VIII. Limitations and Miscellaneous Operations

Warm Mix Asphalt

(Specification 2303)

Warm Mix Asphalt (WMA) refers to a group of technologies used to produce asphalt concrete mixtures at temperatures 50 degrees F or more below those typically used in production of HMA. Temperature reductions may be achieved through use of approved chemical additives, organic (wax-like) additives, or water injection systems. WMA technologies work to lower mix viscosity (resistance to flow), which promotes better aggregate coating during production, workability during placement, and compaction at reduced temperatures.

Advantages of using WMA

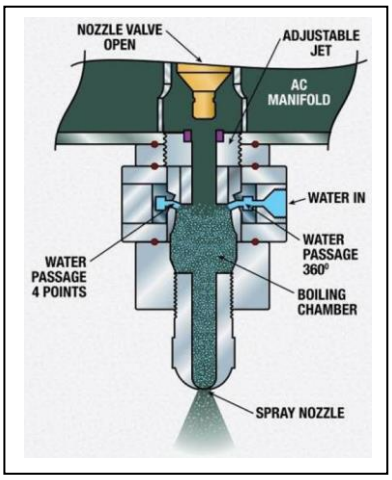
- Lower mix temperature.
- Reduced burner fuel use.
- Reduced plant emissions.
- Better working conditions, due to less heat and fumes.
- Acts as a compaction aid for stiff mixes or during cool weather.
- Increased time available to haul & compact mix.
- Less binder oxidation, leading to increased durability.

Challenges in using WMA

- Moisture control / removal issues.
  - Longer aggregate drying times.
  - Requires better stockpile management practices.
- Potential Instability / Rutting
  - Initial tenderness - may delay opening roadway to traffic.
  - Bump to stiffer binder grade to counteract.

Conditions on WMA use

- WMA (vs. HMA) use is contractor option.
- WMA system used is subject to approval.
- Specifications include lower surface, production & placement temperature requirements for WMA (vs. HMA).
- Moisture sensitivity testing requirements (same as for HMA).



Recycled Asphalt Shingles

(Specification 2303; Materials IM 505 & IM 506)

Use of ground Recycled Asphalt Shingles (RAS) in asphalt mixtures has increased dramatically in recent years, due to the rising cost of asphalt binder, the desire to reduce the volume of waste being sent to landfills, and improvements in shingle grinding / processing methods.

Advantages of using RAS

- Reduced landfilling of shingles.
- Replaces raw materials in the mix.
- Cost savings.
- Desirable materials properties.
  - High binder content (20-30%).
  - Granular coating provides good frictional properties.
  - Lime dust acts as a natural anti-strip agent.
  - Fibers promote mix flexibility.

Challenges in using RAS

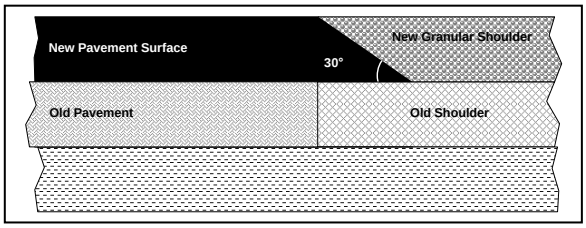
- Harder asphalt binder in RAS - may require “bumping” to lower virgin binder grade.
- “Black Rock” effect (some asphalt binder remains in solid form, with

no contribution to binder content.
- Chunks / clumping vs. fine (loose) grindings, often a result of stockpile exposure to high temperatures.
- Limited supply / suppliers for full-scale use.

Conditions on RAS use
- RAS processed from pre-consumer (factory scraps) or post-consumer (tear-off) shingles.
- RAS certified by an approved supplier (listed in *IM 506*).
- Up to 5% RAS - by total weight of aggregate in the mix.
- Two-thirds (67%) credit for asphalt binder in RAS.

RAS is often used in combination with Recycled Asphalt Pavement (RAP). In this case, the RAS replaces an equal percentage of the allowable percentage of RAP in the mix.

RAS works hand-in-hand with Warm Mix Asphalt (WMA). In this situation, the slightly "harder" binder in the RAS is offset by the somewhat "softer" binder resulting from the WMA process.



Safety Edge

(Specification 2305; Materials IM 502; Standard Road Plan PV-3)

A Safety Edge is a beveled pavement edge to help lessen the severity of roadway departures. When a driver drifts off the paved surface, the Safety Edge provides greater ease of re-entering the roadway, and reduces the risk of over-steering and subsequent loss of vehicle control.
The angle of the bevel is critical for the Safety Edge to function properly.

Measured from level, the bevel is 30 degrees. Adding in the pavement surface slope, the resultant angle is between 30 and 35 degrees.

