8.50 BASE, INTERMEDIATE, AND SURFACE COURSES

8.51 HMA WEDGE CONSTRUCTION FOR SUPERELEVATION OF CURVES

HMA wedge courses are placed on resurfacing projects to correct or increase the superelevation of existing roadway curves. Project plans will identify required rate of super and transition lengths. To establish wedge thickness and sequence of placement, the existing transition, super, and profile must be determined by field measurements. For survey and staking procedures, refer to "Inspector's Handbook for Construction Survey."

Placement of wedge courses should be with single lane width finishing machines. Use of full width pavers can result in excess wedge material on the low side of curve, plus crown correction problems in the transition. When correcting superelevation on resurfacing projects, 70% of transitioning will normally be accomplished in advance of curve PC and beyond curve PT, 30% will be in curve.

Newer method of wedge construction utilizes automatic screed and slope features of HMA finisher. This method requires less survey and grade reference.

Automatic Slope Control

Present day finishing machines have automatic screed controls which allow desired cross slope to be set and then varied during machine movement.

Existing super and desired super must be known prior to wedging. Difference in cross slope percentage determines amount of wedge material. Total proposed thickness of finished wedge at the high side divided by 75 mm (3 inches) will give the number of course passes in wedge operation. Total percent of slope change divided by number of course passes will establish slope percentage for each pass.

EXAMPLE:

Proposed Superelevation Rate 8%
Minus Existing Superelevation Rate - 4%
TOTAL PERCENT CHANGE = 4%

Total Proposed Wedge Thickness on High Side of Curve
4% x 7.2 m (24 feet) = 288 mm (11.5 inches)

Number of Proposed 75 mm (3-Inch) Passes to Construct Wedge

$$\frac{288 \text{ mm (11.5 inches)}}{75 \text{ mm (3 inches)}} = 3.84 \text{ Passes (Use 4 Passes)}$$

$$\text{Percent Slope Change Each Pass} = \frac{4\%}{4 \text{ Passes}} = 1\% \text{ Per Pass}$$

Proposed Schedule for Laying with Automatic Slope Control:

Pass No.	Percent	High Side	Thickness
Existing	4		
1	5		63 mm (2.5 inches)
2	6		75 mm (3 inches)
3	7		75 mm (3 inches)
4	8		75 mm (3 inches)
		TOTAL =	288 mm (11.5 inches)

Lath are placed on shoulder to mark beginning of transition, "X" distance, "Y" distance, and each 1% of change in slope percentage.

Placement of Wedge
To insure that each wedge of curve is constructed in its proper place, a guideline string shall be used for each lift. Top of final wedge for curve is directly over outside edge of pavement. Since edge of wedge has a 1:1 slope, the remaining inches of mat thickness to be laid are also the distance from edge of base to edge of lift being laid.

EXAMPLE:
If total thickness of wedge on the high side is 200 mm (8 inches) on first pass of 75 mm (3 inches), screed will have to be extended 125 mm (5 inches) beyond edge of base.

On second pass of 75 mm (3 inches), screed will have to be extended 50 mm (2 inches) beyond edge of base.

On third pass of 50 mm (2 inches), screed should be same width as the original pavement's edge.

Sequence of Placement
First pass should be in transition section on the high side. Assuming proposed transition is 70 m (230 feet) and 4 total passes are proposed, start first pass approximately 75% or 52.5 m (172 feet) of this length into transition; second pass at 50% or 35 m (115 feet); and third pass at 25% or 17.5 m (57 feet). Each beginning pass is started with automatic slope control set at existing slope.

As laydown machine moves forward, dial slope into screed proportionally until desired slope for that pass is obtained. Check actual slope obtained and make very small adjustments if necessary. Let this slope ride the full length of curve. Reverse procedure for end of curve transition.

First pass is a leveling type operation. High and low spots on existing pavement will result in variable mat thickness. Average depth as per above example will be 63 mm (2.5 inch) thickness at the high side and a 5% slope to centerline. Because of existing super and crown in pavement, two passes of the high side of curve could be done before one pass of the lower side would be necessary, thus also preventing inverse crown situations.

