458 Placing Asphalt Mixtures

458.1 Pre-Pave Meeting

A meeting should be held with the contractor well in advance of the paving. At that time, all aspects of the paving operation should be discussed and agreed upon.

Advance preparation for the meeting will be needed to collect names and telephone numbers of WisDOT, consultant, and contractor contact persons. It will also be necessary to check out equipment and materials against the standard specifications and contract provisions before the meeting.

A suggested list of topics is shown in figure 458-1. Keeping a written record of the meeting agreements is suggested. A copy can then be furnished for reference during paving, if requested.

FIGURE 458-1 Hot Mix Asphalt Pre-Pave Agenda

<table>
<thead>
<tr>
<th>Pre-Pave Agenda</th>
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<tbody>
<tr>
<td>Project ID __________________________ Length</td>
</tr>
<tr>
<td>Termini</td>
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<tr>
<td>Hwy ___________________________ County ______________________________________</td>
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<tr>
<td>Pavement Type</td>
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<tr>
<td>Meeting Date __________________________ At ______________________________________</td>
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<td>Attendees:</td>
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List for Discussion and Agreement

A. These items are to be checked before the pre-pave meeting, provide available information at the meeting. Not all items below will be applicable.

1. Personnel (Names, Phone)
   - DOT/consultant
   - Quality assurance team
   - Survey/staking crew chief
   - Scale inspector
   - Paving inspector
   - Density checker
   - Engineer
   - Contractor
   - Quality control team
   - Plant operator
   - Scale person
   - Paving crew foreman
   - Superintendent
   - Staking crew chief
   - Profiler Operator and Supervisor

2. Equipment (check against specification)
   - Trucks
     - Overall condition?
- End dump truck or bottom dump?
- Paver
  - Loading device or intermediate transfer equipment?
  - Tampers and vibratory system
  - Screed
  - Screed extensions tamper/vibratory system
  - Heater
  - Automatic controls
  - Auger
  - Overall condition
- Profiler

3. Traffic Control (number, hours of operation).
  - Vehicles; use of flashing lights
  - Radios
  - Signs, message boards, arrow boards, barricades
  - Public information sources

4. Materials (grades, gradations, storage, stockpiling, sampling-daytime and off hour, testing).
  - Virgin aggregate
  - Asphalt
  - Salvaged surface
  - Admixtures
  - Fillers
  - Tack
  - Job mix formula
    - Leveling/wedging/widening
    - Lower layer
    - Upper layer
    - Salvage percentage

B. These items are suggested for discussion at the pre-pave meeting. (Not all will apply to your contract.)

1. Paving Operations
  - What are the anticipated dates of paving?
  - What are the anticipated hours of paving?
  - Are there work restrictions in the contract?
  - What is the approximate timeframe for acceptance profiling?
  - What are the traffic control plan provisions that will apply during working and non-working hours? (These should apply to all vehicles and trucks.)
  - Who will be in responsible charge of paving and traffic control during working and nonworking hours?
  - Is the paving being coordinated with other construction operations under this contract or in the area?
  - Has the base or foundation been adequately prepared as required by contract specifications and special provisions?
  - What are the initial proposed mix temperatures (1) at the plant and (2) at the delivery point?
  - Discuss the procedure for filling out, transferring, accepting, and recording tickets for delivered mix.
- What will be the staking needs? Who will perform them?
- What will be the minimum/maximum thickness of each layer or course?
- Are there special requirements when placing wedging, leveling, widening, or curbs?
- How many trucks will be needed? What is the haul distance, haul route, and dumping pattern? Has the haul road been initially inspected? Who will inspect it during paving and how often?
- Discuss the acceptable procedure for constructing traverse joints. Discuss procedures for hand raking longitudinal joints and areas the paver can't operate.
- Will density be tested by nuclear meter or by cut samples? How many tests will be made and when? Will tester require contractor help and protection from traffic?
- Will estimated tonnage or the specified pavement depth govern?