The sloped pavement edge is produced by a “shoe” type device that attaches to the end of paver screed. The device confines the mix at the end gate and extrudes the material in a wedge shape. Approved devices are listed in *Materials IM 502*. Alternative devices may be approved by the Engineer, who may require proof that the alternative device will produce acceptable results.

A pavement section with a properly constructed Safety Edge does not require placement of a granular shoulder or temporary shoulder fillet (discussed later in this chapter) prior to opening the roadway to traffic.

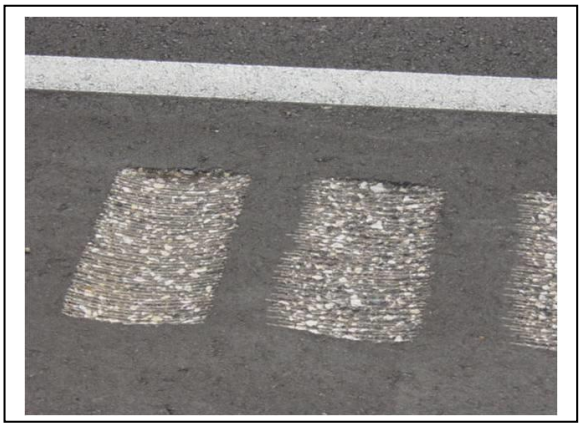
Milled Shoulder Rumble Strips

(Specifications 2308 & 2548; Construction Manual 8.61; Standard Road Plan PV-12)

Milling has become the standard method for installing rumble strips in HMA paved shoulders. The process utilizes a milling machine to produce shallow concave depressions in the HMA shoulder surface. The milled surface is then sealed with asphalt emulsion to prevent intrusion of water into the HMA shoulder.

Standard Road Plan PV-12 illustrates configurations and details for shoulder rumble strips on Interstates, Expressways, and paved shoulders of two-lane roadways. The grinding pattern itself is the same for all three

situations, utilizing a standard width, depth, and spacing. Differences lie in the distance offset from the painted edge line and the “skip” pattern specified for two-lane roadways and the outside shoulder of expressways. Grinding dimensions and alignment of the pattern should be randomly checked and adjusted, if necessary. Rumble strips are typically placed on mainline HMA shoulders only, with the pattern omitted at specified locations near intersections and ramps & loops.



Milling equipment variations can result in differences in the rumble strip construction operation. The cutting head must be capable of providing a smooth cut, without tearing or snagging the HMA pavement. Multiple cutting heads and electronic controls can speed the process and eliminate variability in milling depth and pattern.

All loose material resulting from the milling operation must be removed from the shoulder on a daily basis. Some milling machines are equipped with a vacuum system to assist in this effort. Millings may be used as fillet material adjacent to the paved shoulder, or may become property of the contractor and properly disposed of off the project. Specific plans may require the millings to be taken to a designated location.

Bituminous Fog Seal is used to coat the rumble strips and thereby reduce premature deterioration of the milled (open) surface. Undiluted asphalt emulsion is typically placed on the milled rumble strips only, unless the contract documents call for its use in sealing the entire shoulder.

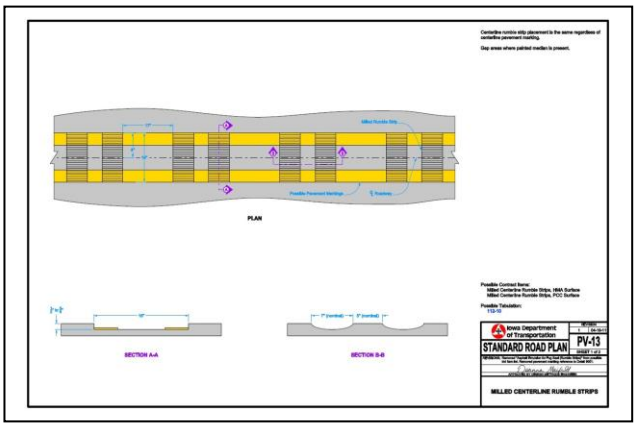
Additional equipment, material and construction requirements are included in *Specification Section 2548*, entitled "Milled Rumble Strips - HMA or PCC Surface".

Milled Centerline Rumble Strips

(Specification 2548; Construction Manual 8.62; Standard Road Plan PV-13)

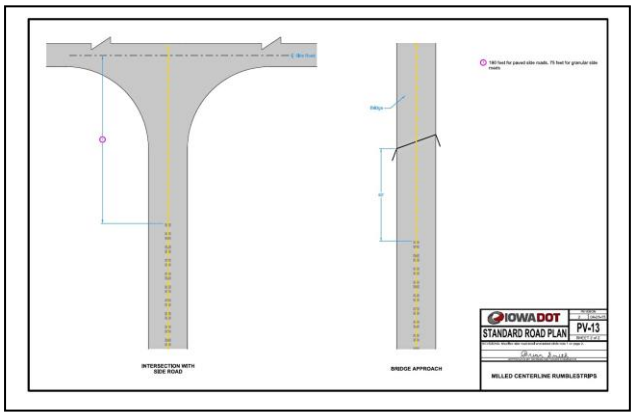
Milled centerline rumble strips are transverse concave depressions that are ground into the pavement surface, along the centerline of an undivided roadway. These devices can be installed on new or existing HMA or PCC pavements, utilizing similar milling equipment as for shoulder rumble strips. Using noise and vibrations, centerline rumble strips alert drivers whose vehicle is crossing the centerline that corrective action is needed.

