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Inspection and Quality Assurance

Learning Outcomes:

- Understand and follow project plans and specifications.

Inspection Objectives:

- Ensure cross-section of roadway constructed to specified elevations and template prior to application.
- Ensure existing surface is prepared properly.
- Ensure new material is delivered to the project site within specifications.
- Ensure proper density is obtained.
- Ensure the quality assurance program is executed.

As representatives of VDOT (consultant or inspector) and the paving contractor, it is important to be familiar with the VDOT Road and Bridge Specifications as well as Special Provisions that are found in the contract. In addition, the VDOT field representative and contractor play a vital role in the execution of the Quality Assurance Program (QAP). The QAP focuses on the processes, procedures and individuals responsible for accepting asphalt concrete (AC) in the field. This chapter will cover the key aspects of inspection and QAP.

Construction Inspection

The Construction Inspector performs a vital service for the Virginia Department of Transportation (VDOT). The placement of AC materials is a high cost operation and when constructed correctly will provide a smooth durable riding surface that will last ten to twenty years or longer. Pavement life depends on proper construction. Placement of the subbase, base material and paving materials, along with proper drainage all have an effect on the life of the riding surface. An improperly constructed AC pavement will result in a shorter life with increased maintenance and user costs.

A certain amount of commitment is required from VDOT personnel and the Contractor in order to obtain quality inspection and construction practices. VDOT personnel must be knowledgeable about paving practices and be able to provide timely decisions so that the Contractor's work is not delayed.

The Inspector and the Contractor need to be able to communicate effectively, and must have a common goal of end result construction being in conformance with the contract, plans, standards and specifications.

The Inspector must ensure the project plans and specifications are being followed. It is also important for the Contractor to provide competent personnel on the project and keep the Inspector informed of any scheduling changes that might affect the inspection process.



Specification Practice

Below is an exercise in looking up specifications. All answers can be found in VDOT Road and Bridge Specifications Section 315 – Asphalt concrete Pavement and Special Provisions located in the Appendix of this document.

1. What section is equipment for asphalt concrete pavement found?
2. What is the equipment and application requirement for tacking joints? What section is this found in?
3. In section 315.05(d) the compacting sub-section of Procedures states, "Rolling shall not cause _____".
4. The variation of the surface from the testing edge of the straightedge between any two contacts with the surface shall not be more than _____. This is found in Section _____.
5. How much should a longitudinal joint in one layer be offset from the layer immediately below? What section is this found in?
6. What is the pay unit for asphalt concrete material? This is found in what section?

Site Preparation

The first step in the paving process is ensuring the site is prepared properly. For new construction, site preparation includes the subgrade, subbase and base installation. The subbase and base will include either a chemically stabilized soil layer, an aggregate layer or a cement treated stone layer. The specifications regarding these operations are covered in other training materials and the VDOT specifications book. Once these layers are constructed, AC layers are laid to the depths and application rates called for in the contract.

With maintenance and rehabilitation projects, the existing pavement is the platform for laying new AC layers. The existing surface is either overlaid with AC or is milled and replaced with a new AC layer or layers. Like the base layer for a new construction project, the existing pavement platform must be prepared properly.

Repairs

In many cases, the existing pavement will be overlaid as part of a maintenance or rehabilitation project. If the existing pavement has cracks or potholes, it should be repaired prior to placement of the AC layer. The process to repair cracks is specified in *Special Provision for Sealing Cracks in Asphalt Concrete Surfaces or Hydraulic Cement Concrete Pavement*.

Unrepaired pavement failures will lead to future failures in the new AC layer(s). When not included as a contract quantity, the *Special Provision for Surface Preparation and Restoration Prior to Plant Mix Overlay* is typically included in contracts. The VDOT inspector can call for a Type I, Type II or Type III repair. Each type is separated by size of the area to patch and the depth of the patching.

Clean Surface

Prior to laying AC on an existing surface, it shall be cleaned properly. This means loose material must be swept, vacuumed or washed from the roadway. Loose material prevents the bonding of the new AC to the existing surface.

Milling

When the pavement surface is milled, the inspector must check the following:

1. Uniform Milled Surface – during the milling process, it is important that scabbing is avoided. Scabbing is caused when the milling machine is travelling too fast, the milling teeth are worn, or the incorrect depth is being milled or was specified in the contract. Milling is covered in Section 515.
2. Drainage – when roadways are milled, maintaining proper drainage is critical for safety. Section 315.05(c) paragraph 10 outlines the requirements.
3. Clean Surface – as will a straight overlay, the milled surface must be cleaned prior to application of the tack coat and AC layer. Cleaning is done with a broom and vacuum truck typically.
4. Performance Milling – for roadways with speed limits of 55 mph or higher, the contractor has the option to performance mill the surface in order to increase the amount of milling that can be exposed to traffic. Performance milling is done with a milling head that results in a surface with a smaller ridges and closer grooves when compared to a conventional milling head. The maximum mean texture depth (MTD) for performance milled surfaces is 2.0 mm.

