1. Cleaning.
The existing surface shall be cleaned and prepared in accordance with ~~Section~~ Article 2212.04, A.

~~**1. 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 self imposed limit, the Contracting Authority will pay repair costs set by the Engineer, representing an increase in cost of repair of damage, if any, caused by such traffic.~~

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~~, and~~. ~~u~~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 shall be adequately cured prior to placement of the HMA.~~ 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. ~~If the tack coat surface becomes dirty from weather or traffic, the surface shall be thoroughly cleaned and, if necessary, retacked.~~

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.

~~B~~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 be heated according to the suppliers recommendations.

c. Handling Hydrated Lime.
The lime must be accurately proportioned by a method acceptable to the Engineer.

1) Hydrated Lime 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:

a) Added to the virgin aggregate on the primary feed belt, as a lime water slurry.
b) Thoroughly mixed with the total combined aggregate if the aggregate contains at least 3% total moisture.
c) 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 augering.

2) Hydrated Lime 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:

a) Placed on the recycle belt which leads directly into the weigh hopper.
b) Added directly into the pugmill.
c) 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.

When any of the above methods for a batch plant is used, the hydrated lime will be considered part of the JMF.

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.

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.

~~C~~D. Placement.
~~The existing surface and t~~ The surface of each layer shall be cleaned in accordance with Article 2212.04, A ~~and free from foreign matter when each succeeding layer is placed. Any surface which becomes dirty shall be cleaned by the Contractor~~ 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 (60-80)	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 ~~slowed as necessary to provide~~ 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 ~~is three times the designated mix size~~ shall be based on the following:

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

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.

~~When placing two adjacent lanes, not more than one normal day's run shall be made on one side before the adjacent side or pass is completed. At the close of each working day, the roadbed shall be free of any construction equipment. The Contractor shall not spread more mixture than can be compacted and finished in daylight hours of the same working day.~~

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.

When placing two adjacent lanes, not more than 1 1/2 days of rated plant production capacity shall be paved in a lane before the adjacent lane(s) is paved. 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. The material shall be placed adjacent to and equal in thickness to the resurfacing. Fillet removal shall be incidental to the HMA mixture.

~~D~~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

~~resurfacing~~ paved shoulders, temporary crossovers, ~~runarounds~~ onsite detours, and for other situations where Class I is not specified.

For Class I compaction, the roadway density (percent of laboratory density) will be based on the density obtained from the Quality Control Program for that day's mixture.

1. Class I Compaction.

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 ~~HMA course~~ 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. ~~Rolling Patterns~~ Test Strip Construction for Class IA and IB Compaction.
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, 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. ~~This will be paid for at the contract unit price for the surface mix.~~ The test strip shall be applied to each mixture which has a plan quantity of at least ~~1500~~ 3000 tons (~~1500~~ 3000 Mg).

The quantity of HMA mixture subject to Class IA compaction, produced and placed for test strip production, will be limited to ~~500~~ 750 tons (~~500~~ 750 Mg) for lift thicknesses of 2 inches (50 mm) or less, and ~~750~~ 1000 tons (~~750~~ 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 ~~successful~~ 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 verify mixture design and effectiveness of compaction procedures.

The test strip production control shall meet the requirements of Article 2303.04, 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.

2. 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~~, and~~ 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.

~~3F~~. 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). ~~Transverse construction joints in succeeding courses shall be separated by not less than 6 feet (1.6 m).~~ 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. ~~At transverse joints, the cold mixture of the layer shall be sawed to a straight line at right angles to the center line so that a full thickness, a true surface, and a vertical edge will be provided.~~

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 ~~at end-of-day's run transverse joints~~ to prevent adhesion. Sand, dirt, or wood shall not be used for this purpose. ~~Use of wood or metal headers to form the edge of the joint during rolling of the fresh mixture will not be permitted.~~

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.

~~When temporary transverse construction joints will be~~ 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.

~~E~~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 ~~insofar as~~ 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, ~~catch basins, valve holes,~~ 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. 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. The Engineer may approve other equipment for placement of fillets, based on a demonstration of satisfactory results.

~~**F. Limitations.**~~
~~Headers, when required to end paving for winter shutdown, shall be located adjacent to each other. A winter shutdown runout of 50 feet (15 m) in length per 1 inch (25 mm) of lift thickness shall be installed. The runout shall be removed before commencement of paving and shall be incidental to HMA.~~

2303.04 QUALITY CONTROL 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 according to Section 2521 will be required. 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 ~~aggregate~~ material into the mix.

1. Sampling and Testing.
Aggregate gradation control shall be based on cold feed gradation.

Aggregate samples shall be taken in accordance with Materials I.M. 204 to determine that materials are being proportioned in accordance with the specifications.

The hot HMA mixture shall be sampled, at random, from the roadway, behind the paver, prior to compaction, in accordance with Materials I.M. 322.

Each day's production shall be considered a lot. 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 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 samples required for a day's production will not exceed four.

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.

Each production sample shall be tested 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.

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 ~~single~~ 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 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 (~~1~~2)
Daily asphalt binder content	by JMF	± 0.3
Field laboratory air voids	4.0 (~~2~~3)	-0.5/+1.0 (~~3~~4)
VMA (~~4~~5)	by JMF	± 1.0 (~~5~~6)

(1)- Based on single test unless otherwise noted.

(~~1~~2)- The filler/bitumen ratio of the plant produced mixture will be maintained between 0.6 and 1.4.

(~~2~~3)- Unless otherwise specified.

(34)- Based on the moving average of four test values.
(45)- Restricted to an asphalt film thickness as specified for the level of HMA mixture.
(56)- 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.

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 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. ~~As a minimum, the following values shall be plotted on Iowa DOT Materials approved control charts as indicated below:~~

~~Laboratory density (each point being an average of two specimens).~~
~~Laboratory air voids (plotted to nearest 0.1%)~~
~~Asphalt binder content (plotted to nearest 0.1%)~~
~~Cold feed gradation (No. 4, No. 8, No. 30, and No. 200 (4.75 mm, 2.36 mm, 600 µm, and 75 µm sieves))~~
~~Maximum specific gravity (Rice) (Materials I.M. 350).~~

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. Density.
Density samples 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. ~~When the day's operation is 2500 square yards (2500 m^2) or less, or the day's operation is 500 tons (500 Mg) or less, or when the mixture is being placed in irregular areas, or for wedge, leveling, or strengthening courses, the Engineer may waive sampling for density provided compaction has been thorough and effective.~~

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.

Seven density samples will be taken for each lot. The length laid in each lot shall be divided into seven approximately equal sections and one sample will be obtained at a random location in each section.

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, ~~or~~ from run-outs, or ~~areas adjacent to~~ from day's work joints or structures.

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

$$QI_{Density} = \frac{(Average\ G_{mb})_{Field\ Lot} - ((\%\ Density)_{Specified} \times (Average\ G_{mb})_{Lab\ Lot})}{(Standard\ Deviation\ G_{mb})_{Field\ Lot}}$$

where $QI_{Density}$ = 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 one of the density test values from a lot is 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. 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 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)

$$QI_{Thickness} = \frac{Average\ Thickness_{Measured} - (Thickness_{Plan} - 0.5)}{Maximum\ Thickness_{Measured} - Minimum\ Thickness_{Measured}}$$

(Metric)

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

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. Smoothness
Smoothness of the surface course shall be in accordance with Section 2316.

D. Sampling and Testing.
The Contractor shall calibrate and correlate the testing equipment with prescribed procedures. Sampling and testing shall conform with specified testing procedures as listed in the applicable Materials I.M. and ~~applicable~~ Specifications. When the results from a lab are used for product acceptance, the lab shall be qualified.

All samples shall be identified, stored and retained by the Contractor for the Contracting Authority until the lot is accepted. The Contracting Authority may acquire these samples for comparative, verification, or assurance testing.

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

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

Samples of loose HMA mixture shall be taken in accordance with Materials I.M. 322, weigh at least 60 pounds (28 kg), and shall be transported to the test facility in a way to retain heat to facilitate sample splitting procedures. The tests for mixture properties shall be conducted on representative portions of the mix, split from the larger sample of mix. After splitting of the sample is completed in the Contractor's QM-A laboratory, the remainder of the sample, approximately 30 pounds (15 kg), shall be retained for laboratory testing by the laboratory designated by the Contracting Authority.

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

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 a daily summary sheet approved by the Contracting Authority. The Daily Quality Control Summary Sheet shall also include a description of quality control actions taken (adjustment of cold feed percentages, changes in JMF, etc.). The Contractor shall FAX, or by other method approved by the Engineer, the daily quality control summary sheet to the ~~appropriate Iowa DOT District Materials Engineer or~~ 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.

2. ~~Finished Pavement Requirements~~ Compacted Pavement Cores.
The Contractor shall cut samples from any course or finished pavement 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 shall be identified and delivered to the Contractor's quality control field laboratory.

The compacted HMA pavement shall be tested by Contractor's personnel who are Iowa DOT Certified in QM-A bituminous quality control.

The minimum number of cores taken shall be in accordance with the following Materials I.M. 204, Appendix G.

The core locations will be determined by the Engineer.