A unique gapped milling pattern, consisting of skipping every third centerline cut, is used to provide a noticeable difference between the rumbling warnings of milled centerline rumble strips and milled shoulder rumble strips. Differentiating between the two is intended to break the conditioning of a driver to always veer left when traveling over rumble strips which, in the case of centerline rumble strips, would be the opposite of the desired effect.



Standard Road Plan PV-13 shows configurations and details for milled centerline rumble strips. Alignment tolerances and other requirements are contained in *Specification 2548*. Grinding dimensions and alignment of the pattern should be randomly checked

and adjusted, if necessary. Centerline rumble strips are gapped at intersections and bridge approaches, as shown on *Standard Road Plan PV-13*.



As with shoulder rumble strips, milling equipment variations can result in differences in the centerline rumble strip construction operation. The cutting head must be capable of providing a smooth cut, without tearing or snagging the HMA pavement. Multiple cutting heads and electronic controls can speed the process and eliminate variability in milling depth and pattern. Similarly, all loose material resulting from the milling operation must be removed from the pavement surface and either used as fillet material adjacent to the pavement edge or properly disposed of off the project.

Unless specified otherwise in the contract documents, centerline rumble strips are not sealed with Bituminous Fog Seal. Since centerline paint markings are subsequently placed through milled areas, there are concerns that the fog seal will prevent adequate bonding of the paint to the pavement surface.

Granular Shoulders

(Specification 2121)

Type B granular shoulders are typically specified adjacent to most HMA pavements. For resurfacing projects, additional granular material is added to existing shoulders to bring them up to the design cross section and eliminate dropoffs at the pavement edge. In some cases, earth fill is required prior to placing granular material.

Minimal surface preparation is generally required prior to placement of granular shoulder material. Existing vegetation is removed and deposited on the foreslope. Bituminous edge rut material and existing aggregate is salvaged and placed on the outer shoulder area.

Granular shoulder material is deposited directly on the shoulder for the width designated and shall not be dumped on the pavement. Blading granular material across the pavement will potentially damage / scar the surface. The aggregate is compacted with no less than four complete coverages of the entire surface with either a pneumatic tired roller or steel tired roller. One finish pass with steel roller follows. Additional moistening may be required if the aggregate is too dry to readily compact.

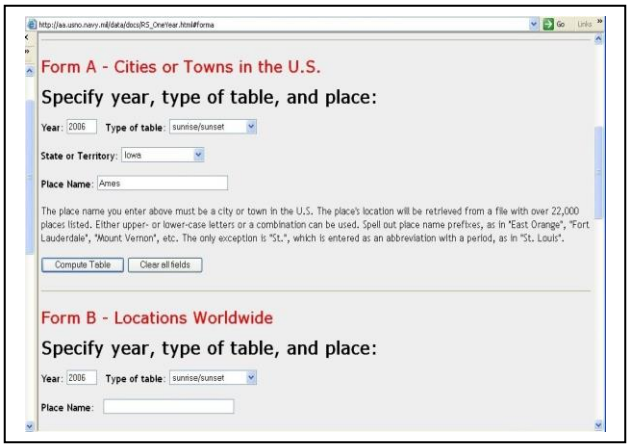
Placement of granular shoulders must be coordinated to bring up the shoulders adjacent to the paving operation before the lane may be opened to traffic. A fillet of granular material (minimum width six times the thickness of resurfacing completed) may be used to temporarily correct a drop-off created by resurfacing. Material used for the temporary fillet must be bladed across the width of the shoulder prior to placing the final layer of granular shoulder.

