

PAVING PROJECT INSPECTION

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The motoring public expects paved roadways to provide a smooth ride, safety, good drainage, good pavement lines and signs, and a maintenance-free surface. When performing paving operations using either Superpave hot-mix asphalt or Superpave warm-mix asphalt materials, municipalities must pay careful attention to details in the pavement construction process so that they deliver a new pavement that meets the public's expectations for many years of acceptable service life.

There is much hype about the new warm-mix asphalt pavement mixes. Warm-mix asphalt is basically the same as the Superpave hot-mix asphalt, but the mix is blended with a warm-mix technology additive or modifier to reduce mix viscosity and increase workability at lower temperatures where placement and compaction take place.

Whether your municipality performs asphalt paving with its own crews or through the services of a paving contractor, it is important to understand the many fine details involved in constructing a successful new asphalt pavement. In all likelihood, the project will cost the same whether the materials are placed 100 percent in accordance with the specifications and best practices or details relating to the equipment, material, weather, preparations, workmanship, or many other factors are overlooked.

Pennsylvania has implemented a best practice of requiring a trained and certified bituminous field technician to be on site while the paving operation is under way. Likewise, a certified bituminous plant technician is responsible for the mixing or batching process at the plant. Ideally, these two technicians are responsible for quality control of the paving operation from batching to final compaction of the asphalt pavement. Together, they will make sure quality materials are properly mixed and placed to ensure a durable pavement. The use of these certified technicians is recommended whenever possible. In addition, careful consideration to details in every step of the paving process will help your municipality to deliver the best possible pavement.

This technical sheet is intended to provide the municipality's roadmaster and/or inspector with a consolidated reference document when preparing for and constructing an asphalt paving project. Other valuable resources regarding paving operations are available from your PennDOT District Municipal Services Representative or through LTAP Technical Assistance.

Plans, Specifications, and Preparations

The municipality's **engineer** will evaluate the pavement in advance and prepare plans, specifications, and the contract documents if the work will be bid to a contractor. The requirements may involve pavement preparation, such as replacement of cross pipes and inlets, drainage corrections, base repairs, milling shoulders, and notification to all utility companies with underground facilities in the vicinity. The engineer will also determine the pavement design and mix selection for the project. The existing pavement structure must be repaired to a stable condition in order to provide a good base for a surface overlay.

Prior to the start of the project, the **inspector** should become familiar with the plans, specifications, and contract documents and understand the exact type of materials specified by the municipality's engineer. Appropriate advance notice should be provided to businesses, schools, residents, police department, emergency services, and PA One Call so that all underground utility facilities are identified. Plans for maintenance and protection of traffic also need to be in place, keeping in mind that the safest and easiest paving operation will detour traffic, if possible, to keep it away from the operation. The approved PennDOT Bituminous Asphalt Mix Design (Job Mix Formula) must be received from the plant at least five days before the start of work. All of this applies whether paving is to be done by a contractor or by the municipality's own crew.

Pavement Preparation

Preparing the pavement for paving may be as simple as sweeping the surface and applying a tack coat. To provide a uniform foundation, additional preparation may be required with proper pothole repairs, base repair, crack sealing, or scratch and leveling courses to address surface irregularities. If paving is performed over a poor base, the surface will crack as the base continues to degrade. Also, if irregular depths of pavement overlay are placed, the pavement will continue to compact under traffic where the paving was thicker, thus resulting in surface depressions. It will be difficult to obtain uniform compaction density resulting in possible premature failure of the pavement in areas of poor compaction.



Before paving, a roadway must be prepared through proper pothole repairs, base repair, crack sealing, or scratch and leveling courses to address surface irregularities and provide a uniform foundation.

The **roadmaster** must be prepared to address the following before paving begins:

- Use full-depth base repair if alligator cracking is evident.
- Fill small potholes, but excavate and repair soft material.
- Avoid irregular edges when saw cutting for potholes or base repair.
- Seal all cracks over ¼ inch wide using a 3-inch overband of sealer flush with the surface.
- Mill the surface to restore curb reveal and/or to eliminate surface irregularities.
- Use scratch and/or leveling courses for rut repair and low areas, remembering to build up the pavement with uniform thickness layers.
- Use a finer mix when placing thin layers. Larger aggregate will be crushed or dragged by the screed.
- Sweep the pavement surface to remove all loose material.
- Apply the AE-T (Asphalt Emulsion Tack) coat immediately after sweeping. Keep the following tips in mind when applying the tack coat operation:
 - All tack nozzles must be clean and turned 30 degrees from the spray bar.
 - The spray bar should be 12 inches above the pavement surface.
 - Nozzles on 4-inch centers should provide triple-lap coverage.
 - 0.02 to 0.07 gallons per square yard of residual asphalt should be applied, depending on surface texture.

The AE-T (33 percent asphalt and 67 percent water) should be calculated to achieve desired residual.

Example – Required Asphalt Residual equals 0.05 gallons per square yard (S.Y.)