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

3. Acceptance, Correlation, and Quality Assurance Testing.
The Contractor's quality control test results will be compared and correlated to the Engineer's test results on a regular basis using guidelines and tolerances set forth in Materials I.M. 208, Appendix C; 216; and 511.

If satisfactory correlation exists between the Contractor's test results and the Engineer tests, the Contractor's results will be used. Disputes between the Contractor's and Engineer's test results, on one sample or one test of one sample, will be resolved ~~by repeated testing of the same sample or additional testing of another sample. When repeated and/or additional sampling fails to resolve a dispute, a third materials laboratory designated by the Contracting Authority will act as a reference laboratory and perform additional testing as necessary to resolve the dispute.~~ in accordance with Materials I.M. 511.

The Engineer will select, at random, a split portion of one or more of the daily hot mix production samples. Some or all of the samples selected will be tested in the materials laboratory designated by the Engineer. The Engineer will test as many of the samples as necessary to establish a correlation.

The Engineer will select one daily set of cores at random each week. These will be tested at the materials laboratory designated by the Engineer. Cores from the initial production will also be tested by the Contractor and the Engineer for correlation and validation of results.

2303.05 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 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.

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. 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 2303.04, 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. Hydrated Lime.
Hydrated lime incorporated in HMA mixtures ~~shall be considered incidental to HMA and~~ will not be measured separately. The quantity will be based on tons (megagrams) of HMA mixture with hydrated lime 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 2303.04 D, or required elsewhere in the contract documents, will not be individually counted for payment.

2303.06 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 hydrated lime, 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.

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 for the quality index for 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.

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 Samples ~~(1)~~	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.

B. Asphalt Binder.
For the number of tons (megagrams) of asphalt binder used in the work, measured as provided in Article 2303.05, 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. Hydrated Lime.
For the quantity of each HMA mixture with hydrated lime, the Contractor will be paid the predetermined contract unit price per ton (megagram) of HMA mixture for designing, adding, and testing of the hydrated lime.

~~D~~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.

~~E~~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.

~~F~~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 2303.04, D.

2001.07, B, Special Procedures for Asphalt Mixtures and Aggregate.

Replace the title and entire article.

Special Procedures for Asphalt Mixtures~~, and~~ Aggregate, and Binders.
Automatic or semi automatic weighing ~~(Procedure 1 or Procedure 2)~~ shall be used ~~in the following cases:~~

~~1. P~~ on projects with contract quantities of asphalt mixtures totaling 10,000 tons (10,000 Mg) or more~~.~~

~~2. Projects with contract quantities of~~ ; or aggregates totaling 10,000 tons (10,000 Mg) or more from a single source.

~~When the item quantity for asphalt mixtures or any aggregate is in tons (megagrams) and measurement is by weight (mass), this paragraph specifies additional requirements and conditions for two measurement procedures.~~

A. ~~Procedure 1~~ Automatic Weighing.
The weighing equipment shall be self balancing and shall include an automatic weight (mass) recorder. All tickets shall be printed automatically with net weight (mass) and all weights (mass) needed to determine total net weight (mass).

B. ~~Procedure 2~~ Semi Automatic Weighing.
The weighing equipment may be self balancing or manually balanced. Equipment shall include an automatic weight (mass) recorder which will not print until the equipment is balanced, and which prints the gross weight (mass) or the batch weights (mass) and number of batches. For weigh hoppers, the printout shall include the empty weight (mass) after each discharge.

For measurement of asphalt binders by tank stick or in-line flow meter, the Contractor shall meet the requirements of Materials I.M. 509 for calibration and measurement.

For asphalt mixtures, the Contractor shall furnish to the Engineer each day, a total quantity of mixture used for the project. The Contractor shall furnish daily totals to the Engineer for all mixture quantities produced and not incorporated into the project. This total shall also identify the quantity of asphalt binder used but not incorporated.

2121.07, B, Type B Granular Shoulders

Add as new third sentence.
If a fillet is placed, the minimum width of the fillet shall be 1 foot (300 mm) per 1 inch (25 mm) of HMA resurfacing completed.

Replace the sixth sentence.
The Engineer may modify this requirement for ~~unusual~~ narrow shoulders and other justifiable conditions.

2122.04, Preparation of Shoulder Area

Replace “Article 2303.03, C” with “Article 2303.03, D” in the second paragraph.

2213.07, Preparation of Subgrade

Replace “Article 2303.03, A, 2” with “Article 2303.03, B, 2” in the second indented paragraph.

2213.08, A, HMA Base Widening

Replace "Article 2303.03, D" with "Article 2303.03, E" in the third paragraph.

Replace the second sentence of the fifth paragraph:

Density samples shall be taken from the compacted material and tested in accordance with Article ~~2303.03, D, except that samples will be randomly located transversely from within 1 inch (25 mm) of the base being widened to 6 inches (150 mm) from the outside edge of a given pass of the placing equipment~~ 2303.04.

2213.09, Limitation of Operations

Replace "Article 2303.03, C" with "Article 2303.03, D" in the fourth paragraph.

2309.02, E, Compaction of Mixture

Replace "Article 2303.03, D, 2" with "Article 2303.03, E, 2" in the article.

2309.02, F, Joints

Replace "Article 2303.03, D, 3" with "Article 2303.03, E, 3" in the article.

2309.03, Limitations

Replace "Article 2303.03, C" with "Article 2303.03, D" in the article.

2310.03, C, 2, a, Hot Mix Asphalt Stress Relief Course

Replace "Article 2303.03, D" with "Article 2303.03, E" in the article.

2316.05, A, 2, Hot Mix Asphalt Pavements

Replace "Article 2303.03, A, 2" with "Article 2303.03, B, 2" in the second paragraph.

2517.03, B, HMA Paving Projects

Replace "Article 2303.03, C" with "Article 2303.03, D" in the first sentence of the article.

Replace "Article 2303.03, D" with "Article 2303.03, E" in the second sentence of the article.

Delete Standard Notes 223-3 and 223-5.

Clarify use for Standard Note 223-4. Recommend deleting if not used for other than Type B Granular Shoulders.

Comments: The Office of Materials explained the changes to the moving average that were requested. "A mandatory plant shutdown for failure to maintain the average within the production tolerance" is basically defined later in the article, as "One moving average point for laboratory air voids outside the specification tolerance limit shall be cease to cease operations." The industry asked that moving average be restarted when a significant mix design change is made. A significant mix design change is defined in Article 2303.04, B, 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." The industry did state that they would respect whatever discussion the Specification Committee made. The District Materials Engineers requested the requirement "or when approved by the District Materials Engineer". The Specifications Committee believes this has evolved and was needed when the process was just starting, but now mix designers and the technician are far more educated about the entire process so there is very rarely a problem. A significant mix design change can be made and still be within the moving average and not cause a restart. Each situation is so unique that are no written guidelines. The Specification Committee agreed to delete both proposed phrases.

The Specification Committee asked that the friction aggregate classification be rewritten to make the exact requirements clearer. The three paragraphs were rewritten after the meeting by the Office of Materials, District 2 Materials Engineer, and the Specification Section.

Specification Section Recommended Text: See Member's Requested Change.

Comments: Specifications Section participated in the review team for this item.

Member's Requested Change (Redline/Strikeout):

Section 2303. Hot Mix Asphalt Mixtures.

2303.01 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.

Quality Management - Asphalt (QM-A) shall apply to contracts with HMA quantities of 5000 tons (5000 Mg) or greater and all Interstate contracts. The Contractor shall follow the procedures and meet the criteria established in Article 2303.02, Section 2521, and Materials I.M. 510 and 511.

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.

2303.02 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.

B. Aggregates.

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

VIRGIN MINERAL AGGREGATES		
Mixture	**Aggr. Type**	**Aggregate Requirements**
Base	Type B	Section 4126(1) & 4127
Intermediate and Surface	Type B	Section 4126
Intermediate and Surface	Type A	Section 4127
(1)When the size of the mixture is not specified, 1/2 inch (12.5 mm) shall be used.		

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 ~~a~~ sources identified in Materials I.M. T203 ~~as having the specified frictional classification. The aggregate retained on the No.4 (4.75 mm) sieve shall meet or exceed the following amount for each classification:~~.

~~FRICTION AGGREGATE CLASSIFICATION~~			
~~Friction Level~~	~~Type 2~~	~~Type 3~~	~~Type 4~~
~~L-2~~	~~25%~~		~~80%~~
~~L-3~~		~~45%(1)~~	~~80%~~
~~L-4~~			~~50%~~
~~(1) A minimum of 30% of Type 2 friction aggregate may be substituted for the Type 3 aggregate.~~			

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% 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% shall be Type 3 or better friction aggregate. If Type 2 is used in place of Type 3, the minimum shall be 30%.

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.
RAP shall be from a source designated in the contract documents, a certified stockpile, or unclassified RAP furnished by the Contractor subject to the following limitations:

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.

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 (%)					
Mixture Size	**Aggr. 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 ~~O~~on Interstate projects, the Contractor has the option to substitute ~~a Type A~~ the mainline intermediate or surface mixture for a specified ~~Type B~~ base mixture ~~for the outside shoulder~~ 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.