Public Convenience and Safety

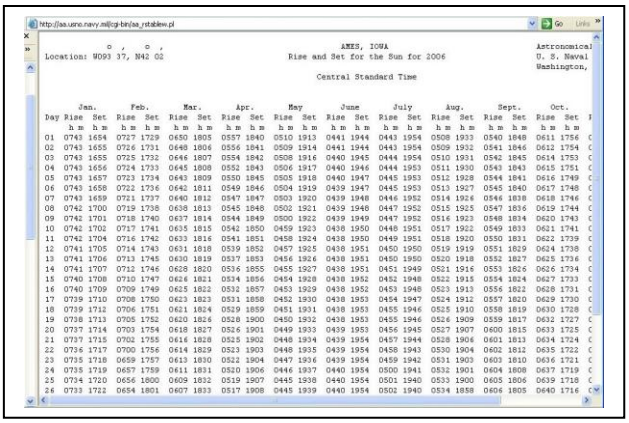
(Specification 1107.08)

When it is not practical for the Contracting Authority to close the road for construction, the contractor will be expected to perform the work under traffic. The contract documents will

indicate this fact and provide instruction on handling traffic through the work zone. If traffic is to be maintained through the project, the contractor shall conduct the work to assure the least possible obstruction to access by residents along the project, and to provide for the safety of workers and the traveling public.



Unless otherwise stated in the contract documents, all work shall be performed by the contractor between the hours of 30 minutes after sunrise and 30 minutes before sunset. Charts and tables of official daily sunrise and sunset times for locations throughout the state are readily available, and may be used as a basis in determining specification compliance.



The contractor's machines and equipment should all be in good mechanical condition. This should also include all safety guards required for the equipment. This is for the protection of workers and inspection staff in the immediate area, as well as the nearby traveling public.

The condition of the haul roads used by the contractor should also be inspected. The contractor has the responsibility to maintain dust control on these roads, and the inspector has the responsibility to assure they do so.

If any violations of the specifications or any safety problems are noticed, the inspector should notify the contractor immediately. The grade inspector should also notify the inspector in charge of the project as soon as possible.

Any violations or problems and conversations with the contractor about them should be noted in the inspector's diary.

Haul Roads

(Specifications 1105.13 & 1107.07; Construction Manual 2.12)

A haul road is the designated road on which the contractor is to haul material to the grade from the plant or supplier. There are many considerations given to a road before it is declared a haul road. The structure of the road, weight restrictions of structures, traffic signing, and other aspects are reviewed before a road is declared a haul road. An agreement is reached with the affected entity (city or county) before its roadways are used as designated haul roads.

There will be occasions when the haul road will not be the most direct route for the contractor to take and, consequently, they may want to use a different road. It is the responsibility of the both the grade inspector and plant monitor to insure the contractor is using the designated haul road. If the contractor is allowed to use different roads than those designated as haul roads, the county or city that owns the road will most likely seek damage considerations.

Specification Article 1107.07, "Safety, Health, Pollution, and Sanitation", and *Construction Manual Section 2.12* explain when and how dust control should be maintained. These items should be reviewed before operations begin.

Mat Surface Conditions

(Specification 2303.03, C, 4)

HMA mixtures shall not be placed on a wet or damp surface. An HMA overlay placed on a wet or damp surface may result in a slippage or sliding-type failure of the overlay. This failure mode, which usually shows up relatively quickly, requires removal and replacement of the affected overlay.

Clearly, HMA placement should not start if wet conditions exist or rainfall is imminent. The major issue is what to do if rain begins at some point during paving. Some contractors expect to be able to place the remaining "trucks on the road" despite wet conditions. The contractor should not be allowed to place HMA under wet or damp conditions simply because the trucks have already been loaded. Contractors must take a proactive approach in assessing the weather conditions with forecasts, radar, etc., and adjusting their operations accordingly. This includes slowing or stopping the plant as rain approaches to minimize loads arriving at the paver after rain begins.

There is still some room for judgement on the part of the field inspector. If the rain has temporarily stopped and using a broom and/or air compressor can artificially dry the surface, then waiting load(s) can be placed. This assumes the temperatures of the road surface and hot mix have remained above the respective specification minimums, the tack coat remains in place and undamaged, and that placement and compaction can take place prior to additional rains.

Surface Temperature

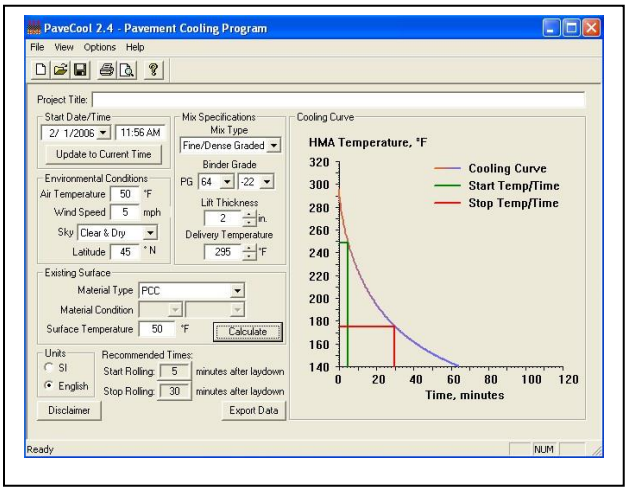
(Specification 2303.03, C, 4)

HMA mixtures shall not be placed when temperature of the shaded portion of the roadway surface is less than shown in the tables within the specification listed above. The tables provide minimum surface temperatures based on thickness and location of the lift to be placed. The project engineer may further limit placement when other conditions exist that are considered detrimental to quality work. An example of this situation is when the temperature is near the minimum and wind is significant.

