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CHAPTER SEVEN:
MIX PLACEMENT AND COMPACTION

The procedures for mix placement and compaction are in general specified by the Contractor for QC/QA HMA in the Quality Control Plan for the contract. HMA and SMA mixtures are placed and compacted in accordance with Sections **402** and **410**, respectively.

WEATHER LIMITATIONS

Hot mix asphalt may be placed only when weather conditions are favorable. Placing the mix on a cold surface or when the air temperature is low causes the mix to cool too quickly. No mixture may be placed on a frozen subgrade. QC/QA HMA courses of less than 138 lb/yd^2 are required to be placed when the ambient temperature and the temperature of the surface on which the mix is to be placed is 45° F or above. For Non-QC/QA HMA, minimum temperatures have been established and are summarized as follows:

HMA Courses	Air Temperature	Surface Temperature
Equal to or greater than 220 lb/yd^2	32° F	32° F
Equal to or greater than 110 lb/yd^2, but less than 220 lb/yd^2	45° F	45° F
Less than 110 lb/yd^2	60° F	60° F

HMA courses may be placed at lower temperatures provided the density of the HMA course is controlled by cores as indicated in Section **402.16**.

Paving mixtures may not be laid on wet surfaces or when other conditions are obviously not suitable, even if air and surface temperatures are within the limits.

Mixing at the plant is required to stop when rain starts; however, material which is on the way to the contract may be placed if the rainfall is light enough to avoid excessive cooling or honey-combing after compaction. Since rain may be prevalent at the paving site but not at the plant, a means of rapid communication is required to be provided to prevent having several loads of material delivered which may not be used.

ALIGNMENT

The alignment of the edge of the pavement is critical to the appearance of the highway. When overlaying an existing pavement with a uniform edge, the paver operator may use the edge as a guide for laying the new pavement. When the edge is irregular or the lay is on a new base, an off-set string line to guide the paver is required. The requirement for good alignment is discussed with the Contractor before starting the paving operation. Neat lines are a requirement for a good quality pavement.

Another cause of poor alignment is overloading the propulsion capabilities of the paver. On steep grades, the haul truck may be required to dump only a portion of the load and pull ahead to take the additional dead load off the paver. This may also be necessary on fresh tack where the paver is not maintaining traction. Fishtailing of the paver is usually caused by overloading, slipping of the crawlers or drive wheels, or steering clutches in poor condition.

The pointer mounted on the paver is required to be rigid rather than a pendulum type because the rigid type permits more control in following the string line or pavement edge.

GRADE and SLOPE CONTROL

The paver may be equipped with an automatic grade and slope device. The automatic grade device controls the screed to adjust the thickness of the mat as the mix is placed to meet the desired grade. The automatic grade device may be guided with a string line, a grade leveler, or a joint marker, depending on the conditions of the existing pavement.

The screed may also be controlled by turning the depth crank. Once the paver is adjusted to the automatic grade device, the depth cranks are not used. One exception would be if the automatic grade device quit working. Manual controls may be used if this occurs to place the material in transit, but the operation is then stopped.

The slope meter is used to pre-set the paver to produce the specified cross slopes for crown and superelevation. The screed is hinged in the middle to permit crown adjustment at both the leading and trailing edges of the screed. The leading edge is required to always have slightly more crown than the trailing edge to provide a smooth flow of material under the screed. Too much crown produces an open texture along the edges of the mat. Too little crown results in an open texture in the center.

MIX TEMPERATURE AND APPEARANCE

The HMA Technician is required to continually monitor the quality and temperature of the mix at the paving site. This is done by visually observing each load and by periodically checking the temperature of the mix before being unloaded.

When the mix arrives at the site, the following items are checked:

1) Check the top size of the aggregate to verify that the size is correct for the course being placed. The mixture designated on the ticket is required to match the type of mixture designated for that day.

2) The mix is required to be of similar color throughout the load. Improper mixing at the plant may result in some parts of the mix being lighter than others.

3) All aggregates are required to be coated with asphalt. Large coarse aggregate may not be entirely coated because of the rough surface texture.

4) Puddles of asphalt sitting on the mix indicate insufficient mixing. These loads are not accepted.

5) Blue smoke rising from the mix is an immediate indication that the temperature of the mix is too hot. The temperature of the mix is checked to confirm this observation. A smokey load may also indicate the use of fuel oil as an anti-adhesive in the truck bed. Blue smoke is required to be investigated and reported to the PE/PS immediately.

6) The aggregate particles are required to be distributed throughout the mix. If the coarse aggregates tend to roll out of the truck into the paver at the very beginning or very end of the load, the mix is segregated. Segregation is the most common mix problem.

To attain the best results, HMA mixtures are required to be placed at the optimum temperature. Temperature checks of the mix are made for the first 5 loads of each day's production and recorded on the weigh tickets. When the temperature is checked, the temperature, time, and station is recorded on the ticket. When temperatures are stable, further checks are made at 2-hour intervals. If the temperatures do not stabilize, the PE/PS, the Contractor's Paving Foreman, and the HMA plant are required to be notified. The temperature of each mixture at the time of spreading is required to not be more than 18° F below the minimum mixing

temperatures indicated on the DMF/JMF for non-QC/QA mixtures. The thermometer is required to be operating properly before rejecting a load for temperature limitations. **ITM 909** is the procedure for verifying the temperature of the thermometer.

PLACEMENT OF MIXTURE

START-UP

Three types of start-ups are used in hot mix asphalt paving:

1) Full depth

2) Continuing an existing lay

3) Feathering

A full depth start-up is used where paving is started at an intermediate point in the contract. Before starting, the screed is required to be elevated from the grade the thickness of the mat plus an allowance for the compaction to be achieved by the rolling. Wooden blocks of the required thickness are placed under each end of the screed.