~~The HMA mixture designed shall meet gyratory design and mixture criteria corresponding to the size of the mixture and the 20 year design traffic level (ESALs) for the project or an appropriate design level as specified in the contract documents. Shoulders placed as a separate operation shall be designed for less than 300,000 ESALs.~~

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

On 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), hydrated lime will be required in the affected intermediate and surface course mixture.

On Primary highways other than Interstate 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, hydrated lime will be required in the affected mixtures requiring Type A aggregate.

Hydrated lime will not be required for base repair, patching, or temporary pavement.

When hydrated lime is required based on aggregate source, the Contractor may arrange for Superpave 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 indicate more than 80% tensile strength retained (TSR), hydrated lime will not be required. Confirmation of AASHTO T 283 test results will be completed by the Central Materials Laboratory during placement of the test strip.

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

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

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 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.

~~When the plant is completely assembled and before any mixture is produced,~~ ~~e~~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.

~~Each plant scale and metering system shall be calibrated before work on a contract begins. 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 curves shall be available in the plant laboratory.~~ ~~New calibration curves shall be made each time there is a change in size or source of any aggregate being used.~~ ~~On all plants, aggregate samples shall be taken in accordance with Materials I.M. 204 to determine that materials are being proportioned in accordance with the specifications.~~

2. Paver.
Article 2001.19 shall apply. ~~When placing paved shoulders, spreaders described in Article 2001.13, D, may be used for all but the top lift.~~ Spreaders, as described in Article 2001.13, D, 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.

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, 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, shall be used.

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

2303.03 CONSTRUCTION.

~~1~~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.

~~A~~B. ~~Surface~~ Preparation of Existing Surfaces.

1. Cleaning.
The existing surface shall be cleaned and prepared in accordance with ~~Section~~ Article 2212.04, A.

~~**1. 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 self imposed limit, the Contracting Authority will pay repair costs set by the Engineer, representing an increase in cost of repair of damage, if any, caused by such traffic.~~

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, in accordance with Article 2001.12, on the area to be covered~~, and~~. ~~u~~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 shall be adequately cured prior to placement of the HMA.~~ 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. ~~If the tack coat surface becomes dirty from weather or traffic, the surface shall be thoroughly cleaned and, if necessary, retacked.~~

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.

~~BC~~. 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 be heated according to the suppliers recommendations.

c. Handling Hydrated Lime.
The lime must be accurately proportioned by a method acceptable to the Engineer.

1) Hydrated Lime 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:

a) Added to the virgin aggregate on the primary feed belt, as a lime water slurry.
b) Thoroughly mixed with the total combined aggregate if the aggregate contains at least 3% total moisture.
c) 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 augering.

2) Hydrated Lime 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:

a) Placed on the recycle belt which leads directly into the weigh hopper.
b) Added directly into the pugmill.
c) 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.

When any of the above methods for a batch plant is used, the hydrated lime will be considered part of the JMF.

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.

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.

~~C~~D. Placement.
~~The existing surface and t~~ The surface of each layer shall be cleaned in accordance with Article 2212.04, A ~~and free from foreign matter when each succeeding layer is placed. Any surface which becomes dirty shall be cleaned by the Contractor~~ 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 (60-80)	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 ~~slowed as necessary to provide~~ 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 ~~is three times the designated mix size~~ shall be based on the following:

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

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.

~~When placing two adjacent lanes, not more than one normal day's run shall be made on one side before the adjacent side or pass is completed. At the close of each working day, the roadbed shall be free of any construction equipment. The Contractor shall not spread more mixture than can be compacted and finished in daylight hours of the same working day.~~

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.

When placing two adjacent lanes, not more than 1 1/2 days of rated plant production capacity shall be paved in a lane before the adjacent lane(s) is paved. 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, safety fillets or full width granular shoulders shall be placed in accordance with Article 2121.07, B. The material shall be placed adjacent to and equal in thickness to the resurfacing.

~~D~~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

~~resurfacing~~ paved shoulders, temporary crossovers, ~~runarounds~~ onsite detours, and for other situations where Class I is not specified.

For Class I compaction, the roadway density (percent of laboratory density) will be based on the density obtained from the Quality Control Program for that day's mixture.

1. Class I Compaction.

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 ~~HMA course~~ 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. ~~Rolling Patterns~~ Test Strip Construction for Class IA and IB Compaction.
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, 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. ~~This will be paid for at the contract unit price for the surface mix.~~ The test strip shall be applied to each mixture which has a plan quantity of at least ~~1500~~ 3000 tons (~~1500~~ 3000 Mg).

The quantity of HMA mixture subject to Class IA compaction, produced and placed for test strip production, will be limited to ~~500~~ 750 tons (~~500~~ 750 Mg) for lift thicknesses of 2 inches (50 mm) or less, and ~~750~~ 1000 tons (~~750~~ 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 ~~successful~~ 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 verify mixture design and effectiveness of compaction procedures.

The test strip production control shall meet the requirements of Article 2303.04, 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.

2. 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~~, and~~ 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.

~~3F~~. 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). ~~Transverse construction joints in succeeding courses shall be separated by not less than 6 feet (1.6 m).~~ 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. ~~At transverse joints, the cold mixture of the layer shall be sawed to a straight line at right angles to the center line so that a full thickness, a true surface, and a vertical edge will be provided.~~

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 ~~at end-of-day's run transverse joints~~ to prevent adhesion. Sand, dirt, or wood shall not be used for this purpose. ~~Use of wood or metal headers to form the edge of the joint during rolling of the fresh mixture will not be permitted.~~

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.

~~When temporary transverse construction joints will be~~ 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.

~~E~~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. 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 ~~insofar as~~ 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, catch basins, valve holes, 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. 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. The Engineer may approve other equipment for placement of fillets, based on a demonstration of satisfactory results.

~~**F. Limitations.**~~
~~Headers, when required to end paving for winter shutdown, shall be located adjacent to each other. A winter shutdown runout of 50 feet (15 m) in length per 1 inch (25 mm) of lift thickness shall be installed. The runout shall be removed before commencement of paving and shall be incidental to HMA.~~

2303.04 QUALITY CONTROL 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 according to Section 2521 will be required. 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 ~~aggregate~~ material into the mix.

1. Sampling and Testing.
Aggregate gradation control shall be based on cold feed gradation.

Aggregate samples shall be taken in accordance with Materials I.M. 204 to determine that materials are being proportioned in accordance with the specifications.

The hot HMA mixture shall be sampled, at random, from the roadway, behind the paver, prior to compaction, in accordance with Materials I.M. 322.

Each day's production shall be considered a lot. 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 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 samples required for a day's production will not exceed four.

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.

Each production sample shall be tested 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.

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 ~~single~~ 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 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 (~~1~~2)
Daily asphalt binder content	by JMF	± 0.3
Field laboratory air voids	4.0 (~~2~~3)	-0.5/+1.0 (~~3~~4)
VMA (~~4~~5)	by JMF	± 1.0 (~~5~~6)

(1)- Based on single test unless otherwise noted.

(~~1~~2)- The filler/bitumen ratio of the plant produced mixture will be maintained between 0.6 and 1.4.

(~~2~~3)- Unless otherwise specified.

(~~3~~4)- Based on the moving average of four test values.

(~~4~~5)- Restricted to an asphalt film thickness as specified for the level of HMA mixture.

(~~5~~6)- 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.

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 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, when a significant mix change is made, or when approved by the District Materials Engineer. Control charts shall include a target value and specification tolerances. ~~As a minimum, the following values shall be plotted on Iowa DOT Materials approved control charts as indicated below:~~

~~Laboratory density (each point being an average of two specimens).~~
~~Laboratory air voids (plotted to nearest 0.1%)~~
~~Asphalt binder content (plotted to nearest 0.1%)~~
~~Cold feed gradation (No. 4, No. 8, No. 30, and No. 200 (4.75 mm, 2.36 mm, 600 µm, and 75 µm sieves))~~
~~Maximum specific gravity (Rice) (Materials I.M. 350).~~

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. Density.
Density samples 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. ~~When the day's operation is 2500 square yards (2500 m^2) or less, or the day's operation is 500 tons (500 Mg) or less, or when the mixture is being placed in irregular areas, or for wedge, leveling, or strengthening courses, the Engineer may waive sampling for density provided compaction has been thorough and effective.~~
The Engineer may waive sampling for density provided compaction has been thorough and effective in the following situations:

5. when the day's operation is not more than 2500 square yards (2500 m^2),
6. when the day's operation is not more than 500 tons (500 Mg),
7. when the mixture is being placed in irregular areas, or
8. when placing wedge or strengthening courses.

Seven density samples will be taken for each lot. The length laid in each lot shall be divided into seven approximately equal sections and one sample will be obtained at a random location in each section.

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, ~~or~~ from run-outs, or ~~areas adjacent to~~ from day's work joints or structures.

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

~~Quality Index (Q.I.) Density =~~ $\frac{\text{~~Average density \% - Specified density \%~~}}{\text{~~Standard deviation density \%~~}}$

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

$$QI_{Density} = \frac{(\text{Average } G_{mb})_{\text{Field Lot}} - ((\%\ \text{Density})_{\text{Specified}} \times (\text{Average } G_{mb})_{\text{Lab Lot}})}{(\text{Standard Deviation } G_{mb})_{\text{Field Lot}}}$$

where $QI_{Density}$ = 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 one of the density test values from a lot is 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. 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 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)

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

(Metric)

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

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. Smoothness
Smoothness of the surface course shall be in accordance with Section 2316.