2. Contingency Plans

- Are there contingency plans for:
  (1) Cold weather.
  (2) Rain.
  (3) Plant pollution correction.
  (4) Major plant corrections and stoppages.
  (5) Minor plant adjustments for changing mix percentages, temperature, etc.
  (6) Accidents at the plant or on the grade.
  - Is backup equipment available in case of breakdown of trucks, paver, or rollers?
  - What is the timing of the shouldering operations? Have traffic control needs been considered?
  - Will shouldering be done in more than one operation?

458.2 Maintenance of Aggregate Base

On aggregate bases carrying traffic, chuck holes and raveled areas frequently develop in the base between the time it is shaped and the mat is placed. If the damage to the base is extensive, it may be necessary to reshape, but usually the base can be satisfactorily restored by filling the depressions with the paving mixture. If the depths of the depressions are approximately one inch or more, they should be filled and compacted ahead of the paving operation.

458.3 Ambient Air Temperatures

Air temperature is measured as described in standard spec 450.3.2.1. This section has separate temperature restrictions for paving asphalt upper and lower layers. When paving asphalt bid items (and the contract has special provisions supplementing section 460/465 bid items paid by the ton) and the ambient temperature is anticipated to be below the specified threshold, the contractor is to submit a cold weather paving plan, see 458.10. The department pays for cold weather paving measures in the cold weather paving plan under the Cold Weather Paving Bid Item.

The standard specifications do not permit any asphaltic mixtures to be placed upon unstable roadbed, frozen base or subgrade regardless of the ambient air temperature. Asphalt mixtures are to be placed on a prepared, firm, and compacted base, foundation layer, or existing pavement substantially surface-dry and free of loose and foreign material.

458.4 Inspection of Delivered Mixtures

458.4.1 Covering of Loads

All loads of hot mixtures must be covered to minimize heat loss during transport if (1) there is inclement weather, or (2) the ambient air temperature falls below 65 F.

458.4.2 Appearance of Loads

When arriving at the paver, the covers should be rolled back, and the inspector should observe the appearance of the load before it is dumped into the paver. A properly designed and controlled mix will arrive in a slightly mounded condition, be of uniform color and texture, and be without separation of
aggregate from asphalt binder. The less stable but still acceptable mixes may flatten out in the truck box, but any loads arriving in a fluid condition or with free asphalt on the surface contain excessive asphalt content and should be rejected. Likewise, close visual inspection will detect loads with excessive uncoated particles, evidence of segregation, loads that are too hot as evidenced by blue smoke, or loads that have lost too much heat in transit as evidenced by hardened crust on the surface or on the edges; these should all be rejected.

458.4.3 Mix Delivery Temperature
As provided in standard spec 450, the mix delivery temperature designated on the asphaltic mix design should be entered in the paving inspector's diary. The temperature of the delivered mixture should be checked periodically and entered in the paving inspector's diary. If the temperature exceeds +/- 20°F of the temperature recommended by the asphaltic material supplier, both the paving foreman and the project leader should be notified immediately. The optimum delivery temperature will vary with the materials used and the prevailing atmospheric conditions, but generally the delivery temperature should be as low as possible for proper workability, placement, and compaction on the road, while still allowing for proper mixing and coating of the particles at the plant.

458.4.4 Weigh Tickets
The paving inspector must receive a weigh ticket from the truck driver for each load of asphaltic mixture delivered. When recordation or random-checking weighing procedures are not used, the weigh ticket must have been signed or initialed by the inspector observing the weighing, and the paving inspector must inspect the ticket to see it has been validated. If the load appears satisfactory on the basis of this visual inspection, the paving inspector will sign or initial the ticket to verify the material was delivered and incorporated in the work. The inspector will accumulate the tickets and turn them over to the project engineer daily.

458.5 Longitudinal Joints
It is very important that the highest degree of density achievable be obtained in material placed adjacent to a previously placed lane or existing pavement. If material is placed below the level of the previously placed mat, the previous mat will support the roller, and the newer material along the joint will not be adequately compacted. This occurrence is commonly referred to as "bridging" since the roller bridges over the joint while supported by the higher mat. This frequently leads to raveling of the joint at an early age, particularly when the mat is placed in cool weather in the fall, with rapid cooling of the newer material next to the joint and without the beneficial effect of warm weather and traffic before winter sets in.