AE-T Application Rate = $0.05 \text{ gal. per S.Y.} \times 1.0 \text{ gal. per S.Y. of AET}$
0.33 gal of Asphalt Residual

AE-T Application Rate = 0.15 gal. per square yard

AE-T should be applied to all vertical surfaces that will come in contact with the new paving course.

Superpave Asphalt Delivery

Following best practices in hauling the asphalt mixture from the plant to the paver is essential for a paving project to be successful. The plant operator, the truck driver, and the paver operator must pay careful attention to detail, including the proper care and handling of all equipment being used in the mixing, paving, and compaction process.



Avoid interruptions to the flow of material to achieve a smooth and long-lasting pavement surface.

As the first rule, you want to ensure an uninterrupted flow of material from the plant to the paver to avoid stopping and starting the paver, which may result in small bumps in the riding surface. The following best practices have been proven to contribute toward a smooth and long-lasting pavement surface:

- Calculate the number of trucks required to deliver material with uninterrupted delivery. Consider haul time to and from, load time, delays at plant and job, and dump time.
- Clean the truck bed and apply a non-petroleum release agent. Raise the bed and drain any excess agent before loading.
- Load the truck uniformly with two or three drops starting at the cab, then the tailgate, and finally the center to avoid segregation of the aggregates.
- Pick up the delivery ticket to verify the mix and loading temperature.
- Tarp the entire load, overlapping the truck sides to avoid air cooling portions of the load.

- Proceed to park at the project site just far enough ahead of the operation.
- Back toward the paver but stop short to let the paver make contact with the truck first.
- Make sure the inspector verifies the delivery ticket mix and temperature against the mix design.
- Raise the bed allowing the load to break against the locked tailgate.
- Open the tailgate and flood the hopper while gradually raising the bed to unload.
- Lower the bed, and then pull away from the paver and proceed to a designated cleanup area.
- Insulate the truck on all sides or provide a heated body when the air temperature is below 50 degrees F or anytime between October 1 and April 30.

Superpave Asphalt Paving

Throughout the paving operation, many techniques and established practices exist to ensure a successful paving project. Understanding the components of the paving equipment and proper operations are the first step in a long process that involves delivering material from the plant, transferring it from the truck to the paver, placing it on the pavement, and providing initial consolidation. The inspector must be familiar with the contract documents and specifications and ensure the proper material is delivered and placed. When the product arrives at the project, the inspector must compare the Daily Bituminous Certification (Form 465 or CS 4171) with the approved PennDOT Bituminous Asphalt Mix Design (Job Mix Formula) and the delivery tickets each day to verify the right mix. Note that different Superpave mix designs are used for each course of paving (scratch, leveling, and wearing).

Remember that Superpave hot-mix asphalt and Superpave warm-mix asphalt are nearly identical with the exception of additives and mix temperatures. Refer to the “Placement Temperatures” table below for the difference in allowable temperature ranges of the mix at time of placement.

Placement Temperatures		
	Hot Mix	Warm Mix
PG 58-22	260°F to 310°F	215°F to 310°F
PG 64-22	265°F to 320°F	220°F to 320°F
PG 76-22	285°F to 330°F	240°F to 330°F

The paver is the primary piece of equipment on the project, and failure to address the following may result in an uneven riding surface or material segregation that will likely result in premature pavement failure:

- Adjust the hopper low to the ground to allow trucks to dump. Make sure the overflow guards are in good repair to avoid spilling material onto the pavement.
- Run the conveyors continuously, and adjust the flow gates to yield a continuous flow of material to the augers.
- Ensure augers receive a steady supply from the conveyors to provide a uniform depth of material at half the height of the augers.
- Understand that the screed provides initial compaction, and the screed plate develops initial texture. To avoid pulling of material, use the screed heater to preheat to 300 degrees at the beginning of the operation or after a prolonged shutdown.
- Adjust the mat thickness. One full turn of the control screw increases or decreases the mat thickness by ¼ inch. The full effect of the adjustment is achieved after traveling five times the screed arm length (typical 40 feet). As a rule, 1¼ inch of screed-placed material will compact to 1-inch depth. Use this ratio for thicker lift thicknesses.
- Ensure the inspector checks each course of paving and calculates to verify the material yield to manage material quantities and to achieve the desired pavement thickness.
- When starting the paver next to a transverse joint, place the screed on starter blocks at ¼ inch of height more for every inch of pavement to be placed.
- Null the screed when starting by turning control screws back and forth until finding loose play to eliminate irregular stresses in the screed plates.
- Maintain a level head of material in front of the screed (half the auger height) out to the end plates.
- Avoid backing the truck into the paver and causing a bump, which will reflect in the pavement surface when compacted.
- Maintain uniform paver speed at all times to achieve a smooth riding surface.
- Set the angle of the screed with the nose slightly higher (1/8 inch) than the tail.
- Understand how weather and temperatures can affect the long-term performance of the mix. Do not place Superpave from November 1 to March 31, when pavement surfaces are wet, or when the air or pavement surface temperature is 40 degrees F or lower.