D. Sampling and Testing.
The Contractor shall calibrate and correlate the testing equipment with prescribed procedures. Sampling and testing shall conform with specified testing procedures as listed in the applicable Materials I.M. and ~~applicable~~ Specifications. When the results from a lab are used for product acceptance, the lab shall be qualified.

All samples shall be identified, stored and retained by the Contractor for the Contracting Authority until the lot is accepted. The Contracting Authority may acquire these samples for comparative, verification, or assurance testing.

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

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

Samples of loose HMA mixture shall be taken in accordance with Materials I.M. 322, weigh at least 60 pounds (28 kg), and shall be transported to the test facility in a way to retain heat to facilitate sample splitting procedures. The tests for mixture properties shall be conducted on representative portions of the mix, split from the larger sample of mix. After splitting of the sample is completed in the Contractor's QM-A laboratory, the remainder of the sample, approximately 30 pounds (15 kg), shall be retained for laboratory testing by the laboratory designated by the Contracting Authority.

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

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 a daily summary sheet approved by the Contracting Authority. The Daily Quality Control Summary Sheet shall also include a description of quality control actions taken (adjustment of cold feed percentages, changes in JMF, etc.). The Contractor shall FAX, or by other method approved by the Engineer, the daily quality control summary sheet to the ~~appropriate Iowa DOT District Materials Engineer or~~ 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.

2. ~~Finished Pavement Requirements~~ Compacted Pavement Cores.
The Contractor shall cut samples from any course or finished pavement 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 shall be identified and delivered to the Contractor's quality control field laboratory.

The compacted HMA pavement shall be tested by Contractor's personnel who are Iowa DOT Certified in QM-A bituminous quality control.

The minimum number of cores taken shall be in accordance with the following Materials I.M. 204, Appendix G.

The core locations will be determined by the Engineer.

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

3. Acceptance, Correlation, and Quality Assurance Testing.
The Contractor's quality control test results will be compared and correlated to the Engineer's test results on a regular basis using guidelines and tolerances set forth in Materials I.M. 208, Appendix C; 216; and 511.

If satisfactory correlation exists between the Contractor's test results and the Engineer tests, the Contractor's results will be used. Disputes between the Contractor's and Engineer's test results, on one sample or one test of one sample, will be resolved ~~by repeated testing of the same sample or additional testing of another sample. When repeated and/or additional sampling fails to resolve a dispute, a third materials laboratory designated by the Contracting Authority will act as a reference laboratory and perform additional testing as necessary to resolve the dispute.~~ in accordance with Materials I.M. 511.

The Engineer will select, at random, a split portion of one or more of the daily hot mix production samples. Some or all of the samples selected will be tested in the materials laboratory designated by the Engineer. The Engineer will test as many of the samples as necessary to establish a correlation.

The Engineer will select one daily set of cores at random each week. These will be tested at the materials laboratory designated by the Engineer. Cores from the initial production will also be tested by the Contractor and the Engineer for correlation and validation of results.

2303.05 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 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.

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. 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 2303.04, 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. Hydrated Lime.
Hydrated lime incorporated in HMA mixtures ~~shall be considered incidental to HMA and~~ will not be measured separately. The quantity will be based on tons (megagrams) of HMA mixture with hydrated lime 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 2303.04 D, or required elsewhere in the contract documents, will not be individually counted for payment.

2303.06 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 hydrated lime, 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.

B. 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 for the quality index for 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.	

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 Samples ~~(1)~~	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.

B. Asphalt Binder.
For the number of tons (megagrams) of asphalt binder used in the work, measured as provided in Article 2303.05, 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. Hydrated Lime.
For the quantity of each HMA mixture with hydrated lime, the Contractor will be paid the predetermined contract unit price per ton (megagram) of HMA mixture for designing, adding, and testing of the hydrated lime.

~~D~~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.

~~E~~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.

~~F~~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 2303.04, D.

2001.07, B, Special Procedures for Asphalt Mixtures and Aggregate.

Replace the title and entire article.

Special Procedures for Asphalt Mixtures~~, and~~ Aggregate, and Binders.
Automatic or semi automatic weighing ~~(Procedure 1 or Procedure 2)~~ shall be used ~~in the following cases:~~

~~1. P~~ on projects with contract quantities of asphalt mixtures totaling 10,000 tons (10,000 Mg) or more~~.~~

~~2. Projects with contract quantities of~~ ; or aggregates totaling 10,000 tons (10,000 Mg) or more from a single source.

~~When the item quantity for asphalt mixtures or any aggregate is in tons (megagrams) and measurement is by weight (mass), this paragraph specifies additional requirements and conditions for two measurement procedures.~~

A. ~~Procedure 1~~ Automatic Weighing.
The weighing equipment shall be self balancing and shall include an automatic weight (mass) recorder. All tickets shall be printed automatically with net weight (mass) and all weights (mass) needed to determine total net weight (mass).

B. ~~Procedure 2~~ Semi Automatic Weighing.
The weighing equipment may be self balancing or manually balanced. Equipment shall include an automatic weight (mass) recorder which will not print until the equipment is balanced, and which prints the gross weight (mass) or the batch weights (mass) and number of batches. For weigh hoppers, the printout shall include the empty weight (mass) after each discharge.

For measurement of asphalt binders by tank stick or in-line flow meter, the Contractor shall meet the requirements of Materials I.M. 509 for calibration and measurement.

For asphalt mixtures, the Contractor shall furnish to the Engineer each day, a total quantity of mixture used for the project. The Contractor shall furnish daily totals to the Engineer for all mixture quantities produced and not incorporated into the project. This total shall also identify the quantity of asphalt binder used but not incorporated.

2121.07, B, Type B Granular Shoulders

Add as new third sentence.
If a fillet is placed, the minimum width of the fillet shall be 1 foot (300 mm) per 1 inch (25 mm) of HMA resurfacing completed.

Replace the sixth sentence.
The Engineer may modify this requirement for ~~unusual~~ narrow shoulders and other justifiable conditions.

2122.04, Preparation of Shoulder Area

Replace “Article 2303.03, C” with “Article 2303.03, D” in the second paragraph.

2213.07, Preparation of Subgrade

Replace "Article 2303.03, A, 2" with "Article 2303.03, B, 2" in the second indented paragraph.

2213.08, A, HMA Base Widening

Replace "Article 2303.03, D" with "Article 2303.03, E" in the third paragraph.

Replace the second sentence of the fifth paragraph:

Density samples shall be taken from the compacted material and tested in accordance with Article ~~2303.03, D, except that samples will be randomly located transversely from within 1 inch (25 mm) of the base being widened to 6 inches (150 mm) from the outside edge of a given pass of the placing equipment~~ 2303.04.

2213.09, Limitation of Operations

Replace "Article 2303.03, C" with "Article 2303.03, D" in the fourth paragraph.

2309.02, E, Compaction of Mixture

Replace "Article 2303.03, D, 2" with "Article 2303.03, E, 2" in the article.

2309.02, F, Joints

Replace "Article 2303.03, D, 3" with "Article 2303.03, E, 3" in the article.

2309.03, Limitations

Replace "Article 2303.03, C" with "Article 2303.03, D" in the article.

2310.03, C, 2, a, Hot Mix Asphalt Stress Relief Course

Replace "Article 2303.03, D" with "Article 2303.03, E" in the article.

2316.05, A, 2, Hot Mix Asphalt Pavements

Replace "Article 2303.03, A, 2" with "Article 2303.03, B, 2" in the second paragraph.

2517.03, B, HMA Paving Projects

Replace "Article 2303.03, C" with "Article 2303.03, D" in the first sentence of the article.

Replace "Article 2303.03, D" with "Article 2303.03, E" in the second sentence of the article.

Delete Standard Notes 223-3 and 223-5.

Clarify use for Standard Note 223-4. Recommend deleting if not used for other than Type B Granular Shoulders.

Reason for Revision: To clarify and update the specifications based on current practices. This task was identified, assigned, and reviewed by the QMA Steering Committee. Task was completed by DOT, industry, and local agency representatives.

County or City Input Needed (X one)	**Yes** X	**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 3**
Submittal Date: 4-19-04	**Proposed Effective Date:** 10-19-04	
Article No.: 2316 **Title:** Pavement Smoothness	**Other:**	

Specification Committee Action:			
Deferred:	**Not Approved:**	**Approved Date:** 5-13-04	**Effective Date:** 10-19-04

Specification Committee Approved Text:

1102.17, F, Post Construction Requirements.

Replace "penalty" with "price adjustment" in the second sentence of the second paragraph.

Replace "penalty" with "price adjustment" in the third sentence of the second paragraph.

Replace "penalty" with "price adjustment" in the fourth paragraph.

2316.02, Measurement.

Replace the second sentence of the fourth paragraph:

The profilogram shall include the ~~15~~ 16 feet (5 m) ~~at~~ beyond the ends of the section.

2316.04, A, Pavement.