An additional 15 mm (1/2 inch) thickness should be placed at centerline, so longitudinal joint may be constructed and rolled with flat steel rollers on curve. This will give a slight crown to superelevated section.

Inspector should be constantly checking slope using 1 m (4 foot) level and ruler. If desired slope is not obtained on a pass, then adjust slope and thickness of next pass. Final pass should always be made at final superelevation rate.

8.52 LAYING WIDTHS FOR HMA

Plans for HMA projects will show the overall dimensions of finished pavement.

When spreading layers of HMA 38 to 50 mm (1.5 to 2 inches) in thickness, a typical 7.2 m (24 feet) pavement will broaden 50 to 100 mm (2 to 4 inches) in width during rolling. Therefore, laydown width before rolling would typically require 75 mm (3 inches) less than final design width. An intended lap of 25 to 50 mm (1 to 2 inches) at longitudinal joint is necessary for proper joint construction. Use of a cutoff shoe when matching a longitudinal joint is not acceptable.

When using finishing machines that spread pavement full width, inspectors shall insure that contractors adjust spreading width so final dimensions conform to dimensions specified in project documents.

Finishing machine screed extensions are usually available in 150 mm (6 inch) increments. Where standard screed extensions are utilized to increase paver width by more than 300 mm (1 foot), paver auger shall also be extended. Many newer pavers are equipped with automatic screed extensions which can be adjusted to conform to required width for most resurfacing situations. Some paver models have automatic auger extensions as well.

The specifications require longitudinal joints on multi-lift resurfacing projects to be stacked directly over each other rather than offset. For full depth HMA paving, offset must be no more than 75 mm (3 inches). A diagram of properly stacked joints is in *Appendix 8-1*.

When city streets or other multilane pavements are being surfaced, laying widths shall be inspected according to procedure described in *Construction Manual 8.54*.

8.53 SPREAD RATES FOR HMA BASE, INTERMEDIATE, AND SURFACE COURSES

Inspector shall check contract quantities for accuracy.

In general, spread rates for HMA shall be determined using contract megagrams (tons) as a basis. Estimated unit weight from design standards used to calculate contract quantities will provide sufficient material for construction of design thickness for most mixtures used in the state.

Where "average thickness" is specified on plans, the spread rate shall not be increased. This avoids construction of spots which are significantly more than design thickness, provided contract quantities have been calculated correctly.

If contract quantity is not sufficient to construct required thickness, notify the District. The District will adjust the spread rate as necessary to attain design thickness.

For lower layers on resurfacing projects, automatic controls should not be adjusted repeatedly based on megagram (ton) yields taken at short intervals. Automatic controls should be allowed to correct for irregularities in underlying base without frequent adjustments. Accordingly, the spread rate for individual truckloads will sometimes vary

substantially from contract rate because of irregularities in old base. However, over longer distances, 500 m (1640 feet) or more, taking both sides of the pavement into account, inspectors should select a general spread rate that compares as closely as possible with contract quantities.

For paved shoulders or other construction where dimensions are controlled by specified elevations, existing structures, or other unusual requirements, spread rates shall be adjusted as necessary.

8.54 HMA RESURFACING ON CITY STREETS

When a city street or other pavement involving more than two lanes for finishing machine is surfaced with HMA, certain procedures and principles produce a finished product with a high quality appearance and smooth riding qualities. Although details may vary in individual projects, the preferred approach utilizes procedures described in this section.

In addition to basic work of base repair, cleaning, and tacking, leveling shall be spread to correct lack of drainage, poor riding qualities, and ensure that no longitudinal joints occur in an inverted crown (except in rare cases when drainage is not adjacent to curb).

Correct construction of longitudinal joints is associated with straight lines and a uniform minimum lap of each lane over adjacent lanes.