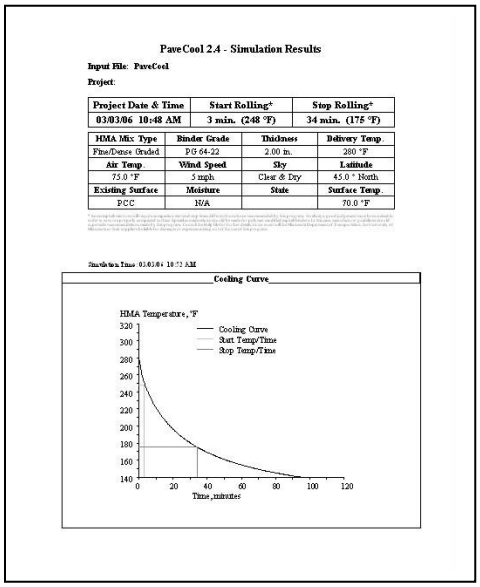
Mat Cooling

(Construction Manual Section 8.55 & Appendix 8-2; PaveCool software)

Base temperature is the single greatest factor in the rate of cool down for freshly placed HMA mat. Consequently, base temperature has direct affect on recommended minimum laydown temperature and rolling time available to obtain specified density. The tables in *Construction Manual Appendix 8-2* illustrate this relationship.



Wind velocity, air temperature, and cloud cover are additional factors that affect the cooling rate of HMA. *PaveCool* is a software program, developed by the Minnesota Department of Transportation and Minnesota Asphalt Paving Association, used to determine approximate cooling rates for hot mix asphalt pavement under various conditions. The program uses numerous variables to graph cooling curves and provide a resulting



PaveCool 2.4 - Simulation Results

Input File: PaveCool

Project:

Project Date & Time	Start Rolling*	Stop Rolling*
03/03/06 10:48 AM	3 min. (248 °F)	34 min. (175 °F)

HMA Mix Type	Binder Grade	Thickness	Delivery Temp.
Fine/Dense Graded	PG 64-22	2.00 in.	280 °F
Air Temp.	**Wind Speed**	**Sky**	**Latitude**
75.0 °F	5 mph	Clear & Dry	45.0 ° North
Existing Surface	**Moisture**	**State**	**Surface Temp.**
PCC	N/A		70.0 °F

Simulation Time: 03/03/06 10:52 AM

Cooling Curve

"time available for compaction" following mix laydown.

The latest version of the *PaveCool* software is currently available to download through links provided under "Hot Mix Asphalt (HMA)" on the Office of Construction & Materials websites found on DOTNET (for DOT network users) and the worldwide web (www). A *PaveCool* link is also provided within *Construction Manual Section 8.55* text on the Electronic Reference Library (ERL) version.

This program is not intended to replace good engineering judgement; rather, it is a tool to provide the user with insight on how actual climate conditions affect the time available for compaction of HMA mixtures. Results can be used to decide when to pave and/or make compaction operation adjustments.

Mix Temperature

(Specification 2303.03, C, 3)

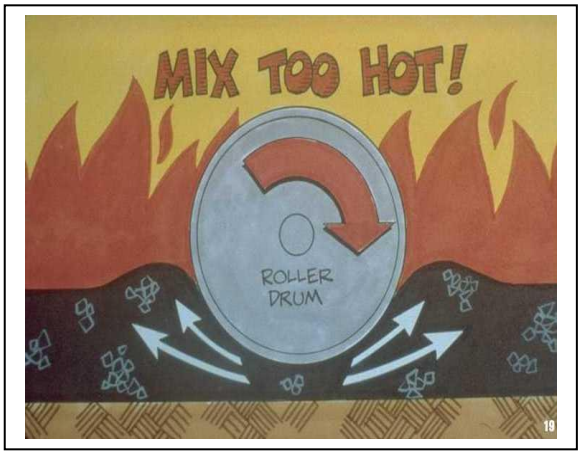
The mix temperature is usually established at the plant. It is important to know what the minimum, maximum and intended temperatures are for the mix you plan to use.

Minimum Temperature

The minimum HMA temperature for placing a nominal layer thickness of 1-1/2 inches or less is 245 degrees F. The minimum HMA temperature for placing a nominal layer thickness greater than 1-1/2 inches is 225 degrees F. For WMA, the minimum production temperature is 215 degrees F. A mix temperature that is too low will allow the mat to crack and tear under rolling

operations. Also, specified compaction and mat density will be hard to achieve if mix temperature is too low.