The paver screed should overlap the previous pass by 1" +/- 1/2" and should leave the material higher than the previous pass by an amount slightly greater than the consolidation being obtained under the rollers. To ensure that the joint is not starved of material and no bridging of the roller will occur, the material placed on the hot-side of the joint should be slightly higher (approximately 0.1 inch) than the cold side after rolling. Do not rebroadcast excess material across the mat.

SDD 13c19 shows longitudinal joints. The notched wedge joint is the standard joint used at HMA pavement centerlines and lane lines. Lanes paved in echelon are considered confined on both sides of the joint regardless of joint design. The contractor should use a vertical joint for SMA pavements when the notched wedge is not required for traffic.

When constructing notched wedge joints, the paving inspector should ensure that an effective device is used to shape wedge and notches as follows:
- Should be similar to TransTech Notched Wedge Joint Maker, Carlson Tapered Notch, or Willow Notch Wedge Pneumatic Solid Wheel Design, unless the department approves otherwise.

When inlay paving below the elevation of the adjacent lane, the longitudinal joint along the adjacent lane is considered unconfined.

458.6 Transverse Construction Joints
458.6.1 General
There are many variations in the methods used by the various contractors to build transverse construction joints. The emphasis should be on obtaining a smooth riding transition from the cold to the hot mat, and any method proven capable of producing such a joint is satisfactory. Basically, some method must be used to cut back the end of the cold mat to a vertical edge and full depth of the course. The joint may be at right angles to the roadway or on a skew. When proceeding away from the joint, the paver...
is placed so the leading edge of the screed is back of the joint and the screed is supported on the compacted mat by wood or metal strips having a thickness about equal to the amount of consolidation expected due to compaction. The screed should be well heated, and the distributing screw box filled with hot material to the normal operating level before starting the machine. After paving, the joint should be cross-rolled and straight edged to ensure a continuous smooth profile before proceeding.

The following specific procedures are recommended:

**458.6.2 Ending a Lane**

When terminating paving operations at the end of a day's work, the pavement mat must be cut off vertically, so a full depth lift can be placed squarely against it. This requirement can be satisfied by the following procedure:

1. When the paver is placing the last load of the day, it is shifted into low gear as it approaches the location of the proposed joint.
2. As the hopper empties and the amount of material in the screed chamber decreases below normal operating level, the paver is stopped.
3. The screed is raised and the paver moved out of the way.
4. Asphalt mix is then shoveled away from the end of the mat to form a clean, vertical end.
5. A board or heavy wrapping paper is placed along the edge.
6. The material that was shoveled away in Step 4 is replaced and used to form a taper.

**458.7 Resumption of Paving Operations**

When construction is ready to resume, the following procedure is used to form a suitable transverse joint.

1. The taper of material is removed along with the board or paper.
2. A straightedge is used to check the longitudinal grade of the mat. Because the paver was running out of material as it laid the last few feet of mat, it is possible those last few feet taper slightly (ramp down) from the specified level of the mat. If this is the case, a new transverse end must be cut behind the point where the ramping down begins.
3. The vertical face of the mat end is tack-coated.
4. The paver is backed up to the end of the mat and the screed rested on the mat surface.
5. The heated screed is raised and shims as thick as the difference between the compacted mat and the uncompacted mat are positioned under its ends.
6. The truck with the first load of hot mix is backed carefully to the hopper. During discharge of the mix from the truck bed to the paver, it is essential the truck not bump the paver and cause it to move.
7. The paver starts forward in a low gear.
8. Once the paver has moved away, excess hot mix is cleaned off the surface of the mat and the evenness of the joint is checked with a straightedge.
9. If a joint is satisfactory, a 6-inch width of the hot mix is rolled transversely and the joint checked for smoothness. If the joint is satisfactory, transverse rolling is continued in 6-inch to 12-inch wide increments until the entire width of the roller is on the new hot mix. If straight edging shows an uneven joint, the surface of the new mat must be scarified while still warm and workable. Scarification is done preferably with tined lute. Excess material can then be removed or additional material added, and the joint rolled. During rolling, timbers should be placed along the edges of the mat to prevent the roller from driving off the longitudinal edge and distorting it.
10. Dirty and rolled-down transverse joints should be cleaned and tacked, where needed.