Replace the first paragraph:

A profile index shall be calculated for each segment from the profilogram in accordance with Materials I.M. 341 except for:

1. Side road connections less than 600 feet (180 m) in length.
2. Single lift pavement overlays 2 inches (50 mm) or less in thickness unless the existing surface has been corrected by milling or scarification.
3. Storage lanes and turn lanes.
4. Pavement less than 8.5 feet (2.6 m) in width.
5. The ~~15~~ 16 feet (5 m) at the ends of the section when the Contractor is not responsible for the adjoining surface.
6. Runout tapers on HMA overlays at existing pavement, bridges, or bridge approach sections when the thickness is less than the design thickness.

2316.06, A, Bumps.

Replace the first paragraph:

For all pavements evaluated under Schedule A, all bumps exceeding 0.5 inch (13 mm) within a 25 foot (7.6 m) span, as indicated on the profilogram, shall be corrected except as stated in Article 2316.06, C. On all pavements evaluated under Schedule B the bumps shall be corrected except when otherwise allowed by the Engineer and as stated in Article 2316.06, C.

Replace the second sentence of the second paragraph:

For all bumps under Schedule B not corrected, the Contractor will be assessed a ~~penalty~~ price adjustment for each bump over 0.5 inch (13 mm) except ~~when located within 15 feet (5 m) of the end of the section or taper where the Contractor is not responsible for the adjoining pavement~~ as stated in Article 2316.06, C.

Replace "penalty" with "price adjustment" in the third paragraph.

2316.06, B, Dips.

Replace the second sentence of the first paragraph:

The Contractor will be assessed a ~~penalty~~ price adjustment for dips of 0.5 inch to 1.0 inch (13 mm to 25 mm) that are not corrected except ~~when located within 15 feet (5 m) of the end of the section or taper where the Contractor is not responsible for the adjoining pavement~~ as stated in Article 2316.06, C.

Replace "penalty" with "price adjustment" in the second paragraph.

2316.06, C, Exceptions.

Add new article:

When the Contractor is not responsible for the adjoining pavement, bumps and dips exceeding 0.5 inches (13 mm) located within 16 feet (5 m) either side of the end of a section will be evaluated by the Engineer. The Contractor will not be price adjusted for bumps and dips in this area. When instructed by the Engineer, the Contractor will be paid to repair these bumps and dips in accordance with Article 1109.03, B.

2316.08, Schedule of Payment.

Replace the fourth paragraph:

Surface correction (grinding) of bridge approach sections~~,~~ and as stated in Article 2316.06, C, will not count as surface correction on adjacent pavement segments and will not detract from possible incentive payments on those segments.

Replace the sixth paragraph:

A $900 price ~~reduction~~ adjustment shall be assessed for each dip not corrected in each pavement lane under Schedule A and B except as stated in Article 2316.06, C. In addition, a $900 price ~~reduction~~ adjustment will be assessed for each bump not corrected under Schedule B except as stated in Article 2316.06, C. Bumps and dips not corrected will also be included in the evaluation for the segment smoothness.

2505.05, Limitations

Replace the fifth paragraph:

On a roadway that is open to traffic during guardrail construction, each guardrail installation exceeding the 5 working day completion requirement will be subject to a ~~penalty of~~ $100 per working day contract price adjustment.

Comments: The terms "penalty" and "penalize" should not be used in most cases. Penalties can not be collected in court, but damages can be. The Specification Committee asked the Specification Section to review the entire book for correct terminology usage. The additional changes are a result of that search.

Specification Section Recommended Text:

2316.02, Measurement.

Replace the second sentence of the fourth paragraph:

The profilogram shall include the ~~15~~ 16 feet (5 m) ~~at~~ beyond the ends of the section.

2316.04, A, Pavement.

Replace the first paragraph:

A profile index shall be calculated for each segment from the profilogram in accordance with Materials I.M. 341 except for:

1. Side road connections less than 600 feet (180 m) in length.
2. Single lift pavement overlays 2 inches (50 mm) or less in thickness unless the existing surface has been corrected by milling or scarification.
3. Storage lanes and turn lanes.
4. Pavement less than 8.5 feet (2.6 m) in width.
5. The ~~15~~ 16 feet (5 m) ~~at~~ beyond the ends of the section when the Contractor is not responsible for the adjoining surface.

6. Runout tapers on HMA overlays at existing pavement, bridges, or bridge approach sections when the thickness is less than the design thickness.

2316.06, A, Bumps.

Replace the first paragraph:

For all pavements evaluated under Schedule A, all bumps exceeding 0.5 inch (13 mm) within a 25 foot (7.6 m) span, as indicated on the profilogram, shall be corrected except as stated in Article 2316.06, C. On all pavements evaluated under Schedule B the bumps shall be corrected except when otherwise allowed by the Engineer and as stated in Article 2316.06, C.

Replace the second sentence of the second paragraph:

For all bumps under Schedule B not corrected, the Contractor will be assessed a penalty for each bump over 0.5 inch (13 mm) except ~~when located within 15 feet (5 m) of the end of the section or taper where the Contractor is not responsible for the adjoining pavement~~ as stated in Article 2316.06, C.

2316.06, B, Dips.

Replace the second sentence of the first paragraph:

The Contractor will be assessed a penalty for dips of 0.5 inch to 1.0 inch (13 mm to 25 mm) that are not corrected except ~~when located within 15 feet (5 m) of the end of the section or taper where the Contractor is not responsible for the adjoining pavement~~ as stated in Article 2316.06, C.

2316.06, C, Exceptions.

Add new article:

When the Contractor is not responsible for the adjoining pavement, bumps and dips exceeding 0.5 inches (13 mm) located within 16 feet (5 m) either side of the end of a section will be evaluated by the Engineer. The Contractor will not be penalized for bumps and dips in this area. When instructed by the Engineer, the Contractor will be paid to repair these bumps and dips in accordance with Article 1109.03, B.

2316.08, Schedule of Payment.

Replace the fourth paragraph:

Surface correction (grinding) of bridge approach sections, except as stated in Article 2316.06, C, will not count as surface correction on adjacent pavement segments and will not detract from possible incentive payments on those segments.

Replace the sixth paragraph:

A $900 price reduction shall be assessed for each dip not corrected in each pavement lane under Schedule A and B except as stated in Article 2316.06, C. In addition, a $900 price reduction will be assessed for each bump not corrected under Schedule B except as stated in Article 2316.06, C. Bumps and dips not corrected will also be included in the evaluation for the segment smoothness.

Comments:

Member's Requested Change (Redline/Strikeout):

2316.01 GENERAL.

Pavement smoothness shall be evaluated for all Interstate and Primary main line pavement surfaces, and all other road surfaces included on Primary projects, except when specifically excluded by the contract documents. Pavement smoothness shall not be evaluated for all other roads unless specified in the contract documents. Main line pavement is defined as all permanent pavement for traffic lanes, including tapers to parallel lanes or through lanes at intersections, tapers to climbing lanes, and tapers to ramps and loops. Pavement smoothness shall also be evaluated for all interchange ramps and loops.

If this specification is required by contract documents on non-Primary projects let by the Department, it will be added in its entirety. Selected portions of the specification will not be deleted.

Bridge approach sections which are a part of the paving contract will be tested for smoothness.

A. Smoothness Requirements.

The following shall apply to all Interstate and Primary projects, and to non-Primary projects when specified.

Smoothness requirements in inches per mile (millimeters per kilometer) are listed in Schedules A and B. On lanes over 8.5 feet (2.6 m) in width, for through traffic which requires matching the surface of the new pavement to the surface of an existing old pavement, an Average Base Index (ABI) will be calculated as shown below; this will be the smoothness base in inches per mile (millimeters per kilometer) for payment for the new pavement unless otherwise specified. The requirements are shown in Schedule C.

Schedule for Identification of Pavements And Bridge Approach Sections

Pavement	Schedule By Posted Speed (mph) (Existing or Proposed)	
	45 or less	**Over 45**
Mainline, curbed (one or both sides of roadway)	B	A
Mainline, not curbed	A	A
Ramps	A	A
Loops	B	B
Side Roads	B	A
Grade Separations (1)	B	A
Pavement adjacent to existing pavement (added lane)	C(2)	C(2)

(1) Including municipal and Secondary Roads therein.

(2) $ABI = \frac{PI + X}{2}$

Where,

PI = the profile index of the edge line of the abutting lane. If the computed ABI is less than X, use an ABI equal to X.

X = 7 inches/mile (110 mm/km) if Schedule A, or 22 inches/mile (350 mm/km) if Schedule B.

B. Exclusions.

Areas excluded from smoothness testing are crossovers, shoulders, and sections less than 50 feet (15 m) long. All excluded areas will be checked with a surface checker by the Engineer and shall not exceed 1/8 inch in 10 feet (3mm in 3 m).

2316.02 MEASUREMENT.

The Contractor shall provide and operate a California type profilograph to determine the pavement profile in accordance with Materials I.M. 341. Other types of profilographs or profilers that produce compatible results and meet the requirements of Materials I.M. 341 may be used.

When a pavement, for which smoothness is to be tested is adjacent to an existing old pavement, smoothness must also be tested on the old pavement 3 feet (1 m) from the adjacent edge for ABI calculation. Should the surface of the old pavement be specified for correction, smoothness testing for ABI calculation shall be done after correction.