Maximum Temperature
The maximum production temperature of HMA is 330 degrees F, unless otherwise approved by the Engineer. For WMA, the maximum temperature is 280 degrees F (up to 330 degrees F allowed after October 1st). Overheating a mix may burn the "oil" in the mix and produce a mix with undesirable properties. The appearance of blue smoke rising from a loaded delivery truck is indication of an overheated mix.



A mix temperature that is too high may also lead to shoving and blistering of the mat during rolling operations.

Temperature Consistency
Consistent mix temperature is essential for uniform compaction of the mat. The plant must be operated so that the temperature of the mixture at discharge does not vary by more than 20 degrees F. Locations for taking mix temperature readings include:

- Plant Site
- Truck Box
- Mat, directly behind the paver (readings should be taken every 2 hours and recorded)

Calendar Dates

(Specification 2303.03, C, 4)

HMA mixtures shall not be placed after November 15, except with approval of the Project Engineer. Placement of wearing (surface) courses one inch or less in design thickness may be further

restricted by the contract documents or Project Engineer.

Winter Shutdown

(Specifications 2121.03, C, 2214.03, D, 2303.03, C, 6, 2318.03, J, & 2527.03)

Projects are sometimes required to have a winter shutdown period. This may be planned, such as with a multi-year project when all work can not be completed in one season. For other projects this may be the result of delays due to weather, availability of materials, or project timing itself. The recent increase in projects with winter shutdown has necessitated additional specification requirements to address the following issues.

Granular Shoulders

Granular shoulder material shall be brought up to the pavement edge for the full width of the shoulder, at the design cross slope, prior to winter shutdown. This serves to increase safety to the traveling public as well as assist necessary winter maintenance operations.

Scarification

When resurfacing is part of the contract, all scarified surfaces shall be covered with at least one full lift of HMA prior to winter shutdown.
The HMA provides a safer roadway surface and protects the existing pavement from damage during the winter.

Headers

Headers, when required to end paving for winter shutdown, shall be located across from each other.

Temporary Runouts
When required to end paving for winter shutdown, runouts shall be located adjacent to each other. The runout shall be 25 feet in length per 1 inch of lift thickness. The runout shall be removed before paving resumes. The additional runout length provides increased safety to drivers during the extended shutdown period versus the 10' temporary (end of day) runout.

Cold In-place Recycling
When resurfacing is part of the contract, all cold in-place recycled surfaces shall be covered with at least one full lift of HMA prior to winter shutdown. The HMA seals and protects the recycled surface from damage and deterioration during winter.

Pavement Markings
The specifications require that pavement markings be completed before the roadway is open to traffic (or within a limited number of working days after the roadway opening, depending on the marking type). This requirement also applies to placement of edge lines and symbols prior to winter shutdown. The contractor is typically paid the unit bid price for the additional pavement marking quantities required.

This increases safety by providing necessary guidance to the traveling public during a winter suspension period.

Tickets, Quantities, and Yield

(Specification 2001.07)

Tickets

Tickets must accompany every load of HMA to be used as documentation. The ticket should show the project number, mix type, mix design number, date, and tons represented. Tickets for projects with quantities over 10,000 tons of asphaltic mixtures must be automatically printed.

Quantities

Check project plans for design quantities based on design weights, thickness, width, and lengths. Look for extra quantities required for fillets, crown correction, and irregularities. Check and double check the quantities of mix used on the road and verify the totals with the plant daily. Quantities must be watched carefully for over / under-runs.

Yield

Yield is a measure of the area of pavement, of known thickness, that will be produced by a quantity of hot mix asphalt. If mat width is known, yield determines the distance a known quantity of hot mix will pave. This information tells the inspector many things, including how far each truckload of hot mix will pave and, more importantly, alerts the inspector that the average design thickness is being exceeded which may result in a quantity overrun.

The term “yield” is often used when referring to the comparison of the actual quantity of hot mix asphalt incorporated into the project versus the design quantity shown on the plans for a given portion of the work. In this case, yield is

usually expressed as a percentage of plan quantity. Similarly, yield calculations can be made for other project items, such as emulsion for tack coat / fogseal, and shoulder rock.

It is recommended that the HMA yield be checked every 2 hours. Calculate the tons required per station for various widths of pavement that will be laid prior to the start of paving. All calculations should be based on the design weight (145 lbs. per cu. ft. or as shown otherwise in the plans). Keep daily yields as well as cumulative (to date) yields. To avoid surprises at the end of the project, it is advisable to occasionally project the final yield by totaling the quantity used to date with the calculated remaining quantity to be placed and comparing this total to the project (plan) quantity.