Preliminary Layout

- Establish working centerline by dividing street at end of each block.
- If laying HMA to face of curb is required at 30.5 m (100-foot) intervals on right and left sides, measure and record distance from working centerline to face of curb.
- Offset working centerline to stakes in parking area or to painted X's on sidewalk. Also cross-tie all fixtures to be covered with HMA.
- Plan the laying procedure using measurements from working centerline to face of right and left curbs. Planned procedure should be drawn up showing width of each lane, cutoff necessary from entire machine width, and guideline string offset from established centerline.
- Guideline string for planning purposes should be 300 mm (1 foot) from edge of screed. At least 75 mm (3 inches) should be allowed between each curb and edge of screed for irregularities.

If possible, plan the laying procedures so all street widths can be resurfaced with both intermediate and surface courses using the same basic machine width. This eliminates installing and removing screed extensions during construction. Use cut-off shoe for varying the widths, but make the last lane the entire machine width with no cutoff used.

Most laydown machines are now equipped with hydraulic screed extensions, eliminating the concern of matching lane widths to fixed screed extensions and greatly simplifying layout procedures.

Width of lanes for different width streets should be planned so inside lanes may be laid continuously. This eliminates many transverse joints and gives the job a better continuous appearance.

Inspector shall adapt designed cross section to existing street measurements. Lane widths should be planned to ensure screed edge will not drag on face of curb.

Provisions should be made to ensure straight longitudinal joints with a uniform lap of approximately 25 mm (1 inch) of each lane over adjacent lanes.

Because the narrowest dimension from working centerline to face of curb controls the above factors, that dimension shall be used as the basis for construction. All wider dimensions are filled with HMA along the curb by bleeding the mix from outer edge of finishing machine as necessary.

Construction

Inspector shall carefully lay out and thoroughly check lane widths and guideline string offsets before construction begins. This eliminates errors which cause time loss to contractor. Basic purposes of layout are to:

- Provide straight longitudinal joints with a uniform minimum lap of one lane over adjacent lanes.
- Keep edge of screed from dragging on face of curb.

Although all construction should work toward those ends, it is often necessary to vary procedures as work progresses. Lane widths shown on plans are widths of at least one of the lanes after the first lane is placed and before the last one is placed. Lane with adjusted width is normally the next-to-last lane placed. This is important if closing lane (which must be the entire machine width without a cutoff shoe) is to be placed without an excessive, unsightly lap at longitudinal joints. Because of widening under rolling, it is also necessary to vary width between guideline string and edge of screed to provide desired joint lap.

A lap of 25 mm (1 inch) at longitudinal joint is recommended. To eliminate confusion, guideline string should be placed as shown on planned procedure. On all but the first lane placed, measurement between edge of screed and guideline should be adjusted until desired 25 mm (1 inch) lap is obtained. On the first lane placed, edge of screed should be exactly 300 mm (1 foot) from guideline string.

Use of guideline string is required by specification. Curb, gutterline, or edge of previously constructed lane are not acceptable substitutes. String shall be accurately set and maintained. Contractor shall appoint a knowledgeable full-time person each day to mark working centerline from offset line with crayon. Guideline string is then set by measuring from working centerline.

Hard steel nails are the only thing which can usually be driven between bricks or cracks in old pavement to hold guideline string.

Edge alignment of each lane determines trueness of longitudinal joints. For satisfactory joint construction and uniform alignment, inspector shall require handwork wherever needed to straighten unevenly placed edges.

When resurfacing an old street, the shape of finished pavement should be kept in mind. It is nearly impossible to make a longitudinal joint inversely crowned without leaving objectionable roller marks. It may be necessary to raise inside edge of certain lanes more than intended thickness to provide slight crown at joint.

When the street under construction makes a right angle turn, paving shall proceed through intersection. Finishing machine will make a joint along the edge (which shall be sawed if allowed to cool) instead of turning the corner.

Thickness Taper at Curb Line

Thickness tapers are sometimes designed at outer edges of HMA resurfacing adjacent to existing curbs to maintain gutter depth and still permit full resurfacing thickness as wide as possible.

