Supplemental Section 310 - Tack Coat

Tack Coat Inspection and Verification Process

Ron Hobson, P.E. - Area Construction Engineer
Richmond District - Southern Region

Harry King - Vice President
Colony Construction
VDOT will begin paying for Asphalt Tack Coat per gallon. It is no longer included in the price of other pay items.
Opening Remarks ........

- Consider this specification change as a concerted effort to address a paving quality concern. It is NOT perfect.

- Rob Crandol and others would appreciate your feedback at the end of the 2016 Paving Season.

- This presentation is one ACE’s and one Contractor’s opinion of a specification interpretation. You may agree or disagree.

- We are both hopeful that the presentation will get you thinking about how you will approach the change.

- Some slides came from Dave Johnson (Asphalt Institute).
Revised Specification 310

Why are things changing?
Pavement Behavior

Load Distributed by Tire

Shear Transfer?

Stress Distribution

Compression

Tension

Aggregate Base

Soil Subgrade

Courtesy of Rich May
Bonded Demonstration

½” Deflection, 60# Load

¼” Deflection, 160# Load

Unbonded

Fully Bonded
Cores Showing De-bonding

Bonding Failures
Consequences of Poor Bonding

- Layer independence
- Reduced fatigue life
- Increased rutting
- Slippage
- Shoving

Compaction difficulty

Direction of Traffic
What happens without sufficient Tack?
Delamination Pothole
Revised Specification 310

What stays the same?
Surface Preparation

- The existing surface shall be patched, cleaned, and rendered free from irregularities to the extent necessary to provide a reasonably smooth and uniform surface. The Contractor shall remove unstable corrugated areas, and replace with suitable patching materials when required by the contract specifications.
- Section 310.03
The Contractor shall clean the edges of existing pavements that are to be adjacent to new pavement to permit adhesion of asphalt.

Section 310.03
The Contractor shall apply tack coat and non-tracking tack coat in accordance with the weather limitations that apply to the course being placed......
Appearance

The contractor shall uniformly apply tack coat or non-tracking coat.....
Tack Material

- Bill of Lading

**ALL TACK MATERIALS STORED LONGER THAN 30 DAYS SHALL BE RETESTED**

No longer using CRS-2
Revised Specification 310

What changes for VDOT personnel?
SET CLEAR EXPECTATIONS AND COMMUNICATE THE SAME

> Begin at the Pre-Construction Meeting
Suddenly, a heated exchange took place between the King and the Moat Contractor.
Safety

Contractor & VDOT Representatives will be handling plates with hot Tack (Application Rate – NOT Residual Rate).

Train & Equip your personnel
Insulated & Petrochemical resistant GLOVES

What is your plan to pick up the plates?
Asphalt Institute Burn Information

KEEP COOL
DO NOT PANIC OR DELAY
ON-SCENE FIRST AID
FOR ASPHALT BURNS

- Immediately address any Airway, Breathing or Circulation concerns and START COOLING with water
- Do NOT try to remove asphalt from skin
- Quickly place affected area under running/flowing water (ice or cold packs may be used in the event water is unavailable)
- Leave the asphalt burn area uncovered
- Notify others
- CALL FOR HELP!
1. VDOT to observe & document Distributor Calibration Test. Contractor to conduct test.

2. VDOT Representatives to conduct plate tests within first 500 tons (300 ft.) of paving. VDOT to use TL-143 Method A sheet to document appropriate Tack Application Rate. 

VDOT must ACTIVELY inspect this operation.