When continuing from a previously laid mat, the tapered material is removed back to the full-depth section and the joint lightly tacked. Strips of lath thick enough to allow for compaction are placed under the ends of the screed as illustrated in Figure 7-1. The front of the screed should never be placed beyond the joint.

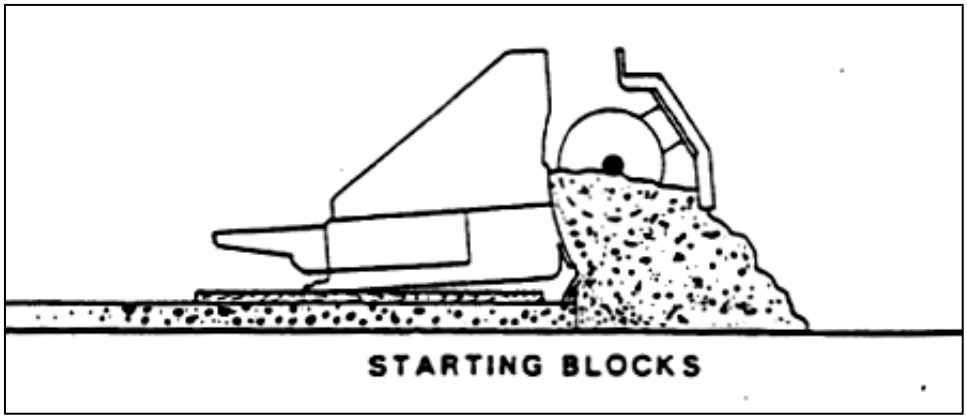


Figure 7-1. Continuing on Existing Lay

When building a start-up feather joint, the screed is set directly on the existing pavement at an angle to gradually taper up to the full depth. The feathering is required to be long enough to provide a smooth transition. Feathering is not normally allowed on INDOT contracts. Any start-up feathering is required to be approved by the PE/PS.

Paving exceptions are indicated on the plans. Bridges, except for earth-filled arches, are usually an exception from paving. Adding HMA pavement over a concrete bridge deck would cause deterioration to the deck. There may be exceptions when paving under a bridge if the added pavement would reduce the overhead clearance to an unacceptable height. The minimum vertical clearance for interstate and divided lane roadways is 16 ft. For all other pavements, the minimum vertical clearance is 14 ft. The total designed thickness of overlay is placed under overhead structures, except where the resulting minimum clearance would be less than 16 ft 6 in. or 14 ft 6in. depending on the type of road. The base and/or intermediate courses are feathered down to the existing pavement 50 ft on each side of the structure. Only the surface course is placed under the structure when the clearance is not met; however, no surface course is placed when the clearance is 16 ft 0 in. or 14 ft 0 in. or where laying the surface course would result in a clearance of less than 16 ft 0 in. or 14 ft 0 in.

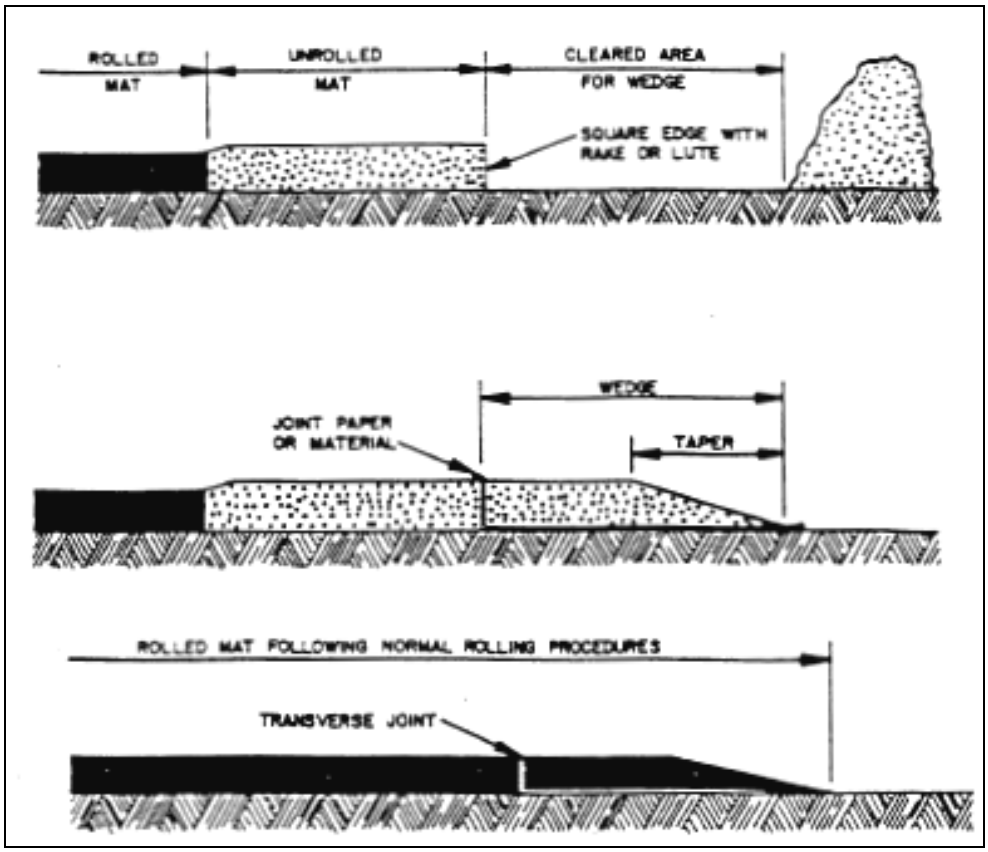
Form M-232, Preliminary Report of Overhead Structures, is required to be completed and submitted when a change in the overhead clearance is made. The information is given by phone immediately and followed up with the M-232 form. Form 232A, Bridge Measurement Report, is submitted by the District Office after the work is completed and the exact height clearance is known.