All objects and foreign material on the pavement surface, including protective covers, if used, shall be removed by the Contractor prior to testing, and if appropriate, protective covers shall be properly replaced by the Contractor after testing.

A profilogram shall be made for each segment of 50 feet (15 m) or more. The profilogram shall include the 16 ~~15~~ feet (5 m) beyond ~~at~~ the ends of the section.

A. Pavements.

The pavement surface will be divided into sections that represent continuous placement. A section will terminate at a day's work joint (header), a bridge, similar interruption, or when continuous placement crosses to a section with a different smoothness designation. Sections longer than 778 feet or 0.147 miles (240 m) placed without interruption will be separated into segments of 0.1 mile (160 m). The terminating

segment may be shorter than 0.1 mile (160 m) and greater than 250 feet (80 m) and is still considered a segment. A segment is to be in only one traffic lane. Each traffic lane will be tested and evaluated separately. Gaps in otherwise continuous sections, for temporary crossings, or similar construction sequencing, will be tested, when placed, and included in the adjacent section evaluation.

B. Bridge Approach Sections.
Bridge approach sections shall be tested with the profilograph. Each lane of each approach will be an individual segment and will not be considered a part of a pavement segment, section, or project. Testing will be at the center of each traffic lane of travel.

2316.03 PROFILOGRAPH TESTING.
The Contractor shall perform testing and furnish the profilogram results to the Engineer. The testing and evaluation shall be done by a trained and certified person, and the evaluation shall be certified in accordance with Materials I.M. 341.

A. Pavements.
Each segment shall be tested and evaluated. The profile trace and index for each segment of paving shall be furnished to the Engineer by noon of the next day worked following the placement until there has been 3 consecutive days of paving where the index for all segments would result in 100% payment or better. After 3 consecutive days of paving that qualify for at least 100% payment, the profile trace and index must be furnished to the Engineer within 48 hours after each day's run. Should any following day be evaluated to receive less than 100% payment, a trace and index shall be furnished to the Engineer by noon the following day worked for each day until there has been 3 consecutive days of 100% payment or better.

For each day's run, an evaluation shall be submitted to the Engineer within 5 working days. This evaluation submittal shall include identification of segments that may qualify for less than 100% payment, segments that may qualify for incentive payment, segments to be corrected, and the section weighted average in inches per mile (millimeter per kilometer) certified smoothness testing.

The Engineer may also subject the surface to monitor testing. Any portion of the project may be tested if the Engineer determines that the Contractor certified test results are inaccurate. If they are inaccurate, the Contractor will be charged for this work at a rate of $250 per lane per mile ($150 per lane per kilometer), with a minimum charge of $500. In addition, furnishing inaccurate test results could result in decertification.

B. Bridge Approach Sections.
Bridge approach sections shall be tested and evaluated.

2316.04 PROFILE INDEX.

A. Pavement.
A profile index shall be calculated for each segment from the profilogram in accordance with Materials I.M. 341 except for:

1. Side road connections less than 600 feet (180 m) in length.
2. Single lift pavement overlays 2 inches (50 mm) or less in thickness unless the existing surface has been corrected by milling or scarification.
3. Storage lanes and turn lanes.
4. Pavement less than 8.5 feet (2.6 m) in width.
5 . The 16 ~~15~~ feet (5 m) at the end~~s~~ of the section when the Contractor is not responsible for the adjoining surface.
6. Runout tapers on HMA overlays at existing pavement, bridges, or bridge approach sections when the thickness is less than the design thickness.

If there is a segment of 250 feet or 0.047 mile (80 m) or less in length at the end of a section, the profilograph measurements for that segment shall be added to and included in the evaluation of the adjacent segment in that section.

Bumps and dips shall be separately identified on all profilograms. These appear as high or low points on the profilogram and correspond to high points (bumps) or low points (dips) on the pavement surface. They are

identified by locating vertical deviations exceeding 0.5 inches for a 25 foot (13 mm for a 7.6 m) span for both bumps and dips as indicated on the profilogram.

B. Bridge Approach Sections.
A profile index shall be calculated for each bridge approach section in accordance with Materials I.M. 341 except for plan lengths less than 50 feet (15 m) which will be checked for bumps and dips only.

2316.05 SURFACE CORRECTION.
Surface correction for pavement smoothness may be required which includes bumps or dips. The correction shall be completed before the determination of pavement thickness.

Bump, dip, and smoothness correction work shall be for the full lane width of the paved surface.

All correction work shall be subject to the approval by the Engineer. After all required correction work is completed, the final profile index shall be determined.

A. Pavements.

1. Portland Cement Concrete Pavement.
PCC pavement surface correction shall be accomplished by grinding the pavement using a diamond grinder, by PCC resurfacing, or by replacement. Grinding and texturing equipment shall meet the requirements of Section 2532, except the cutting head shall have a minimum width of 24 inches (600 mm). Surface correction shall be performed parallel to lane lines or edge lines as directed by the Engineer and each pass shall be parallel to the previous passes. The ground surface shall be of uniform texture.

Adjacent passes shall not overlap more than 1 inch (25 mm) and they shall not have a vertical difference of more than 1/8 inch (3 mm) as measured from bottom of groove to bottom of groove. Smoothness correction shall begin and end at lines normal to the pavement lane lines or edge lines within any one corrected area. The grinding shall proceed from the center line or lane line toward the pavement edge to maintain pavement cross slope.

2. Hot Mix Asphalt Pavements.
For asphalt pavements, the surface correction shall be accomplished by diamond grinding, by overlaying the area, by replacing the area, or by inlaying the area.

If the surface is corrected by diamond grinding, the work and equipment shall be the same as specified for PCC pavement except that the ground surface shall be covered with a seal coat as described in Article 2303.03, A, 2, for a runout.

If the surface is corrected by overlay, replacement or inlay, the surface correction shall begin and end with a transverse saw cut normal to the pavement lane lines or edge lines within any one area. Profile of surface must be smooth with no bumps or dips at beginning or end of correction. Overlay correction must be for the entire pavement width. Pavement cross slope must be maintained through the corrected areas.

B. Bridge Approach Sections.
Surface correction of bridge approach sections shall be accomplished by grinding or other approved methods. This work shall be as identified in Section 2532.

The area requiring correction shall be ground full lane width.

2316.06 BUMPS AND DIPS.
Bumps and dips, including those at headers, on all pavements for which pavement smoothness is designated shall be evaluated. Correction work will be required in accordance with the following criteria and in areas excluded from profilograph testing, for deviations exceeding 1/8 inch in 10 feet (3 mm in 3 m).

A. Bumps.
For all pavements evaluated under Schedule A, all bumps exceeding 0.5 inch (13 mm) within a 25 foot (7.6 m) span, as indicated on the profilogram, shall be corrected with the exception of those in C below. On all pavements evaluated under Schedule B the bumps shall be corrected except when otherwise allowed by the Engineer and in C below.

Corrected bumps will be considered satisfactory when measurement by the profilograph shows that the bumps are 0.3 inch (8 mm) or less in a 25 foot (7.6 m) span. For all bumps under Schedule B not corrected, the Contractor will be assessed a penalty for each bump over 0.5 inch (13 mm) except as noted in C below.~~when located within 15 feet (5 m) of the end of the section or taper where the Contractor is not responsible for the adjoining pavement.~~

When a lane over 8.5 feet (2.6 m) in width, for through traffic, is constructed adjacent to an existing old pavement, bump correction or penalty to the Contractor for a bump will not apply if a bump exists at that location in the adjacent existing old pavement.

B. Dips.
On all pavements, dips of 0.5 inch to 1.0 inch (13 mm to 25 mm) in a 25 foot (7.6 m) span, as indicated on the profilogram, shall be corrected when required by the Engineer. The Contractor will be assessed a penalty for dips of 0.5 inch to 1.0 inch (13 mm to 25 mm) that are not corrected except as noted in C below. ~~when located within 15 feet (5 m) of the end of the section or taper where the Contractor is not responsible for the adjoining pavement.~~ The Contractor will be required to replace the pavement in areas with dips over 1.0 inch (25 mm). Corrected dips will be considered satisfactory when the profilogram shows the dips are less than 0.3 inch (8 mm) in a 25 foot (7.6 m) span.

When a lane over 8.5 feet (2.6 m) in width is constructed adjacent to an existing old pavement, correction of a dip or penalty to the Contractor for a dip will not be required if a dip exists at that location in the adjacent existing old pavement.

C. Exceptions.
Bumps and dips exceeding 0.5 inches (13 mm) located within 16 feet (5m) either side of the end of a section where the contractor is not responsible for the adjoining pavement will be evaluated by the engineer. There will be no penalty or cost to the contractor for repair to these bumps and dips.

2316.07 SMOOTHNESS.
The smoothness of pavements will be compensated by the addition (incentive) or the subtraction (price reduction) of a determined amount for each segment of pavement to the price bid for pavement. These amounts are identified in the appropriate schedule of Article 2316.08.

A. Pavement Where Schedule A Smoothness is Required.
For the appropriate categories of highway, as shown in Schedule A, incentives for pavement smoothness will be paid for each segment of pavement with an initial index per mile (kilometer) per segment of 3.0 inches (48 mm) or less.

A second incentive will also be paid for each segment in a section if all segments in the section qualify for 100% payment with no grinding.