Thickness tapered sections of surface layers shall be constructed with finishing machines whenever possible. Thickness tapers at outer edges of intermediate layers may be constructed by hand methods or a wing plate, since they will be covered by surface layers and not affect drainage.

Inspector shall insure that finishing machines are used for constructing tapers whenever plans provide sufficient width.

Extending Paver Width

Many HMA paving machines are now equipped with hydraulic strikeoff extensions. If extensions do not contain a screed plate with vibration as required under *Specification 2001.19*, they shall not be used to increase width of spread of HMA mixture except in lieu of a wing blade or handwork, and for short irregular areas.

8.55 COLD WEATHER HMA CONSTRUCTION

The specifications contain limitations for placement of HMA and liquid bitumen under cold weather conditions. These restrictions apply to pavement surface temperature and time of year, and vary according to whether layer is surface course, lower intermediate, or base course, and nominal lift thickness.

Cold weather construction problems may show up in the form of mat raveling, low density, high voids, segregation, slippage, or failure of tack coat to break. Project engineer and inspector should be aware of other weather-related conditions which may further limit placement.

After October 1, it is appropriate to require tarping and insulation of truck bodies especially if hauls exceed 20 –25 km (approximately 12 –15 miles). Cold pockets of mix in trucks or in corners of the paver hopper can pass through the paver without breaking up. These cold clumps can drag under the screed and disfigure the mat. Clumps of cold material should be removed from the mat and the mat surface repaired before being compacted. Insulated truck bodies can help minimize or reduce this problem.

Rubber tired rollers must be well skirted and the tires kept hot during cold weather construction to prevent pick-up of fines from the mat surface. Rubber tire rollers should be kept moving as much as possible on the hot mat so the tires don't cool down and start picking up. Rapid cooling of the mix due to placement on a cold base can also result in checking (hairline cracks) in the mat surface under the action of the steel rollers.

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. See tables in Appendix 8-2, developed by National Asphalt Pavement Association, which 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 that may be used to determine

approximate cooling rates and resulting "time available for compaction" for hot mix asphalt pavement considering these variables. The latest version of the program is available to download through links provided on the Construction Office websites found on DOTNET and world wide web (www), or by clicking this PaveCool link on the Electronic Reference Library (ERL) version of this document.

Use of emulsion tack coats is required prior to October 1. For work after that date, a cutback asphalt may be used. Cold surface temperatures cause emulsions to lose tackiness and increase breakage (curing) time, resulting in higher risk of mat slippage.

Temperature Determination for Placing HMA and Liquid Bitumens

The specifications limit the placement of HMA or liquid bitumens when a shaded portion on road surface is less than a specified temperature.

The following method shall be used to determine the temperature on road surface:

- Select representative portion of road surface to be covered by HMA or liquid bitumen. If all of road surface is subjected to direct sunlight, test location should be in sunlight. If portions of road surface are shaded, test location should be in shade.
- Lay thermometer directly on road surface in test location and shade test location temporarily while taking temperature. Inspector performing test may need to stand so thermometer is shaded by shadow. To insure a condition of equilibrium, thermometer should remain in test location no less than five minutes.

8.56 RELEASE AGENTS AND SOLVENTS

HMA mixing, transporting, and placement equipment, particularly truck bodies and paver hoppers, must be kept clean and free from HMA buildup. *Specifications 2001.01 and 2001.03* address approved methods and materials. Diesel fuel or distillate is not approved for use in any fashion as an HMA release agent for truck bodies, paving equipment, or tools on DOT projects since contamination from petroleum based solvents is extremely detrimental to the performance of HMA. Approved release agents listed in *Materials I.M. 491.15* should be used to keep HMA from building up in truck bodies and other equipment.

Release agents are not solvents. They are generally not effective as cleaning agents. There may be times when a contractor must resort to use of a petroleum based solvent for cleaning certain items of equipment. This is not allowed on DOT property due to concerns with contamination of property or HMA. Truck bodies or paving equipment cleaned with a distillate should not be allowed for use for HMA hauling or placement for a minimum of 5 hours after cleaning.