Contractor Sampling

(Specifications 2303.03, D, 3 & 5; Materials IM's 204, 301, 322, 323; Iowa DOT Form 193)

Uncompacted hot mix asphalt (hot box) samples are taken behind the paver and ahead of the rollers. For a typical project, the contractor is responsible for field sampling. The project inspector or monitor must direct and witness sampling to ensure that samples are timely and taken properly, by appropriately certified personnel.

The first production sample each day shall be randomly obtained within the first 500 tons of mix produced. However, the first sample should not be taken from the first 100 tons of HMA produced for the day, to allow plant

production to stabilize prior to sampling. Subsequent daily samples will be randomly obtained from the remaining daily production as indicated in *Table 2303.03-4* (Uncompacted Mixture Sublot Size) of the specifications. A maximum of five paired hot box samples (sublots) per day are obtained by the contractor. The contractor may request to have a quality control plan that indicates a higher testing frequency, if approved by the engineer at the preconstruction meeting.

Contractors may, at their discretion, obtain and analyze additional samples of plant produced mixture. This practice is encouraged and will allow better product quality control because of the additional information provided. However, only the information obtained from samples selected at random and designated as "production samples" will be used for specification compliance and included in the moving averages.

The inspector or monitor is typically required to direct and witness contractor sampling of other materials, such as aggregates and asphalt binder. The methods and procedures for sampling are given in applicable Materials IM's and are also taught in required Iowa DOT certification courses. Minimum sampling frequencies are as stated in *IM 204*. All sampling done for project acceptance purposes must be directed and witnessed by the inspector or monitor.

Whenever possible, the inspector or monitor should accommodate contractor requests for additional sample witnessing beyond minimum requirements.

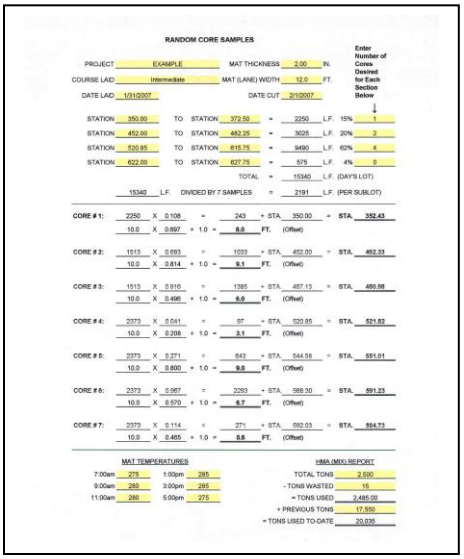
The inspector must properly identify samples (using *Form 193*) and use tamper-proof security measures if custody of the samples is not maintained by the contracting authority. This situation commonly occurs when the contractor or other courier service transports the samples to the lab for testing.

Coring

(Specification 2303.03, D, 5; Materials IM's 204, 320, 321 & 337; Construction Manual section 8.13)

The contractor cuts samples from any HMA course or finished HMA pavement for tests to determine field density (voids), thickness, and/or composition (when appropriate). The inspector identifies the limits of each section (sublot) and marks the random location of each core.

Computer programs and spreadsheets are available to assist inspectors in determining random core locations. The latest version of "Random Core Location Program," is available for download from Office of Construction & Materials websites on DOTNET and worldwide web (www).



RANDOM CORE SAMPLES

PROJECT EXAMPLE MAT THICKNESS 2.00 IN.
COURSE LAID Intermediate MAT (LANE) WIDTH 12.0 FT.
DATE LAID 1/31/2007 DATE CUT 2/1/2007

Enter Number of Cores Desired for Each Section Below

STATION	350.00	TO	STATION	372.58	=	2250	L.F.	15%	1		
STATION	452.00	TO	STATION	462.25	=	3025	L.F.	20%	2		
STATION	520.85	TO	STATION	615.75	=	9490	L.F.	62%	4		
STATION	622.00	TO	STATION	627.75	=	575	L.F.	4%	0		
				TOTAL	=	15340	L.F.	(DAY'S LOT)			
	15340	L.F.	DIVIDED BY 7 SAMPLES		=	2191	L.F.	(PER SUBLOT)			

CORE # 1:	2250	X	0.108	=	243	+	STA.	350.00	=	STA.	352.43
	10.0	X	0.897	+ 1.0 =	8.0	FT.	(Offset)				
CORE # 2:	1513	X	0.683	=	1033	+	STA.	452.00	=	STA.	462.33
	10.0	X	0.814	+ 1.0 =	9.1	FT.	(Offset)				
CORE # 3:	1513	X	0.916	=	1385	+	STA.	467.13	=	STA.	480.98
	10.0	X	0.496	+ 1.0 =	6.0	FT.	(Offset)				
CORE # 4:	2373	X	0.041	=	97	+	STA.	520.85	=	STA.	521.82
	10.0	X	0.208	+ 1.0 =	3.1	FT.	(Offset)				
CORE # 5:	2373	X	0.271	=	643	+	STA.	544.58	=	STA.	551.01
	10.0	X	0.800	+ 1.0 =	9.0	FT.	(Offset)				
CORE # 6:	2373	X	0.967	=	2293	+	STA.	568.30	=	STA.	591.23
	10.0	X	0.570	+ 1.0 =	6.7	FT.	(Offset)				
CORE # 7:	2373	X	0.114	=	271	+	STA.	592.03	=	STA.	594.73
	10.0	X	0.465	+ 1.0 =	5.6	FT.	(Offset)				