If all segments in a project qualify for 100% payment with no grinding, a third incentive will be added to the amount paid per segment.

For segments with an initial index of 7.1 to 10.0 inches per mile (110.1 mm/km to 160 mm/km), the Contractor may grind the surface to a final index of 7.0 inches per mile (110 mm/km) per segment or receive a price reduction.

For segments with an index of 10.1 inches per mile (160.1 mm/km) and greater, the Contractor shall grind the surface to a final index of 7.0 inches per mile (110 mm/km) or less.

B. Pavement Where Schedule B Smoothness is Required.
For all highways, incentives for pavement smoothness will be paid for each segment of pavement with an initial index of 12 inches per mile (190 mm/km) per segment or less.

For all segments with an initial index of 22.1 to 30.0 inches per mile (350 mm/km to 470 mm/km), the Contractor may grind the surface to a final index of 22.0 inches per mile (350 mm/km) per segment or receive a price reduction.

For segments with an index of 30.1 inches per mile (470.1 mm/km) and greater, the Contractor shall grind the surface to a final index of 22.0 inches per mile (350 mm/km) or less.

C. Pavement Adjacent to Existing Pavement.
For each segment of new pavement 8.5 feet (2.6 m) or more in width, and over 600 feet (180 m) in length, which is to be matched to the surface of an existing pavement, smoothness will be evaluated by the Average Base Index (ABI) as defined in Article 2316.01, A or B.

Surface correction is required for smoothness exceeding ABI + 12 (190) when Schedule A is required and exceeding ABI + 30 (470) when Schedule B is required. Payment will be based on results after correction in accordance with Schedule C.

Areas not included in the profilograph test shall be checked longitudinally with a 10 feet (3 m) straight edge and the surface shall not deviate from a straight line by more than 1/8 inch in 10 feet (3 mm in 3 m). If correction is necessary, it shall meet requirements of Article 2316.05.

D. Bridge Approach Sections.
Where Schedule A or Schedule B smoothness is required, bridge approach sections shall be constructed to an index of not greater than 22.0 inches per mile (350 mm/km). If the original surface does not meet this criteria, the surface shall be ground to an index of 22.0 inches per mile (350 mm/km) or better.

Smoothness of bridge approach sections will not be used in the calculations for incentive or price reduction of pavement segments, sections, or the project.

2316.08 SCHEDULE OF PAYMENT.
For each traffic lane of main line pavement and each traffic lane of interchange ramps and loops evaluated for smoothness, as defined in Article 2316.01, the Engineer will determine the length of each segment in miles (kilometers).

For roadways, the Contractor may receive an incentive payment or be assessed a price reduction based on the number of qualifying segments and the initial profile index.

Pavement segments excluding repair work that are subject to profilograph testing, as defined in Article 2316.04, will be considered for additional payment as a smoothness incentive or price reduction. For a segment to be qualified for incentive, there must be no grinding within that segment.

Surface correction (grinding) of bridge approach sections and areas noted in Article 2316.06 C will not count as surface correction on adjacent pavement segments and will not detract from possible incentive payments on those segments.

Single lift pavement resurfacing 2 inches (50 mm) or more in thickness that have milling or scarification of the original pavement, shall be rated using the multi-lift schedules.

A $900 price reduction shall be assessed for each dip not corrected in each pavement lane under Schedule A and B except areas noted in Article 2316.06 C. In addition, a $900 price reduction will be assessed for each bump not corrected under Schedule B except areas noted in Article 2316.06 C. Bumps and dips not corrected will also be included in the evaluation for the segment smoothness.

Reason for Revision: HMA Industry indicated at the last APAI/IA DOT Specification meeting that some language is confusing. Entire article language is included to help the readers.

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

Industry Notified:	**Yes** X	**No**	**Industry Concurrence:**	**Yes** X	**No**
Comments: Suggested changes were sent to the industry representative who brought up the issue. His response, “It appears to be worded to clarify very well.”					

SPECIFICATION REVISION SUBMITTAL FORM

Submitted by: Jim Berger	**Office:** Materials	**Item 4**
Submittal Date: April, 2004	**Proposed Effective Date:** October 19, 2004	
Article No.: 2415.01 **Title:** Description	**Other:**	

Specification Committee Action:

Deferred:	**Not Approved:**	**Approved Date:** 5-13-04	**Effective Date:** 10-19-04

Specification Committee Approved Text:

2415.01, Description.

Replace "ASTM C 850" and "ASTM C 789" with "ASTM C 1433" in the second paragraph.

Replace the sixth sentence of the second paragraph:
Concrete strength ~~tests may~~ will be based on cylinder~~s~~ tests.

Comments: ASTM C 789 has also been discontinued and replaced by ASTM C 1433.

Specification Section Recommended Text:

2415.01, Description.

Replace "ASTM C 850" with "ASTM C 1433" in the second sentence of the second paragraph.

Replace "ASTM C 850" with "ASTM C 1433" in the third sentence of the second paragraph.

Replace the sixth sentence of the second paragraph:
Concrete strength ~~tests may~~ will be based on cylinder~~s~~ tests.

Comments:

Member's Requested Change (Redline/Strikeout):

2415.01 DESCRIPTION.
The provisions of this section shall apply to all cast-in-place concrete culverts. The requirements of Sections 2401, 2402, 2403, 2404, and 2414 shall also apply.

Precast box culverts may be accepted when shown in the contract documents. These culvert sections shall meet requirements of ASTM C 789, or if the cover is less than 2 feet (0.6 m) and the culvert is subject to highway loading, ASTM C 850. The contract documents will designate the span, rise, and either the design earth cover, as defined in ASTM C 789 or the design loading, as defined in ASTM C1433 Section 2407 shall apply to the aggregates used in the concrete. Appropriate requirements of Section 2407 shall also apply to inspection of the process of manufacture. Concrete strength shall be based on cylinder tests.

Reason for Revision: ASTM C850 has been discontinued and replaced with ASTM C1433

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

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

SPECIFICATION REVISION SUBMITTAL FORM

Submitted by: John M. Smythe	**Office:** Office of Construction	**Item 5**
Submittal Date: 4/27/04	**Proposed Effective Date:** 10/19/04	
Article No.: 2502.03, 2502.05, 2502.08 **Title:** Placing Standard Subdrains, Placing Longitudinal Subdrains, Basis of Payment	**Other:**	

Specification Committee Action:

Deferred:	**Not Approved:**	**Approved Date:** 5-13-04	**Effective Date:** 10-19-04

Specification Committee Approved Text:

2502.03, Placing Standard Subdrains.

Add new ninth paragraph:

All subdrain outlets shall be marked with a steel post. The post shall meet the requirements of Article 4154.09. The Contractor shall drive the post 3 feet (1 m) into the ground and install a 4 foot (1.1 m) plastic sleeve over the post. When sleeves are furnished by the contracting authority, the Contractor shall install them. Only one post shall be required to mark the location of a double outlet.

2502.05, Placing Longitudinal Subdrains.

Replace the last paragraph:

~~The outlet of a~~ All subdrain~~s~~ outlets shall be covered with a rodent guard described in Article 4143.01, B. ~~The outlet of a~~ All subdrain~~s~~ outlets, except for medians, shall be marked with a~~n orange metal fence~~ steel post meeting the requirements of Article 4154.09. The Contractor shall drive the post 3 feet (1 m) into the ground and install a 4 foot (1.1 m) plastic sleeve over the post. The sleeve will be furnished by the contracting authority. Only one metal fence post shall be required to mark the location of a double outlet.

2502.08, C, Subdrain Outlet.

Replace the entire article:

For each subdrain outlet installed, the Contractor will be paid the contract unit price. This payment shall be full compensation for furnishing and installing corrugated ~~culverts at outlets~~ metal pipe, double walled PE, or PVC pipe; including the outlet coverings, grouted joints and special connections, drilling or forming into an existing drainage facility, and associated excavation, backfill with specified material, furnishing and installing steel post and concrete patio block, installing plastic sleeve, and restoration of the site.

Comments: The County Engineer pointed out that not all local agencies supply the sleeves; therefore the third sentence of Article 2502.03, was changed to reflect this.

Specification Section Recommended Text:

2502.03, Placing Standard Subdrains.

Add new ninth paragraph:

All subdrain outlets shall be marked with a steel post. The post shall meet the requirements of Article 4154.09. The Contractor shall drive the post 3 feet (1 m) into the ground and install a 4 foot (1.1 m) plastic sleeve over the post. The sleeve will be furnished by the contracting authority. Only one post shall be required to mark the location of a double outlet.

2502.05, Placing Longitudinal Subdrains.

Replace the last paragraph:

~~The outlet of a~~ All subdrain~~s~~ outlets shall be covered with a rodent guard described in Article 4143.01, B. ~~The outlet of a~~ All subdrain~~s~~ outlets, except for medians, shall be marked with a~~n orange metal fence~~ steel post meeting the requirements of Article 4154.09. The Contractor shall

drive the post 3 feet (1 m) into the ground and install a 4 foot (1.1 m) plastic sleeve over the post. The sleeve will be furnished by the contracting authority. Only one metal fence post shall be required to mark the location of a double outlet.

2502.08, C, Subdrain Outlet.