3. Contractor to provide daily Tack usage. Contractor to use TL-143 Method B sheet to agree on volume EACH DAY.

>VDOT & Contractor to sign.
The Distributor shall be calibrated by the Contractor in the presence of the Engineer prior to initial asphalt plant mix placement to demonstrate an even and accurate spray application.
CONTACT DISTRICT MATERIALS TO OBSERVE AND DOCUMENT THE TEST

Test conducted off-site PRIOR to C-5

I will accept another VDOT representatives observation assuming I get a statement from the contractor that the Distributor Truck is in the same working condition (no damage / repairs or modifications) since the Calibration Test.
Distributor Truck Setup
Distributor Truck Setup

- Liquid temperature
  - Monitor and Match to material
- Calibrate distributor truck
  - Spray bar height
  - Spray bar pressure
  - Nozzle angle
  - Nozzle selection
- Thermometers
- Volumeter
Spray Bar/Nozzles

- **Single Coverage**
- **Double Coverage**
- **Triple Coverage**

- Nozzle angle setting: 15 to 30 degrees
- Spray bar axis
Effect of Nozzle Orientation
Tack Plates

What are they supposed to look like?
Answer: C

NOTE THAT PLATE C HAS THE MINIMUM RESIDUAL AMOUNT.
METHOD A: Tack Plate Method, VTM 137

District: RICHMOND
UPC: 107849
Project Number: PM-4D-16
Asphalt Producer: CONTRACTOR-X

Tack Manufacturer: BLACKLIDGE
Material Type: NTSS-1 HM
Target Application Rate: 0.07

<table>
<thead>
<tr>
<th>Test No. / Plate Number</th>
<th>Date</th>
<th>County</th>
<th>Route</th>
<th>Dir</th>
<th>Air Temp, F</th>
<th>Surface Temp, F</th>
<th>Plate Area (a)</th>
<th>Tare Wt of Plate (b)</th>
<th>Wt. of Plate + Asphalt (c)</th>
<th>Wt. of Asphalt (d)</th>
<th>Application Rate* (gal/sq. yd)</th>
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<tbody>
<tr>
<td>1</td>
<td>3/14/16</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>65°</td>
<td>80°</td>
<td>0.992</td>
<td>1.32</td>
<td>1.38</td>
<td>-</td>
<td></td>
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</table>

*Application Rate = ((d) x 9 / (a)) / 8.41

Project Inspector: E. BAILEY  VDOT Reviewer: Ron Hobson
### OBSERVE / VERIFY
CONTRACTOR CALIBRATION TEST

Calibration must be within 0.02 gallons per SY of the design application rate

<table>
<thead>
<tr>
<th>Comp, F</th>
<th>Plate Area (a)</th>
<th>Tare Wt. of Plate (b)</th>
<th>Wt. of Plate + Asphalt (c)</th>
<th>Wt. of Asphalt (d) = (c) - (b)</th>
<th>Application Rate* (gal/sq. yd)</th>
</tr>
</thead>
</table>

Aim @ 0.07 g/SY
The Engineer shall verify the desired tack application rate is achieved using VTM-137 Method A (Tack Plate Method).

This test shall be performed at a **minimum frequency of once per each roadway, within the first 500 tons of asphalt mix placed**, unless otherwise approved by the Engineer.
# Method A: Tack Plate Method, VTM 137

<table>
<thead>
<tr>
<th>Test No./Plate Number</th>
<th>Date</th>
<th>County</th>
<th>Route</th>
<th>Dist.</th>
<th>Air Temp. F</th>
<th>Surface Temp. F</th>
<th>Plate Area (a)</th>
<th>Tare Wt. of Plate (b)</th>
<th>Wt. of Plate + Asphalt (c)</th>
<th>Wt. of Asphalt (d)</th>
<th>Application Rate* (gal/sq. yd)</th>
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<td>026</td>
<td>712</td>
<td>75°</td>
<td>80°</td>
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<td>1.39</td>
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<td>2</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
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<td>0.992</td>
<td>1.33</td>
<td>1.40</td>
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</table>

*Application Rate = \((d) \times \frac{9}{(a)} / 8.41\)

Project Inspector: E. Bailey  
VDOT Reviewer: ______________________
Track Tack Usage for Payment

Contractor to provide daily Tack usage.

Contractor to use TL-143 Method B sheet to agree on volume EACH DAY.
Section 310.04

Measurement and Payment
On a daily basis, the Contractor shall provide the Engineer readings taken from the calibrated distributors Round to the nearest gallon
Insufficient or excessive amounts of Tack is a problem!