**458.7.1 Hand Placing**

Spreading of hot mixtures by hand in areas not accessible to equipment is permissible but placing of material or raking over surface courses placed by machine methods should be avoided unless necessary to correct defects. Any mat defect requiring continued hand correction may result from
malfunctioning, improperly adjusted, or improperly operated equipment, and the source of the trouble should be located and corrected at once.

When placing material by hand, a greater allowance must be made for compaction than when placed with the paver. The material should be placed by shovel to required depth and shaped to grade and contour with lutes or rakes, rather than spread broadcast with the shovel, which results in segregation of the coarse and fine portions of the mix.

It is desirable to end a mat with a butt joint, but if it is necessary to feather out a mat over an old pavement, the pavement should be given a tack coat, and a thin, feathered edge should be formed by raking out and removing the coarse aggregate.

458.7.2 Shoulders

Shoulders paved separately from travel lanes may be placed to a depth not exceeding 4 inches per layer after compaction. The lift thickness of shoulders paved integrally will match that of the travel lane being placed.

If the paving equipment and compaction equipment used for the travel lanes are too wide for the shoulders, the project engineer may approve other equipment either designed for shoulder operations or deemed to be adequate for that purpose. If the shoulders are being paved integrally, paving equipment must be capable of constructing the designed cross slope of the travel lane and shoulder simultaneously.

458.8 Paver Operation

For best results, the paver should be operated as continuously as possible. To avoid stopping and starting the machine for each load of mix, the speed of the paver must be in balance with the plant production. Furthermore, the speed of the paver must not exceed the speed that produces a dense mat of uniform appearance. Any condition of the paver that causes difficulty in the spread will be magnified at higher paving speeds.

There is a tendency for the paver operator to run the machine at a fast rate for a few minutes and use up the material on hand, then stop and wait for more material to arrive. This type of operation should not be permitted, since during the wait the working parts of the machine and the remaining mix cool off and the screed may settle into the mat. When the paver starts up again, a bump in the pavement as well as a scarred and open texture on the surface may result.

Care and coordination between the paver operator and the truck driver is necessary to prevent twisting or jerking of the paver when the paver picks up the truck. Twisting or jerking of the paver can result in bumps or irregularities in the mat, which can contribute to a poor ride.

The slat feeders should be operating most of the time (80% to 90%), and the flow control gates should be set to keep the augers at least 2/3rd covered with material. It is very important the level of the material in front of the screed is kept constant and the augers in front of the screed are operated nearly continuously while paving. If the level of material is allowed to intermittently rise and fall, thereby flooding or starving the screed, a rough mat, segregation of the material, and imperfections in the surface will result.

In the event of a breakdown of the automatic control system, pavers may be operated manually for only the remainder of the working day in which their automatic control system has broken down.

458.9 Screed Extensions

Any use of screed extensions should be monitored, especially when the extensions are 20 inches or more in length.

Extensions of 10-inch length are generally furnished as a static extension and are acceptable for paving both travel lanes and shoulders. Power actuated (vibratory) extensions of 10-inch length are also acceptable and available.

Under standard spec 450, extensions of 12 inches or more used in paving travel lanes must be power actuated. When screed extensions are used to pave a travel lane, the augers used for spreading material in front of the screed must extend to within 12 inches of the edge of the travel lane. Extensions of 20 inches or more used in paving shoulders may be static (assembled by bolting together several 10-inch static extensions), or they may be power actuated. There is no limitation on the length of static extensions added to the shoulder end of the paver screed for paving shoulders.
Frequency of both static and actuated screed extensions should be checked with a vibrating reed tachometer. Frequency obtained in this way for static extensions should be compared to the frequency of the main screed, and for actuated extensions be compared to the manufacturer’s recommended frequency or the desired frequency for the type of mixture being placed. The tachometer will read in RPMs, which is equivalent to vibrations per minute.

Should a significant difference or variation in frequency exist for an actuated screed, adjustment or replacement is called for. If tearing or a difference in texture is observed under a static extension, or if the frequency check indicates a significant difference in frequency between the main screed and the static extension, replacement with an actuated extension is called for.