Tacking

Tack coats provide the glue that holds the different AC layers together. Per Section 315.05(b), all AC layers are to be tacked. VDOT uses conventional and non-tracking tack coats. Tack coat materials must meet the requirements in Section 310 or the *Special Provision for Non-Tracking Tack Coats*.

For conventional tack coats, the application rate is 0.05 to 0.10 gal/yd² for the mainline surface if the material is not diluted. If the tack coat is diluted with water, then the application rate increases to 0.10 to 0.15 gal/yd². When a non-tracking tack coat material is used, then the contractor shall follow the manufacturer's recommendations. Typically, this rate is between 0.05 and 0.10 gal/yd².

During the application of the tack coat, the material shall be spread uniformly using a pressure distributor meeting the requirements of Section 314.04(b).

Longitudinal and transverse joints require extra tack coat material. This extra material is used to improve the final AC density. Per Section 315.05(b)1, the application rate shall be 0.20 gal/yd². Tack can be applied with a hand wand or pressured distributor and shall be two feet in width for the first pass. At

least 4 to 6 inches of tack should be applied beyond the edge of the joint. For the adjacent pass, the vertical face of the joint should be covered with puddling at the bottom. The tack should extend 1 foot into the lane to be paved. When milling occurs and the vertical face is to remain, the same tacking should occur. When the milled face will be removed, the tacking should still extend 1 foot into the lane to be paved. However, when paving in echelon, tacking of the longitudinal joint is not required.

Mix Delivery

The quality of the AC material can be impacted by numerous steps in the paving process. Once the material is produced at an AC plant, it is loaded into trucks for delivery to the site. Within the VDOT specifications, the trucks must meet the following requirements found in the Special Provision for Section 315.03(a):

1. Smooth, tight, and clean beds – metal or a non-absorptive/inert material
2. Release agent from the Department’s Approved list 8, lime solution or a aliphatic hydrocarbon invert emulsion shall be used (NO DIESEL FUEL)
3. Tarpaulin or other cover to protect the load from moisture, foreign material and rapid heat loss. The tarp/cover cannot have holes, must cover the entire load, and cannot be a mesh.

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Pre-loading Inspection of Bed

The bed of the haul truck should be free of all deleterious materials before mix is placed in it. The bed should be reasonably smooth and free from any major indentations or depressions where the truck bed release agent and the AC can accumulate.

Describes inspection, Quality Assurance and/or Quality Control practices.

Once at the project site, the AC mix may be discharged directly into the paver or it may be discharged into a material transfer vehicle (MTV). The use of the MTV is at the option of the contractor unless specified in the contract. For mixes such as stone matrix asphalt and porous friction courses, the MTV is a requirement. The MTV and paver must have a minimum 15 ton capacity and the ability to remix the AC mixture. This can be done in the MTV or in the paver insert.

Before the entire load of mix is discharged, the inspector should ensure:

1. The minimum base temperature exists. This is the temperature of the platform on which the AC will be laid. If the platform is too cold, then it will rob heat from the mix and make compaction difficult. Depending on the mix type, the minimum base temperature varies. There is no maximum base temperature.
2. The right mix has been delivered to the project. Some plants will run numerous mixes during a shift; therefore, check the job mix number and type.
3. The AC mix temperatures must be within specification. For AC produced with a warm mix technology, no minimum temperature exists. The maximum temperature for non-polymer modified mixes is 350F. For polymer and other modified mixes, the maximum temperature is set by the supplier. AC produced by traditional plant temperatures and processes, the temperature ranges are set by Section 315.04 and the Special Provision for Section 315.04.

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When mix is delivered to the job site, three items must be checked.

1. First, is the base temperature at or above the minimum?
2. Second, is the right mix being delivered to the right job site?
3. Third, is the mix being delivered at the correct temperature?

Describes inspection, Quality Assurance and/or Quality Control practices.

When the base temperature is between 40°F and 80°F and a warm mix asphalt technology is not used, the Nomograph (Table III-2) found in Section 315.05 shall be used. The minimum base and lay down temperatures shall not be less than the following:

PG Binder/Mix Designation	Percentage of Reclaimed Asphalt Pavement (RAP) Added to Mix	Minimum Base Temperature	Minimum Laydown Temperature
PG 64-22 (A)	≤ 25%	40°F	250°F
PG 64-22 (A)	≥ 25%	50°F	270°F
PG 70-22 (D)	≤ 30%	50°F	270°F
PG 76-22 (E)	≤ 15%	50°F	290°F
PG 64-22 (S)	≤ 30%	50°F	290°F

Stone Matrix Asphalt (SMA) shall be placed only when the ambient and surface temperatures are 50°F or above when a warm mix technology is not used. The mixture temperature in the truck shall not be less than 300 °F for mixtures containing PG 70-22 and 310 °F for mixtures containing PG 76-22.