With any start-up, the screed is required to be hot before any mix is processed through the paver. Screed heaters are provided on all pavers to preheat the screed. Once the screed is hot, the heaters may be turned off because the heated mixture keeps the screed hot. Screed extensions bolted on to the paver to attain the required width are also required to be heated. The heating device on the main screed does not provide heat to these extensions.

The front of the screed is required to be set slightly higher than the rear of the screed to provide what is commonly referred to as the “angle of attack”. This angle allows the screed to climb enough to equal the amount of compaction that the screed exerts on the mix. Thickness checks are made frequently during the start-up to ensure that the screed is set correctly to produce the desired thickness.

TRANSVERSE JOINTS

A transverse joint, commonly called a day joint, is normally required at the end of each day’s paving to provide a smooth transitional ramp for traffic. A day joint is constructed as indicated in the series of drawings in Figure 7-2.



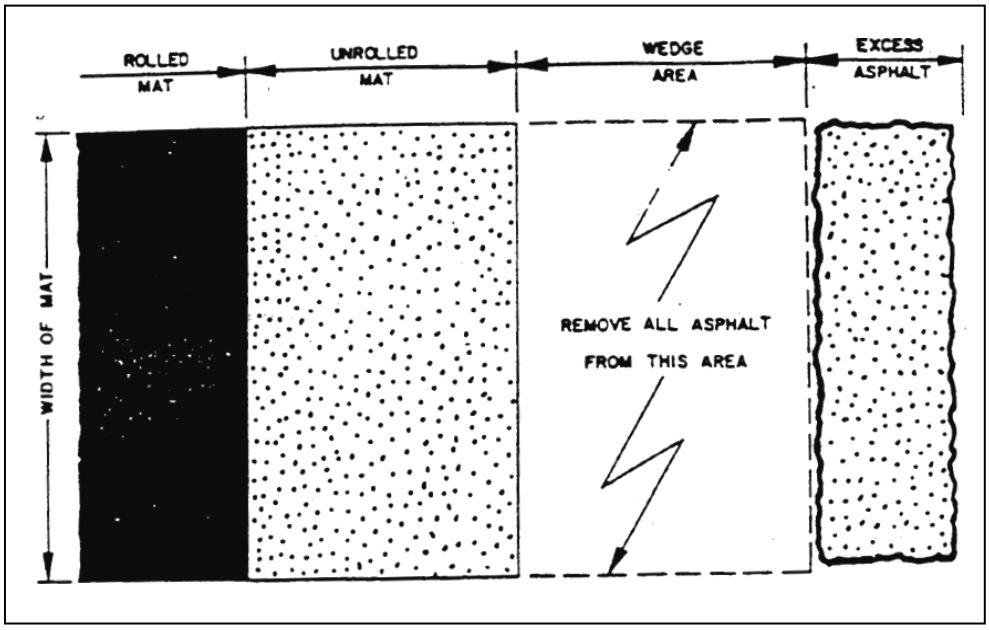


Figure 7-2. Construction of a Day Joint

The last few feet of the mat is left unrolled, the mix is cleared away from the wedge area, joint paper is laid on the existing surface and up the vertical face of the joint, the mix is shoveled over the paper to form the wedge, and the mat is rolled. The Contractor is not allowed to completely empty the paver hopper to make the day joint since some of the mix still in the hopper is too cold. When paving is resumed, the wedge and paper are removed to provide an exposed mat that is full-depth and at the proper grade for continuing the lay. The screed is blocked up with wooden strips as previously described. The paver is positioned with the front of the pre-heated screed over the joint line. After the hot mixture is conveyed into place, sufficient time to re-heat the joint is allowed before moving the paver forward. The paver is advanced enough to allow the workmen to conduct the necessary handwork. The straightedge is required to be used to check the joint to ensure the proper grade before allowing the roller on the surface. Once the joint has been rolled, the joint is rechecked with the straightedge. If any corrections are required there is sufficient heat remaining in the mix to make a smooth joint.

LONGITUDINAL JOINTS

Longitudinal joints are made when joining adjacent lays to make the specified width of pavement. The paver screed does not overlap the previous lay and is carried slightly higher to allow for compaction of the new lay to match the previous lay. The raker uses a lute to remove the excess material from the previous lay into the new lay to obtain a tight, smooth joint and to prevent the rollers from compacting this material into the cold mat. The paver attempts to place the material in such a way that no luting is necessary.

PAVER OPERATION

HMA mixtures are spread and finished with the use of paver finishers and widening pavers. Widening pavers are used for widths of less than 8 ft where the regular paver cannot operate.

Fuel oil, kerosene, or solvents are not allowed to be transported in open containers on any equipment. Cleaning of equipment and small tools also is not allowed on the pavement or shoulder areas.

HMA PAVER

Controlling the vertical position of the free-floating screed, with respect to the grade surface over which the paver is moving, is the primary concern in producing high quality paving.

Several factors, such as the paving speed, head of material, mix consistency, pre-compaction, and screed angle of attack influence the vertical position of the screed. If any one of these factors is varied during the paving operation, the variation causes a change in the mat depth, density, and/or texture.