Paving Joints

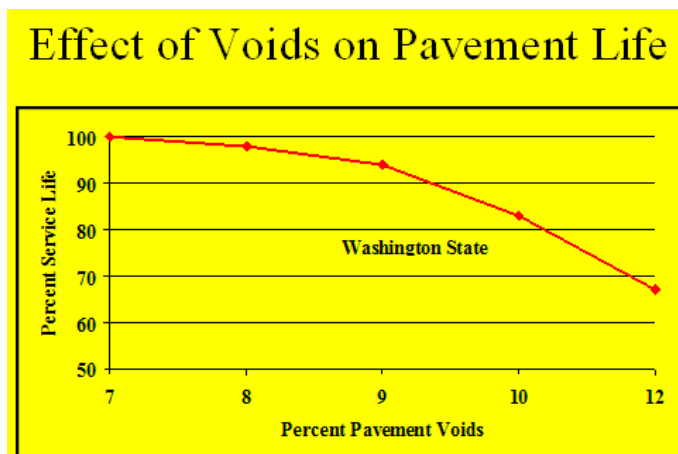
Improper joint construction can lead to cracking along the joint, premature raveling, and water intrusion that will weaken the supporting pavement and result in fatigue cracking. When constructing a transverse joint, run the paver with a full head of material to the end of the paving. Remember to leave additional depth to allow for consolidation. If hand work is required, work quickly to avoid cooling the mat before rolling.

When stopping for the day, a temporary transverse joint is constructed using a wood butt joint, papered butt joint, or a feathered joint. When resuming paving the next day, remove the temporary joint back to full depth of the paving thickness, clean the paving surface, and tack including the vertical joint face. Set the screed on wooden starter blocks to the height of the uncompacted lift and proceed as noted above. Use a straight edge on the uncompacted downstream mat to verify the same height of the starter blocks before the mat is compacted. Ideally roll the joint in static mode in a transverse direction, and then verify the smooth transition.

When constructing a longitudinal joint, always stagger successive layers of paving by 6 inches to avoid a full-depth joint. When paving against a previously placed mat, apply a uniform coating of bituminous tack to the vertical face. Always construct longitudinal butt joints or notched wedge joints in a straight line. As a rule, when paving, overlap the adjacent mat by 1 to 1½ inches of the thickness of the roll-down to ensure a solid joint when compacted. Do not bump back the material with a lute. Pinch the joint by rolling from the hot side to the cold side, overlapping the joint by 6 inches with the roller in the vibratory mode. This roller pattern will force material tight against the joint, and some stone may be crushed on the surface.

Compaction

Compaction is the single most important factor that affects the long-term performance of the pavement. Compaction increases strength and stability, provides resistance to permanent deformation, reduces water penetration, and reduces the potential for low-temperature cracking. Too little compaction will reduce the life of the pavement. For every 1 percent in air voids above 7 percent, the pavement life will decrease by 10 percent. A compacted pavement with 12 percent air voids will only last 64 percent of its intended life!



Asphalt pavement mix designs are based upon the properties of the materials and density, which must be duplicated on the pavement. Compaction is achieved using an optimum-rolling pattern or until there is no movement, which typically results in 8 percent air voids that may further consolidate over time to 4 percent. Hot mixes are produced between 265 and 320 degrees F; delivery temperature must be within this same range; and compaction must be accomplished before the mat cools to 175 to 185 degrees F. Warm mixes are produced between 220 and 320 degrees F. However, warm mixes can be compacted at lower temperatures, and because the mat cools more slowly, more time is allowed to achieve proper compaction. The road can be open to vehicle traffic after 24 hours or after the course cools to 140 degrees F or less.

When compacting the mat, always run with the power drum toward the paver. Make sure the water system is working well to keep asphalt from sticking to the roller. When rolling Superpave mixes, initial compaction can be as close as 3 to 15 feet from the paver, depending on the temperature of the mix. Sometimes a “tender zone” may develop between 190 and 240 degrees F where the material will shove under the roller. The operator should back off to allow some cooling until density can increase. However, proper compaction must be accomplished before the mat cools below 175 degrees F for hot mixes. No further compaction will occur when the mat cools below 175 degrees F. Warm mixes may achieve proper compaction below 175 degrees F. Keep calibrated thermometers on the project to check the mix temperature when it arrives at the paver and as the pavement is compacted. Infrared, probe, and surface thermometers are used to monitor the material. Be careful to avoid burns with this hot material!

Rolling should be performed from the low side of the mat to the high side, and the second pass should be kept 12 to 18 inches away from the longitudinal joint. On the third pass, overlap the longitudinal joint by 6 inches onto the cold mat. The third pass forces hot mix against the adjacent mat and pinches the joint to achieve a uniformly dense longitudinal joint. Although some of the aggregate along the surface of the longitudinal joint may be crushed due to this operation, a well-compacted joint will result. Keep in mind that any crushed aggregate will wear off once the road is open to traffic.

Resources

- PennDOT Publication 372, Pocket Guide for Road Construction and Maintenance
- PennDOT Publication 408,
- Section 409, Superpave Hot-Mix Asphalt
- Section 411, Superpave Warm-Mix Asphalt