458.10 Cold Weather HMA Paving

The main challenge of cold weather HMA paving is to achieve a uniformly consistent mat with adequate compaction while the mixture is rapidly cooling. Generally, if adequate density is obtained, the pavement will perform as expected. Cold weather compaction depends upon having enough time for the mixture to remain workable and enough equipment to obtain adequate density.

The project team and contractor should make a concentrated effort to make sure paving takes place during the acceptable paving times listed below:
- Northern Asphalt Zone (May 1 - October 15)
- Southern Asphalt Zone (April 15 - November 1)

See figure 458-2 for zone definition.

A cold weather paving plan per 458.10.1 is required if temperatures during the time of paving are less than 40 F. Paving is only to take place for lower layers if temperatures are >32 F, and for upper layers > 36 F and rising. Temperatures are to be taken approximately 3 feet above grade, in shade, and away from artificial heat sources. If less than 40 F, a valid project engineer-approved cold weather paving plan is required and remains in effect throughout the entire day of paving and will be re-evaluated each subsequent day of paving. In summary, while temperature 24 hours in advance allows for planning, temperature at the time of paving dictates actions as follows:

40F or Above
Upper Layer Normal Paving
Lower Layer(s) Normal Paving

< 40F to > 36F
Upper Layer Pave with Cold Weather Plan
Lower Layer(s) Pave with Cold Weather Plan

< 36F to > 32F
Upper Layer NO PAVING
Lower Layer(s) Pave with Cold Weather Plan

Below 32F
Upper Layer NO PAVING
Lower Layer(s) NO PAVING

EXAMPLE #1:
Temp. 24 hours in advance: Over 40 F
Actual temperature day of paving: Below 40 F

Discussion:
If the forecasted temperatures are close to 40 F, discussions should take place between the department and contractor regarding how long the temperatures look to be below 40 F, and whether or not the start time needs to be adjusted. A cold weather paving plan should be confirmed or revised as needed. If paving below 40 F, the cold weather paving plan is in effect. The cold weather paving plan would be in effect with full specifications, and the cold weather paving item would be measured and paid for accordingly.
EXAMPLE #2:
Temp. 24 hours in advance: Over 36 F
Actual temperature day of paving: Below 36 F
Discussion:
If the forecasted temperatures are close to the 36 F allowable temperature, discussions should take place between the department and contractor regarding how long the temperatures look to be below 36 F, and whether or not the start time needs to be adjusted. Regardless, upper layer paving is not to occur until 36 F is reached. Additional conversation between the department and the contractor should occur before loadout. Once temperatures are reached, the paving plan is in effect and remains for the entire day with full specifications.

EXAMPLE #3:
Temp. 24 hours in advance: Over 32 F
Actual temperature day of paving: Below 40 F, but over 32 F
Discussion:
Cold weather paving plan is in effect and remains for the entire day with full specifications. The tonnage placed is calculated and the cold weather paving item is measured and paid.

EXAMPLE #4:
Temp. 24 hours in advance: Below 40 F
Actual temperature day of paving: Above 40 F
Discussion:
Paving is to occur as planned. Additional conversations should occur between the department and the contractor before production starts to ensure both parties are on the same page. If the project engineer and contractor agree to pave under the cold weather paving plan in advance, and the contractor has already added the warm mix additive to the tanks of PG Binder, the project engineer and contractor will discuss how to proceed and whether or not payment for the cold weather paving item is reasonable.

GENERAL RULES:
- If temperatures 24 hours in advance look like they will drop below acceptable paving temperatures, no paving is to occur (or not until required temperatures are met and still allow for anticipated production tonnage). For temperatures below 40 F (but > 36 F for upper layer, and > 32 F for lower layer), a cold weather paving plan is to be in place and full specifications apply.
- In all cases, conversations need to occur between the project engineer and the contractor the day before paving, and before production starts for the shift on the day of paving. This conversation is to ensure both parties are in agreement on the operations and if the cold weather paving bid item is in effect or not.
- Standard spec 108 discusses how to handle adverse weather in the contracts and applies to cold weather paving as well.
- Use of warm mix additive as a compaction aid will help with compaction of the mix above 40 F, and should be considered as appropriate, and agreed to by the project engineer and the contractor in advance.
- Contract schedule and future forecast should not be used to limit when the contractor can pave using the cold weather paving item. There are many times near the end of the construction season when several contracts need to be completed, and not all of them can wait for ideal conditions to pave.
- Also note, that paving below 32 F should not occur, unless under an emergency or temporary traffic control situation. STSP 450-010 for extreme cold weather paving is used only for temporary traffic and staging conditions, and should not be used as an extension of the paving season.
- Ideally, all paving will be completed above 40 F, and the cold weather paving provisions will be rarely used. Interim completion dates for paving items, mandatory start dates for contracts, and project completion dates should all be used to minimize asphalt paving in early spring or late fall conditions.