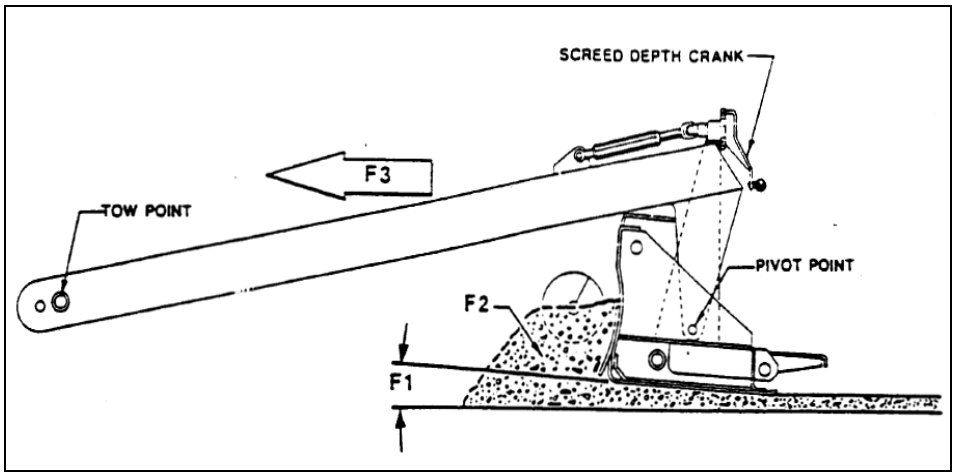


Figure 7-3. Free Floating Screed

The three primary variable factors (Figure 7-3) which influence the vertical position of the free-floating screed are:

1) Factor F-1 -- Angle of Attack

2) Factor F-2 -- Head of Material

3) Factor F-3 -- Paving Speed

The angle of attack is the angle that exists between the bottom surface of the screed and the grade surface over which the paver is moving. Paving over a flat, level surface with all variables held constant produces a mat of constant profile. If the screed or tow points are vertically displaced, a change in the angle of attack occurs. The screed moves to restore the original angle as illustrated in Figure 7-4. The restoration action of the screed is referred to as self-leveling.

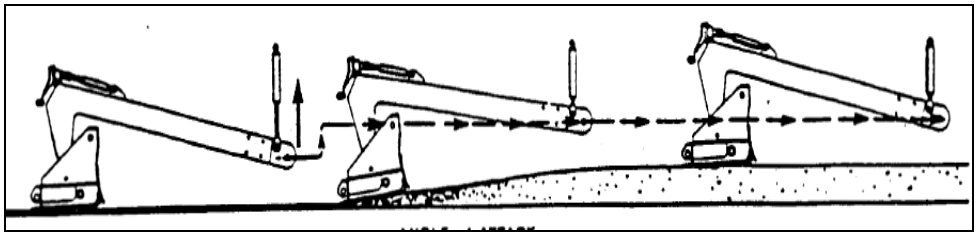


Figure 7-4. Angle of Attack

When the angle of attack is increased, more material is allowed to pass under the screed causing the screed to rise until the screed is again moving in a plane essentially parallel with the grade surface.

Decreasing the angle reduces the amount of material allowed to pass beneath the screed, causing the screed to drop until the screed is again parallel to the grade.

The angle of attack is controlled by either manual screed depth cranks or automatic level controls. One full turn of the depth crank raises or lowers the screed approximately 1/4 in.

Adjustments are made in small increments to produce a smooth riding pavement. The change in depth begins immediately after adjusting the crank; however, the paver is required to move approximately 5 times the length of the screed side arm before the full change in thickness is completed. Once the paver is adjusted for the correct mat thickness**,** very little adjustment of the depth cranks is required.

The head of material is the volume of paving material directly in front of and along the entire length of the screed. The volume and consistency of the head of material are primary factors in the amount of mix that flows under the screed that affect the mat density, texture, and profile. The volume in front of the screed determines the amount of pressure or resistance to forward travel exerted on the screed.

The volume of material in front of the screed is maintained at a near constant level from the center to almost covering the auger shaft along the entire length of the screed (Figure 7-5). Modern pavers have automatic controls to maintain the correct level.

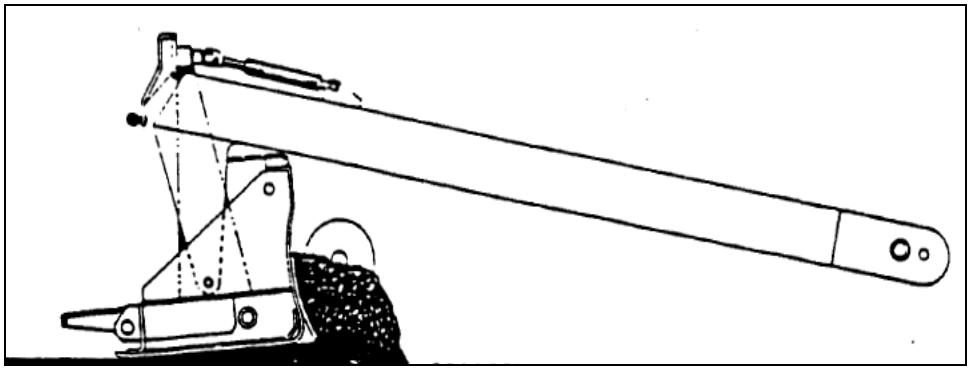


Figure 7-5. Correct Head of Material on Screed

If the head of material is too high (Figure 7-6), the resistance to forward travel is increased. The screed rises and may cause ripples, auger shadows, long waves, increased depth, or a less dense mat.

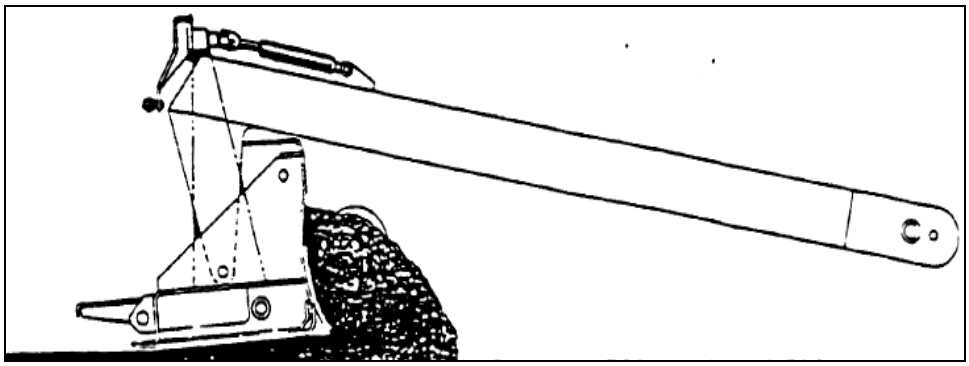


Figure 7-6. Head of Material Too High on Screed

If the head is too low (Figure 7-7), the resistance to forward travel is decreased and the screed gradually falls, resulting in a thin mat and possible voids in the mat.