The process to take the temperature measurements is described in detail in Section 501.02 of the Materials Division Manual of Instructions. In summary, the Project Inspector shall make a temperature measurement at the beginning of paving operations and every hour after the initial temperature check. When measurements are found to be outside of the temperature tolerances, a minimum of 3 additional measurements will be taken from different points of the load. The 4 readings will then be averaged and used as the temperature of the load or batch. All temperature measurements and the average shall be recorded.

Mix Placement

Once the mix is in the paver hopper, the operation of the paver is governed by Section 315.03(b) and 315.05(c). For new construction, the contractor is to use a continuous line for steering the paver. On maintenance and rehabilitation projects, the contractor is able to follow the edge of pavement, stripping, or other continuous lines.

As the paver pulls away from the joint, the inspector will verify the smoothness of the compacted joint per Section 315.07(a). Other items for the inspector to check are:

1. Are the longitudinal joints offset by 6"?
2. Are shoes or skis being used on the paver?

Observations by Inspector	
	<ul style="list-style-type: none"> ▪ Verify head of material at the auger – should be maintained at center of auger shaft for consistent mat thickness ▪ Augers should be turning slowly and consistently approximately 100% of the time ▪ Verifying material thickness behind screed by sticking the mat ▪ Placement of straightedge behind screed, parallel to the screed to verify correct cross-slope ▪ Minimizing folding of hopper wings to every third or fourth load ▪ Uniform mat appearance behind the screed to minimize streaking
<i>Describes inspection, Quality Assurance and/or Quality Control practices.</i>	

Joint Construction Inspection

The proper construction of the longitudinal and transverse joints is essential. For longitudinal joints, proper tacking and compaction is needed to keep water out. Transverse joints constructed poorly will lead to dips and bumps in the final mat.

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	<p>Inspection Items:</p> <ul style="list-style-type: none"> ▪ Surface Tolerance for Transverse Joints using 10 feet Straight-edge ▪ Proper tacking of longitudinal and transverse joints ▪ Proper taper length for temporary transverse joints ▪ Proper rolling procedures for Joints
<i>Describes inspection, Quality Assurance and/or Quality Control practices.</i>	

Compaction Inspection

For mixes where a minimum density requirement exists, the inspector must ensure the roller pattern is followed. The process to establish a roller pattern will be covered in the Density Chapter. In addition to the roller pattern, other aspects of the compaction process must be inspected. For SMA, the contractor is allowed a maximum of three vibratory passes at the higher frequency and lowest amplitude. For all AC mixes, the roller operator should roll toward the crown in the road or to the high side of the super-elevation. Once the first pass is compacted on a roadway, adjacent passes are to be rolled toward the

cold or confined joint. Each rolling pass should overlap the previous pass by a minimum of 6 inches. And for SMA, the maximum roller speed is 3 miles per hour.

Density Inspection

When the contractor is laying AC, the inspector must know the proper specifications to follow. The specifications vary based on the project characteristics. There are three common projects – thin overlays, small quantities, and large quantities. For thin overlays, defined as application rates of 125 lbs/sy or less, no density cores are required. All acceptance is based on establishing a roller pattern and control strip. The average density for the 10 random stratified locations becomes the target density during compaction. For each subplot and lot, the averages must be within 98% and 102% of the target. The same approach is followed when the AC overlay is placed on an existing surface treatment.

Small quantity contracts can be comprised of pavement patching, trench widening, and certain construction projects. For each contract, the quantity of AC is too small for establishing a roller pattern and control strip. Therefore, the contractor uses a combination of experience with the AC mix and the nuclear gauge to monitor density changes with each roller pass. When the rolling is completed, a core is obtained and the minimum density must be 91.5%. Patching requires the density to be verified within the first 20 tons and then every 100 tons thereafter. Trench widening contracts have the initial density determined in the first 500 linear feet and then every 2,500 linear feet. Finally, for construction contracts with short paving lengths, a roller pattern and control strip cannot be constructed. For each lift of AC, the lot should have a minimum density of 91.5%. The number of cores to determine the density is a function of the paving length. Most projects will be 3,000 feet or less.

Large quantity contracts have paving lengths that will allow for the construction of a roller pattern and control strip. For these contracts, VTM-76 must be followed. Once the target density is established and verified, then the project is divided into lots. A lot is defined as a minimum of 6 foot wide by 3,000 feet to 10,500 feet in length. The width of the lot corresponds to the width of the paving. The length is determined by the size of the project and the contractor's placement speed. Each production shift will define a new lot unless directed by the Engineer. A normal lot is 5,000 feet in length; however, it can be as short as 3,000 feet and as long as 7,000 feet. Within the lot, a subplot is 1,000 feet in length. A large lot is usually 7,500 feet long. Each subplot is 1,500 feet in length. A large lot may vary in size from 4,500 feet to 10,500 feet. Each subplot is monitored for density. The average density for the sublots determines the acceptability and any pay adjustments. The process for monitoring the density will be covered in the Density Chapter.