MAT TEMPERATURES			
7:00am	275	1:00pm	285
9:00am	280	3:00pm	285
11:00am	280	5:00pm	275

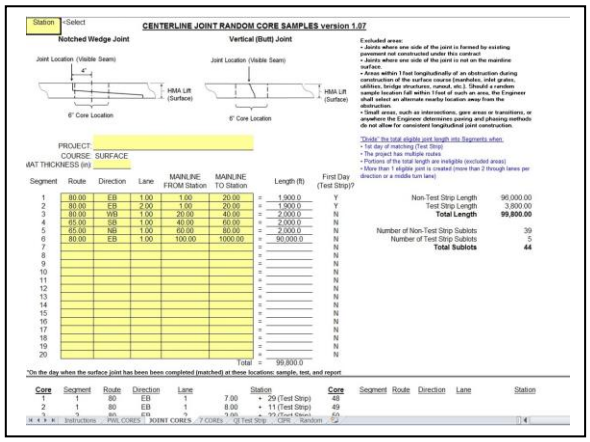
HMA (MIX) REPORT	
TOTAL TONS	2,500
- TONS WASTED	15
= TONS USED	2,485.00
+ PREVIOUS TONS	17,550
= TONS USED TO-DATE	20,035

Computer programs and spreadsheets are available to assist inspectors in determining random core locations. The latest version of "Random Core Location Program," is available for download from Office of Construction & Materials websites on DOTNET and worldwide web (www).

Unless specified otherwise, the sampling frequency shall comply with *Materials IM 204*. Specifications require eight samples to be cut from each lot of mat construction (an independent lot of eight samples are also taken for test strips). The contractor may request to have a quality control plan with a higher testing frequency, at no additional cost to the Contracting Authority, if

preapproved at the preconstruction conference.

The contract documents may also require additional samples be taken directly on the longitudinal joint between adjacent lanes. These longitudinal joint cores, when required, shall be evaluated separately from the eight mat cores. The sampling procedure, frequency and lot size for longitudinal joint cores shall be as specified in contract documents.



The inspector directs and witnesses core drilling and, when applicable, determines and records core lengths. The core sample should then be inspected (for defects and appropriate length) to determine if it is a representative sample and valid for testing. If not, the original core should be discarded and a replacement sample taken.

Transportation of cores to the lab for testing should be coordinated with the plant monitor, such that custody of the samples by the contracting authority is maintained. If transported by others, the samples must be properly identified and secured.

Unless the contract documents indicate otherwise, core density (field voids) testing is performed by the inspector or plant monitor. The testing is typically done in the project field lab, using the contractor's test equipment. Contractor personnel assist in preparing (sawing, etc.) the core sample for testing. Testing personnel must be properly trained and certified for the testing duties required.

Density testing requirements are given in *Materials IM 321*.

The specifications also describe a statistical procedure for field density (voids) evaluation, together with a schedule and corresponding formulas for determining payment adjustments for the lot. The project inspector should become familiar with the specification requirements, as well as the inspection procedures for compacted HMA samples outlined in *Construction Manual Section 8.13*.

Smoothness Testing

(Specifications 2316 & 2317; Materials IM 341; Construction Manual section 8.14)

The requirements for pavement smoothness are outlined in *Specification Sections 2316 and 2317*. Pavement smoothness is evaluated for all primary and interstate mainline pavement surfaces, except when specifically excluded by the contract documents. Smoothness is measured with a 25-foot California type profilograph, which produces a profilogram (profile trace) of the surface tested.

The method of testing using the profilograph (and interpretation of the profile trace) is outlined in *Materials IM 341*.

The results of smoothness testing are used as a basis for incentive payments to the contractor or price reductions, as appropriate. The results are also used to determine whether corrective actions, such as grinding bumps or replacing pavement, are required.

The contractor should be encouraged to use a profilograph, in lieu of rolling surface checker or straight edge, to check additional pavement areas for bumps.

The contractor should test directly behind the finish roller, to allow correction of an identified ½ inch bump by re-rolling while the mixture is still hot enough to be affected. Any resulting mixture build-up on the wheels should be regularly removed.