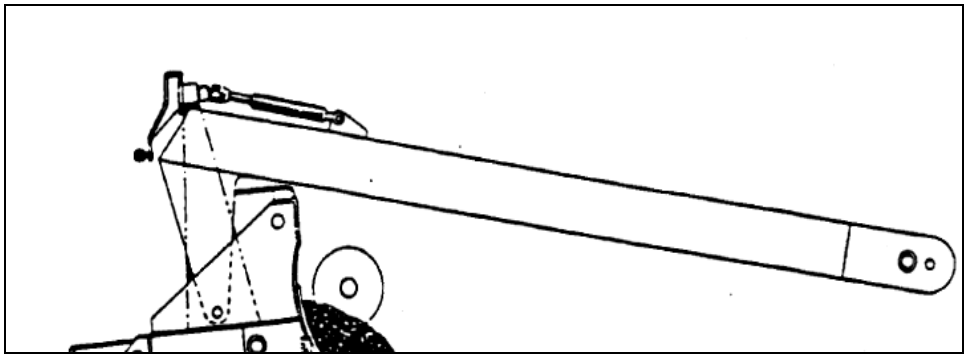


Figure 7-7. Head of Material Too Low on Screed

A fluctuating head of material results in a combination of the mat deficiencies described above plus alternating changes in the mat texture and depth.

The speed of the paving operation is determined by the rate of material delivery to the paver. The optimum speed results in the paver being in continuous operation, using the mixture as the material is delivered, and never having trucks stack up waiting to unload. Continuous, uninterrupted forward travel at a constant speed, with other variables held constant, produces a smooth riding surface. While absolute compliance with this goal is usually not possible, fewer interruptions or changes in paving speed provide a smoother finished surface. The paving speed is required to be adjusted to give a uniform texture and coordinate with plant production.

The paving speed to match the plant production may be computed for any planned quantity. The paving speed and plant production are required to match and be outlined in the Quality Control Plan.

Pavers may not operate at speeds in excess of 50 ft per minute for mixes that are not density controlled by cores. Paver speeds in excess of this speed often result in non-uniform surfaces.

Whenever the absence of loaded trucks necessitates a pause, the paver is stopped with a substantial quantity of mix ahead of the screed. Operating the paver until the mix is too low ahead of the screed results in a dip in the pavement.

In addition to the three major factors discussed, other improper operating procedures which may affect the riding quality of the pavement are:

1) Truck bumping the paver -- this practice is the most common cause of transverse marks and ridges in the finished mat. Drivers are required to stop their trucks ahead of the paver and let the paver operator pick up the truck as the paver travels forward.

2) Truck driver holding brakes -- this practice reduces the paving speed causing an increase in mat depth and may cause the paver wheels to slip or break traction. This problem causes a non-uniform edgeline of the mat and a bump in the mat.

3) Paver engine in poor operating condition -- an improperly functioning engine may cause power and speed surges resulting in ripples, waves, or auger shadows in the mat.

4) Unequal or over inflation of paver tires -- this may cause the drive wheel to slip or break traction resulting in a rough, uneven mat.

5) Loose or unevenly tensioned traction drive chains -- this may cause power or speed surges resulting in ripples, waves, or auger shadows in the mat.

Automatic grade and slope controls are required and outlined in the Quality Control Plan. A ski is used to guide the automatic grade control on all lays except when matching previous lays, where the joint matcher attachment is used.

WIDENING PAVERS

Widening pavers are used only when regular pavers cannot lay the required width or section. These pavers are typically used for paving narrow shoulders which cannot be paved in conjunction with the traveled way. Their use is not allowed for paving widths of 8 ft or more.

Widening pavers are equipped with hoppers for receiving the mix from the haul units, conveyors to carry the mix to either side of the paver, and adjustable strike-offs on each side of the paver to allow paving on either side. The strike-off may be adjusted vertically up to 12 in. below or above the grade, depending on the make and model, to allow placing material in lifts.

The strike-off blade does not have the compactive capability of the screed on a regular paver. Consequently, the surface texture is likely to be more open.

The proper adjustment of the strike-off blade is the key to obtaining a good pavement with a widening paver. The settings for the paver are checked before the paving operation is started. After paving a short distance, the mat is required to be checked for the following:

1) Proper width – if correction is necessary, the width is adjusted by expanding or contracting the strike-off. The outer edge plate may also need to be readjusted parallel with the road edge.

2) Proper elevation – adjusted by raising or lowering the inner strike-offs.

3) Proper slope – adjusted with the outer strike-off support. The sliding outer edger plate, may also require readjustment.

4) Inner edger plate – positioned to prevent paving material from piling up on the existing pavement. The inner edger plate is adjusted to be parallel to the pavement surface set in the lowest position.

5) Flow of material - the flow of material in front of and under the strike-off is watched. Adjustment from the vertical positions may be required.

If the top of the strike-off is tilted back (Figure 7-8), the plate rolls material up. Excessive backward tilt forces the strike-off to pull down into the material.