458.10.1 Cold Weather HMA Paving Plan
Generally, if the contract has the HMA Cold Weather Paving bid item, a cold weather paving plan is required. Standard spec 450.3.2.1 requires the contractor to provide a cold weather paving plan at the preconstruction meeting. The project engineer needs to review and provide written acceptance of the
cold weather paving plan before placement. At a minimum, the contractor is required to include the following items:

1. Use a department approved warm mix additive to help aid in compaction during cold weather paving. Foaming additives that introduce water are not permitted as a cold weather compaction aid.

2. Type/name of additive and dosage rate should be documented by the contractor in the cold weather paving plan. Load tickets will identify when the cold weather paving item is in effect.

3. Identify the measures taken to ensure that the lot density is achieved. Specify intended modification to the compaction process that will be utilized when applicable.

Achieving compaction in cold weather can be a challenging task. The items above may be supplemented by other techniques to aid in achieving compaction. Other recommended techniques include:

1. Avoid handwork or feathering of the HMA mix. These operations take additional time allowing the HMA mix to cool below temperatures needed to achieve good compaction.

2. Adjustments could be made to the mix temperature per the PG binder and WMA additive manufacturer production temperature recommendations.

3. Use heated or insulated boxes on trucks hauling asphalt. Tightly tarp the loads for longer hauls and to prevent exposure to the elements, as loose, flapping tarps may actually increase heat loss.

4. Keep the rollers as close to the paver as possible.

5. The use of more or higher capacity rollers such as rubber-tired rollers. However, measures are needed to prevent tracking of the asphalt when using rubber-tired rollers, and heating the tires is recommended. The rollers can be fitted with skirting around the tires. Additionally, consider ducting engine exhaust inside the skirt enclosures to keep the tires hot. A WisDOT approved release agent could be added to the roller water to prevent tracking by the tires.

6. Use of transfer device may be helpful.

458.10.2 Cold Weather HMA Paving Observation

If cold weather paving is occurring, certain items should be noted and monitored by the project engineer:

1. Is the base inadequately compacted, frozen or excessively moist or a unstable roadbed? If so do not allow paving. Likewise check condition of existing pavement that is being overlaid, ensuring that it is dry.

2. Review the cold weather paving plan before the start of cold weather paving to ensure conformance and provide written acceptance before placement. At the close of business and before the next shift, determine whether or not the contractor is allowed to pave. The quality assurance team should be given proper notification when conditions qualify as cold weather paving.

3. Is the cold weather mix design being used and identified on the truck tickets as having a warm mix additive? Was the mixture used throughout the entire day of production?

4. Monitor the temperature of the mix to ensure that it conforms to the recommended mixture temperatures according to the mix design.

5. Document the additional steps (if needed) the contractor took to comply with the cold weather paving plan in order to meet the minimum density requirements.

6. Are the rollers operating close to the paver to ensure compaction occurs while the asphalt is in the proper temperature range? Do not allow over rolling of the mat.

458.10.3 Compaction Time

Determining time for compaction can be done easily with Multicool software available from the National Asphalt Paving Association at:

http://www.asphaltpavement.org/multicool

It is generally accepted that thicker pavements cool slower than thinner pavements resulting in a longer compaction time window. Increased wind speed can also lead to a quicker cooling of the layer. These variables (and others) can be input into the Multicool software to see the effect on the necessary compaction time. This software can be used by the contractor and, as necessary, engineer to monitor the effectiveness of the cold weather paving operations.