Quality Assurance Program

While there are many steps in the paving process, payment for the material is based on final in-place density. This density is monitored by either cores/plugs obtained from the compacted mat or through the use of a nuclear gauge on the compacted mat. The method to monitor density is at the discretion of the contractor and their results are used for acceptance purposes.

Per the code of federal regulations (23 CFR 637B), transportation agencies that use contractor test results for payment must have a quality assurance program (QAP). The Contractor is responsible for the density testing of the AC and is required to be under VDOT's Quality Assurance Program (QAP). The AC is accepted on a lot by lot basis. Each lot is divided into sublots and will be discussed further in the Density Chapter. The Project Inspector will see that the Contractor follows the specifications and will notify the Construction Manager of any misunderstandings, lack of cooperation, or any other situation that cannot be corrected by the Inspector. It is important for the Inspector to work with the Contractor so that maximum production is achieved while keeping with the plans and specifications. Operations should not be held up unnecessarily as continuous operations are important for uniform results. The Materials Section technician will carry out the independent assurance (IA) and Verification Sampling and Testing (VST) portions of the QAP. When the technician cannot be on-site to perform the IA or VST, the inspector will perform these duties.

Independent Assurance

The Independent Assurance (IA) processes purpose is to ensure the people, procedures and equipment are functioning properly. This is done by observation by the Materials Section Technician and by verifying the bulk specific gravity of cores obtained from the control strip. For every 10 control strips constructed by the contractor, VDOT will perform IA on a minimum of 1 control strip. This is done by obtaining the cores cut by the contractor on the control strip. At least 1 core will be re-bulked by VDOT and the results are compared to the contractor's results on that same core. If the contractor's and VDOT's bulk specific gravity do not compare within 0.015, then additional cores from the control strip are compared. If additional cores do not compare, then the VDOT Materials Engineer will investigate the cause of the discrepancies. The IA process is detailed in the Manual of Instruction Section 503.04.

Verification Sampling and Testing (VST) Sections

Verification Sampling and Testing (VST) sections are established for each project. The VST section corresponds with the contractor's acceptance lots. If a project has 20 lots, then the project will have 20 VST sections. Per VDOT's Materials Division Manual of Instructions Section 500, VDOT will perform monitoring on a minimum of 20% of the VST sections. The sections monitored will be selected on a random basis. In general, for every five acceptance lots by the contractor, VDOT will select one for further evaluation. This evaluation involves the contractor obtaining one core in two different sublots at locations identified by VDOT. These cores are provided to VDOT for density verification in the VDOT lab to ensure the specifications are met. If the cores compare to the bulk specific gravity of the cores from the control strip (98% to 102%), then the VST section and acceptance lot are deemed to be acceptable. If the VST cores do not compare to the control strip, then payment for the lot will be in accordance to the VST cores density. The contractor will have the option to request the referee process. The referee process is detailed in the Special Provision for Section 315.05(e) and in the Manual of Instruction Section 503.03(a)(1).

The VST process is managed by the Materials Section. In most cases, the Materials Section Technician will be on-site to identify the core locations and obtain the cores. When the Technician cannot be present, the inspector will serve as their representative. The inspector will observe the coring process and obtain the cores. The contractor will be allowed to determine the bulk specific gravity of the cores in the field, but these cores cannot be used by the contractor in the acceptance process.

Chapter Eight Knowledge Check

1. What are important qualifications for an Inspector?
 - a. Knowledge, common sense
 - b. Diplomacy, observation skills
 - c. All of the above

2. The most effective learning tool for an Inspector is on-the-job training.
 - a. True
 - b. False

3. What is the minimum placement temperature for PG-64-22 mix type A?
 - a. 375°F
 - b. 200°F
 - c. 250°F
 - d. 270°F

4. The Paving Inspector must keep a daily diary.
 - a. True
 - b. False

5. What is the purpose of inspection?
 - a. Control the quantity of work
 - b. Inspector to act as foreman for the Contractor
 - c. Ensure the quality of work
 - d. All of the above

6. Each load arrives on the job site accompanied by a _____.
 - a. TL-52A
 - b. Weigh ticket
 - c. TL-102A
 - d. Daily diary

7. In order to accept asphalt concrete the Department must have:
 - a. An approved mix design
 - b. A producer who is under VDOT's Quality Assurance Program
 - c. A good water source
 - d. Both A and B

8. It is important for an Inspector to have an understanding of what tests are required both on the road and at the plant.
 - a. True
 - b. False

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