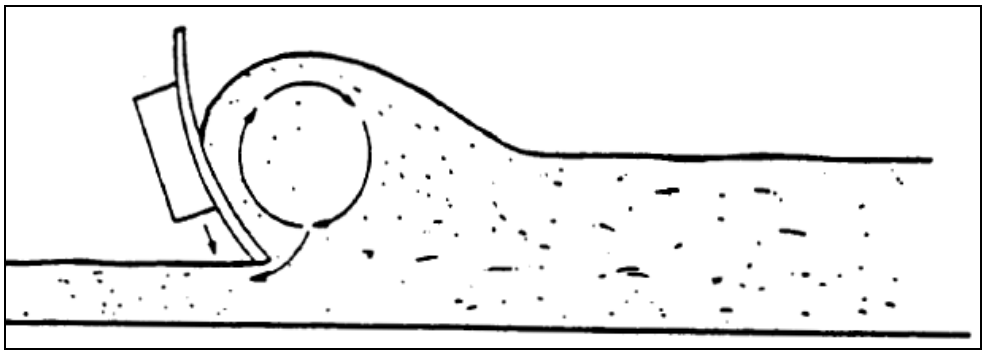


Figure 7-8. Strike-Off Plate Tilted Back

Tilting the top forward (Figure 7-9) causes the strike-off to roll the material down. Excessive forward tilt forces the strike-off to ride up over the material.

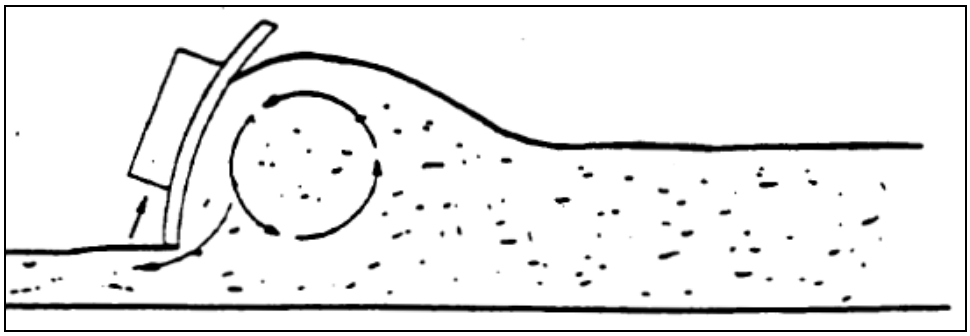


Figure 7-9. Strike-Off Plate Tilted Forward

CARE AND CLEANING OF PAVERS

Pavers are also required to be checked for oil and fuel leaks because petroleum products damage the mix.

The paver hopper, conveyors, augers, and screeds are required to be cleaned at the end of each day. Any hardened mix is removed so the mix is not contaminated when the paving is resumed.

Caution is used at paver cleanout sites because excessive fuel oil saturating the ground may lead to pollution problems. The Contractor is required to clean the areas where the paver is maintained.

OVERALL APPEARANCE AND EVALUATION OF MIXTURE QUALITY

The mat immediately behind the paver is required to have a smooth, even texture. Typical deficiencies in the mat appearance and the probable causes are discussed below. A more complete troubleshooting chart is included in Appendix A. The Contractor is responsible for correcting the deficiencies; however, knowing the causes of the problems is beneficial in evaluating the Contractor's efforts to correct the problems.

Immediate action is required to be taken to determine the cause of any of these deficiencies and remedy the problem.

BLEEDING OR FLUSHING

Bleeding or flushing occurs when excessive asphalt appears on the surface of the finished mat. This problem may be caused by:

1) Excessive moisture in the mix

2) Mix segregation

3) Excess asphalt in the mix

4) Traffic allowed to travel on the new mat too soon

5) Application of too much tack

6) Excess anti-adhesive agent left in the truck bed

7) Different brands of asphalt that react differently under identical temperatures

8) Excess moisture on paver push rolls to prevent mix build-up that causes foaming

STREAKING OR BUBBLING

Streaking or bubbling of the mixture behind the paver may be caused by excessive moisture in the mixture.

SEGREGATION

Segregation is an open appearance of the mixture that may be caused by:

1) Trucks not loaded properly that allows the mix to cone in the trucks while loading. A three dump system is preferred for most loading operations.

2) Running the paver too low on mix at the end of each load

3) Aggregates segregated in the stockpiling or mixing process

4) Surge bin pulled down below the cone

TEARING

Tearing of the mat as the mixture leaves the paver may be caused by:

1) HMA is too cold

2) Screed plate worn excessively

3) Excessive paver speed

4) Lead crown in screed set incorrectly

WAVY SURFACE

A wavy surface appearance may be caused by:

1) Automatic grade controls not working properly

2) Fluctuating head of material in front of the screed

3) Augers on the paver worn out or overloaded

4) Poor rolling sequence

5) Excessive adjustment of the depth crank when operating the paver manually

COMPACTION

Compaction of HMA mixes is conducted with steel-wheel, pneumatic-tired, or vibratory rollers in three phases:

1) Breakdown or initial rolling

2) Intermediate rolling

3) Finish rolling

Both vibratory and tamper-type paver screeds begin the compaction of the mix as the material flows under the screed. Breakdown rolling compacts the material beyond that imparted by the paver, intermediate rolling compacts and seals the surface, and finish rolling removes the roller marks and other blemishes left from the previous rolling.

Compaction may be controlled by the number of passes of a specified series of rollers or by density. The Technician is required to refer to the QCP for the contract to verify the type of rollers to be used. With either method, sufficient rollers are required to be operated to complete the compaction before the temperature of the mix has cooled.

The rolling operation is required to obtain a fully compacted mat. If the necessary compaction is not attained, subsequent traffic consolidates the mat further resulting in wheel ruts. Some of the new PG grade asphalts have a temperature range referred to as the "Tender Zone". This is the temperature range in which after the initial breakdown passes, rolling is required to cease until the temperature drops below this zone. Otherwise, the mat may be damaged and/or any density attained by initial breakdown may be lost.