Replace the entire article:

For each subdrain outlet installed, the Contractor will be paid the contract unit price. This payment shall be full compensation for furnishing and installing corrugated ~~culverts at outlets~~ metal pipe, double walled PE, or PVC pipe; including the outlet coverings, grouted joints and special connections, drilling or forming into an existing drainage facility, and associated excavation, backfill with specified material, furnishing and installing steel post and concrete patio block, installing plastic sleeve, and restoration of the site.

Comments: Article 4154.09 states "Unless otherwise specified, steel line posts shall be 7 feet (2.1 m) in length."; therefore, this information was eliminated from the request.

Member's Requested Change (Redline/Strikeout):

1. Add the following paragraph to 2502.03 Placing Standard Subdrains:

The outlet of all subdrains shall be marked with a metal fence post, 7 foot in length, meeting the requirements of Article 4154.09 that is driven into the ground three feet. The contractor shall install a 4 foot long plastic sleeve, furnished by the contracting authority, over the steel fence post. Only one metal fence post shall be required to mark the location of a double outlet.

2. Replace the last paragraph of 2502.05 Placing Longitudinal Subdrains with the following:

The outlet of all subdrains shall be covered with a rodent guard described in Article 4143.01, B. The outlet of all subdrains, except for medians, shall be marked with an ~~orange~~ metal fence post, 7 foot in length, meeting the requirements of Article 4154.09 that is driven into the ground at least three feet. The contractor shall install a 4 foot plastic sleeve, furnished by the contracting authority, over the steel fence post. Only one metal fence post shall be required to mark the location of a double outlet.

3. Make the following changes to 2502.08.C , Basis of Payment:

C. Subdrain Outlet.

For each subdrain outlet installed, the Contractor will be paid the contract unit price. This payment shall be full compensation for furnishing and installing corrugated ~~culverts at outlets~~ metal pipe, double walled PE or PVC pipe; including the outlet coverings, grouted joints and special connections, furnishing and installing steel fence post and concrete patio block, installing plastic sleeve, drilling or forming into an existing drainage facility, and associated excavation, backfill with specified material, and restoration of the site.

Reason for Revision: outlets of standard subdrains are not currently marked with a steel post; depth of embedment of steel posts is not currently specified, resulting in shallow installations; orange color requirement for steel posts is deleted as contractor will install orange plastic sleeves, furnished by the contracting authority; correct Basis of Payment to include all required work.

County or City Input Needed (X one)			**Yes**	**No**	
Comments:					
Industry Input Needed (X one)			**Yes**	**No** X	
Industry Notified:	**Yes**	**No** X	**Industry Concurrence:**	**Yes**	**No**
Comments: Received concurrence from Office of Maintenance who queried District Maintenance staff.					

SPECIFICATION REVISION SUBMITTAL FORM

Submitted by: Donna Buchwald	**Office:** Specifications	**Item 6**
Submittal Date: 4-28-04	**Proposed Effective Date:** 10-19-04	
Article No.: 2510.04, A and 2510.05, A **Title:** Removal of Pavement	**Other:**	

Specification Committee Action:

Deferred:	**Not Approved:**	**Approved Date:** 5-13-04	**Effective Date:** 10-19-04

Specification Committee Approved Text:

2510.01, Description.

Replace "and concrete curb and gutter" with "detour pavement, and integral and separate curb" in the first sentence.

2510.02, Pavement Removal.

Replace "integral curb" with "integral and separate curb" in the second sentence of the first paragraph.

2510.04, A, Removal of Pavement.

Replace the entire article:

~~For the area of pavement removed in accordance with the contract documents, in square yards (square meters), will be considered the area of removal of pavement. Additional measurement or allowance will not be made for curb above or below the pavement slab or for utility accesses, intakes, etc. within the pavement area, and integral or separate curb.~~ The quantity of Removal of Pavement will be measured in square yards (square meters). This quantity will include areas of utility accesses and intakes within the pavement area; and integral and separate curb. Removal of reinforcing steel will be incidental to removal of pavement and will not be measured for payment.

2510.05, A, Removal of Pavement.

Replace the first sentence of the first paragraph:

For the area of pavement removed ~~in accordance with the contract documents, the area shown in the contract documents,~~ measured in square yards (square meters), the Contractor will be paid ~~for~~ at the contract unit price ~~per square yard (square meter)~~ for Removal of Pavement.

Comments: The Specification Section stated that the changes were made to include detour pavement, standardize the language, and clarify the measurement requirements.

Specification Section Recommended Text:

2510.01, Description.

Replace "concrete curb and gutter" with "integral and separate curb" in the first sentence.

2510.02, Pavement Removal.

Replace "integral curb" with "integral and separate curb" in the second sentence of the first paragraph.

2510.04, A, Removal of Pavement.

Replace the entire article:

~~For the area of pavement removed in accordance with the contract documents, in square yards (square meters), will be considered the area of removal of pavement. Additional measurement or allowance will not be made for curb above or below the pavement slab or for utility accesses, intakes, etc. within the pavement area, and integral or separate curb.~~ The quantity of Removal of Pavement will be measured in square yards (square meters). This quantity will include areas of utility accesses and intakes within the pavement area; and integral and separate curb. Removal of reinforcing steel will be incidental to removal of pavement and will not be measured for payment.

2510.05, A, Removal of Pavement.

Replace the first sentence of the first paragraph:

For the area of pavement removed ~~in accordance with the contract documents, the area shown in the contract documents,~~ measured in square yards (square meters), the Contractor will be paid for at the contract unit price ~~per square yard (square meter)~~ for Removal of Pavement.

Comments:

Member's Requested Change (Redline/Strikeout):

Reason for Revision:

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

SPECIFICATION REVISION SUBMITTAL FORM

Submitted by: Jim Berger	**Office:** Materials	**Item 7**
Submittal Date: April, 2004	**Proposed Effective Date:** October 19, 2004	
Article No.: 2513.09 **Title:** Tolerances	**Other:**	

Specification Committee Action:

Deferred:	**Not Approved:**	**Approved Date:** 5-13-04	**Effective Date:** 10-19-04

Specification Committee Approved Text: See Specification Section Recommended Text.

Comments: The Specification Committee discussed the tolerances being unacceptable by today's standards. These were correct when slip-forming was beginning, with the changes in methods and improvements in operations these appear to be too loose for today's standards. The Office of Materials will review the tolerances from the other states and recommend a change to the tolerances at a later date after reviewing their proposal with the industry.

Specification Section Recommended Text:

2513.09, Tolerances.

Add new third paragraph:

Tolerances for concrete barrier shall be as follows:

Item	Precast Fabrication [(1)] (Permanent or Temporary)	Cast-in-Place or Slip Form Installation
Length	± 3/4 inch (± 19 mm)	
Width	± 1/4 inch (± 6 mm)	[(2)]
Height	± 1/4 inch (± 6 mm)	[(2)]
Horizontal Straightness (Sweep)	1/2 inch maximum in 10 feet (12 mm maximum in 3 m)	3/4 inch maximum in 10 feet (19 mm maximum in 3 m)
Top Straightness (Vertical)	1/4 inch maximum in 10 feet (6 mm maximum in 3 m)	3/4 inch maximum in 10 feet (9 mm maximum in 3 m)
Exposed Ends (Deviation form square)	± 1/4 inch (± 6 mm)	

[(1)] Installation of permanent precast barrier shall include shimming and grouting such that adjoining sections match within 1/4 inch (6 mm) on the sides and top, and the finished height is not less than required by the contract documents.

[(2)] The width and depth shall not be less than required by the contract documents.

Comments:

Member's Requested Change (Redline/Strikeout):

2513.09 TOLERANCES.
A newly fabricated unit of temporary barrier rail shall be free from honeycomb, surface spalling, and surface defects. Corner breaks and bottom spalls after shipping and placement shall not exceed 1 square foot (0.1 m^2) of total surface area, which includes the base.

Other than honeycomb, shallow voids, not exceeding 3/4 inch (19 mm) diameter, which appear on the formed surface after proper consolidation will not be considered as surface defects and need not be filled unless they appear in an abnormal concentration.

Tolerance for concrete barrier shall be as follows:

Item	Precast (1) Fabrication (Permanent or Temporary)	Cast-in-Place or Slip Form Installation
Length	± ¾"	-
Width	± ¼"	(2)
Height	± ¼"	(2)
Horizontal Straightness (Sweep)	½" Max. in 10'	¾" Max. in 10'
Top Straightness (Vertical)	¼" Max. in 10'	¾" Max in 10'
Exposed Ends (Deviation from square)	± ¼"	-

(1) Installation of permanent precast barrier shall include shimming and grouting such that adjoining sections match within ¼ inch both at the sides and at the top, and the finished height is not less than required by the contract documents.
(2) The width and depth shall not be less than required by the contract documents

A used unit of temporary barrier rail shall not have spalls, corner breaks, and bottom spalls totaling more than 5 square feet (0.5 m^2) of surface area, which includes the base.

Connecting loops on all barriers shall not be deformed and shall be true to dimensions.

Gaps between units shall not exceed the dimensions shown in the contract documents.

Reason for Revision: Need to re-instate table. The table was accidentally omitted when 2001 specs. were revised.

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