SPECIFIED ROLLERS

Section **402.15** for non-QC/QA mixtures requires three rollers; a three-wheel steel roller, followed by a pneumatic-tired roller and a tandem steel-wheeled roller. This combination is designated as Option No. 1. Options 2, 3, and 4 allow the Contractor to remove a roller(s) and increase the number of passes with the roller used. A roller pass is defined as one complete coverage by the roller of a given area. The various options for rolling are included in the following table.

Number of Roller Applications						
Rollers	**Courses ≤ 440 lb/yd^2**				**Courses > 440 lb/yd^2**	
	Option 1	**Option 2**	**Option 3**	**Option 4**	**Option 1**	**Option 2**
Three Wheel	2		4		4	
Pneumatic Tire	2	4			4	
Tandem	2	2	2		4	
Vibratory				6		8

PLANT PRODUCTION - NUMBER OF ROLLERS

Before the contract begins, the Contractor is required to verify that there are a sufficient number of rollers and haul trucks to keep pace with the anticipated plant production. This procedure is documented in the Contractor's Quality Control Plan.

COMPACTION CONTROLLED BY DENSITY

For all QC/QA mixtures, density is determined by cores obtained from the mat after all rolling is complete. If cold weather paving is allowed, the density is also determined by cores (Section **402.16**).

For Non-QC/QA mixtures, the density is controlled by the specified rolling option (Section **402.15**).

WIDENING

HMA mixtures placed as widening and other depressed areas are required to be rolled with a trench roller.

ROLLING PATTERNS

Rolling of HMA mixes is conducted in the following order:

1) Transverse joints

2) Longitudinal joints – if the new mat is adjoining a previously placed lane

3) Outside edge

4) Initial or breakdown rolling

5) Intermediate rolling

6) Finish rolling

Any area that cannot be compacted by rollers is required to be compacted with hand tampers, plate vibrators, or other approved equipment.

Rollers, regardless of the type, are not allowed to be parked on the fresh mat.

TRANSVERSE JOINTS

The ramp section and paper from the day joint are required to be removed prior to starting paving. The screed is set enough higher than the previously laid mat to allow for compaction. When the paver has moved away from the joint, any mix on the surface of the old mat is butted into the joint with a lute. The joint is first rolled transversely with the roller compacting on the old mat and extending into the uncompacted mix about 6 in. Pinching the material into the joint in this way helps attain a tight joint. Planks perpendicular to the lay are used to support the roller to

prevent breaking down the edge of the mat while rolling in the transverse direction. Rolling is continued transversely until about 3 ft of the new lay has been rolled.

The roller is then turned parallel to the laydown and rolling is continued. The joint is required to be checked with a straightedge. The roller usually smooths out a bump while the mix is still warm by rolling transversely. Additional material may be required if the straightedge indicates a dip. Material may be added by hand, leveled with a lute, and then re-rolled to correct a dip. However, adding material tends to produce poorer quality surface texture.

LONGITUDINAL JOINTS

The proper technique for the construction and compaction of the longitudinal joint is illustrated in Figure 7-10 and explained as follows:

1. The uncompacted HMA abutting a cold mat is placed 1/4 in. per 110 lb/yd^2 higher than the cold mat. Any HMA placed on top of the cold mat is required to be removed from the cold mat prior to compaction.

2. The first pass of the breakdown roller to the paver and the return pass from the paver are required to overlap an unconfined edge or cold mat by 6 in.

3. The entire width of the mat is required to receive a uniform number of passes of the compaction equipment. If the mat is tender with pushing and shoving during the compaction operation, the rolling operation is required to be delayed until the mat becomes stable under the roller.

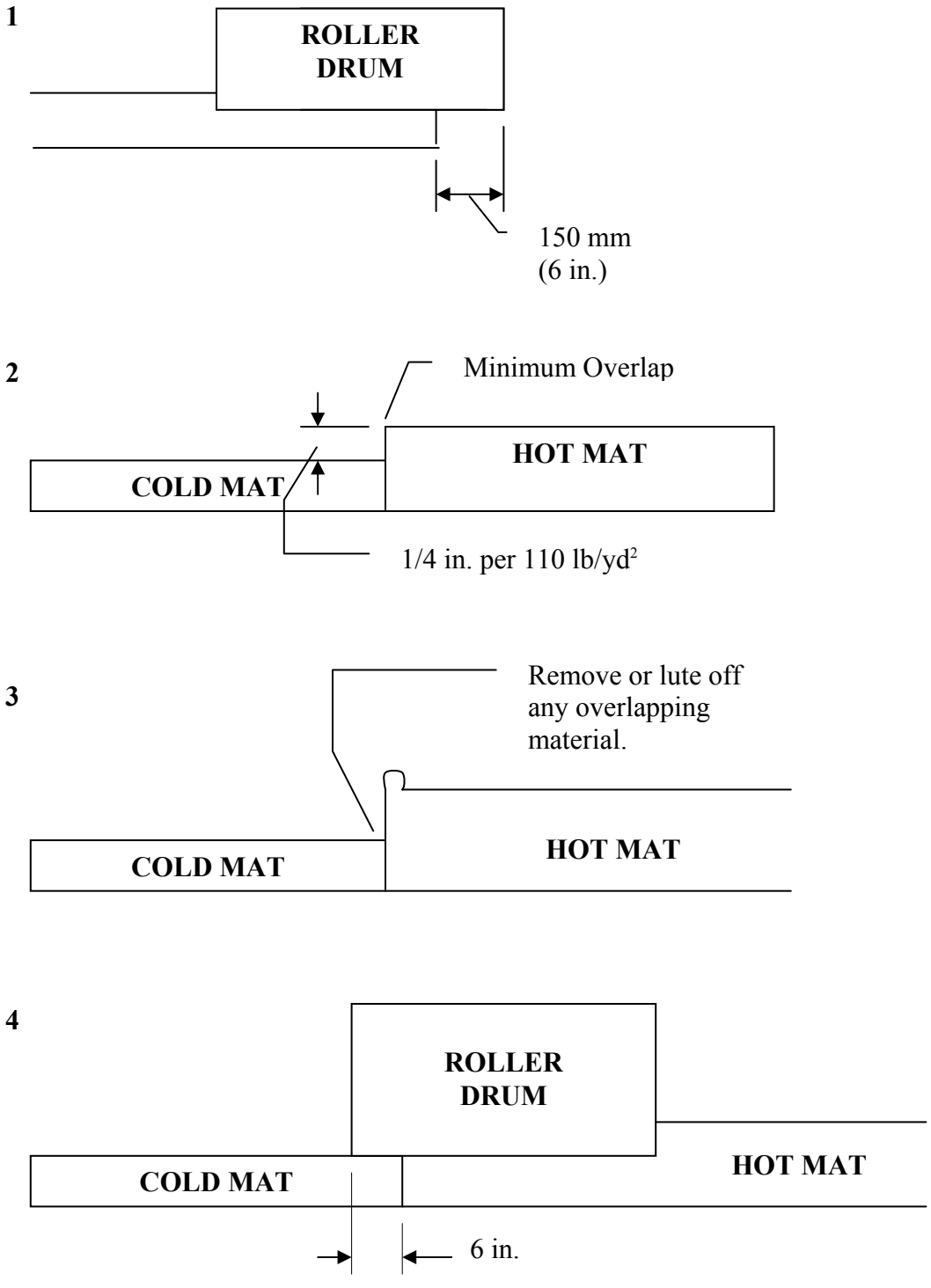


Figure 7-10. Longitudinal Joint Compaction

The notched wedge longitudinal construction joints (Figure 7-11) is another procedure used for constructing the longitudinal joint. This type of joint has shown the potential of improving the construction of longitudinal joints by providing better compaction at the joint.

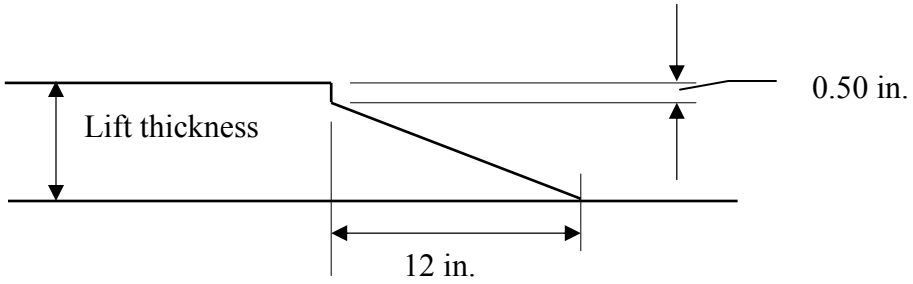


Figure 7-11. Notched Wedge Longitudinal Construction Joint

BREAKDOWN ROLLING

When a single lane is being placed, the outside edge (the low side) of the lane is rolled first. When placing a new mat adjacent to the existing lay, the longitudinal joint is rolled first followed by the breakdown rolling on the low edge.

Every trip of the roller proceeds straight into the uncompacted mix and returns in the same path. All turning movement is completed on previously compacted material. The drive wheel of the roller is toward the paver because there is less tendency for the mix to shove under the drive wheel. The recommended pattern for breakdown rolling is illustrated in Figure 7-12.

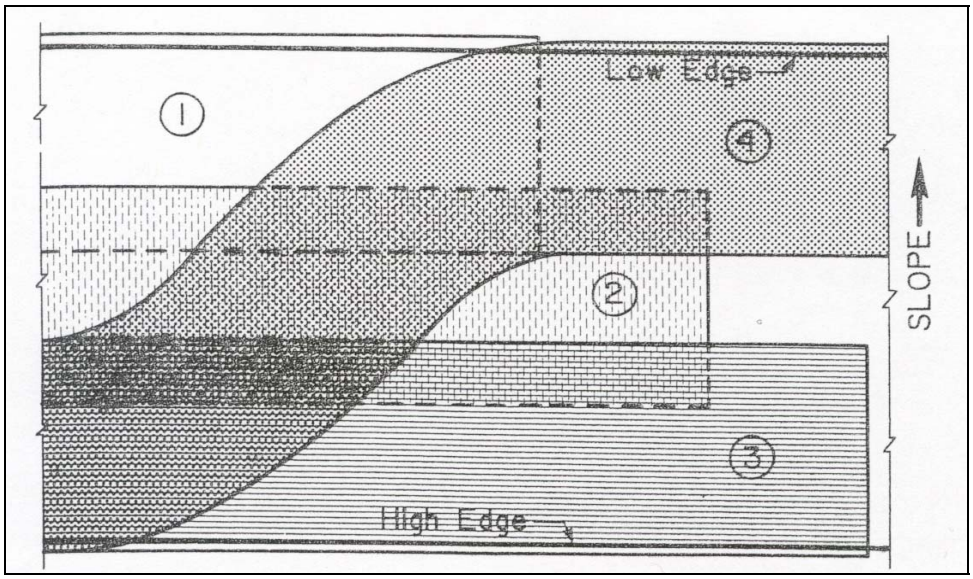


Figure 7-12. Breakdown Rolling Pattern

After the required passes for the breakdown rolling are completed, the roller is moved to the outside of the lane on the cooled portion of the mat to repeat the process on the next segment.

INTERMEDIATE ROLLING

Intermediate rolling is conducted immediately after the breakdown rolling while the mix is still hot and at a temperature that results in maximum density. The rolling pattern is the same pattern as done for the breakdown rolling.

Keeping the tires hot helps prevent the newly laid material from sticking to the tires for the pneumatic-tired roller. Intermediate rolling is continuous until compaction is attained.

FINAL ROLLING

Final rolling is conducted to improve the surface texture. This rolling is completed while the mat is still warm enough so roller marks from the breakdown and intermediate compaction are removed.