The inspection staff needs to stop the work.
Section 310.03

The Engineer reserves the right to perform the tack plate method testing at a higher frequency, as determined necessary, to ensure adherence to specifications.
I recommend that you “discuss and plan” for Distributor Breakdowns & RE-tacking
How do we handle quantities for hand spraying the vertical joints?
“If the Engineer suspects the Contractor is failing to apply good bond promoting procedures or adequately tacking the existing surface per the manufacturer’s recommendation, the Engineer may core a minimum of 10 locations to determine the shear & tensile strength at the interface.”
**METHOD B: Tack Yield Calculation Method, VTM 137**

District: **RICHMOND**  
UPC: **107844**  
Project Number: **PM-4D-16**  
Asphalt Producer: **CONTRACTOR X**  
Tack Manufacturer: **BLACKLIDGE**  
Material Type: **NTSS-1HM**  
Target Application Rate:  

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Date</th>
<th>County</th>
<th>Route</th>
<th>Dir.</th>
<th>Temp. of Tack (°F)</th>
<th>Length, ft.</th>
<th>Width, ft.</th>
<th>Applied Area, ft²</th>
<th>Volume, gal</th>
<th>Inspector Signature</th>
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<td>720</td>
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<td>1950</td>
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<td>-</td>
<td>165</td>
<td>1510</td>
<td>11</td>
<td>1340</td>
<td>1170</td>
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<td>RFR</td>
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<td>168</td>
<td>1010</td>
<td>11</td>
<td>905</td>
<td>717</td>
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<td>RFR</td>
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<td>5/4/16</td>
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<td>3050</td>
<td>11</td>
<td>1625</td>
<td>1170</td>
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<td>RFR</td>
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</tbody>
</table>

\[
(f) = ((d)-e) \times (0.00025 \times (60- (t)) +1) \]

**Application Rate = (f)x9 / (c)\]

R. Hobson
Summary

Safety – PPE / Gloves

1. Calibration Test
   Materials and P.I. should observe

2. Tack Plate Test
   Tack Test Plates must be available
   Scales to weigh the plates

3. Tack Usage
   Agree daily on the quantity placed

4. Consider context.
Revised Specification 310

What changes for the Contractor?

Harry King
Vice President
Colony Construction
New to 2016 Paving Season

- Tack as a Pay Item
- Calibration of the Distributor Trucks
- Quantity Tracking of Material Used
- More Oversight of Tacking Operations
“Tack coat, including Tack Coat and Non-Tracking Tack Coat materials, when a pay item, will be measured in gallons and will be paid for at the contract unit price per gallon.”

“When not a pay item the Contractor shall include the cost in the contract unit price for other appropriate items.”

Sect. 310.04 – Measurement and Payment
“The distributor shall be calibrated by the Contractor in the presence of the Engineer prior to initial asphalt plant mix placement to demonstrate an even and accurate spray application. Calibration will be considered acceptable when the spray rate is uniform and within 0.02 gallon per square yard of the design application rate.” Sect. 310.03
Quantity Tracking

What will we need?

- Daily quantities of tack material used
- Daily temperature of applied material
- Area sprayed (sq. yd.)
- TL-143 form completed on a daily basis
Quantity Tracking

- Quantities to be taken at the beginning and end of each day’s operation

- Quantities can be taken from the computer screen or swing gauge on the tank
Good communication between the project superintendent and the inspection staff will be essential in gathering necessary information.
Temperature Requirements

- The documented temperature shall be taken of the heated material within the tank prior to application.

- It is suggested to use an average daily temperature, preferably sprayed at the manufacturers recommended temp.
Emulsion will be adjusted according to 60° correction factor (0.00025)

Ref. Sec. 109 of Road and Bridge Specifications
Link to TL-143
Divisions

City, town and county support
- Transportation Planning
- Local Assistance

Contractor support
- Consultant Procurement
- How To Obtain Falcon Access
- Procurement
- Materials Certification schools

Engineering and construction
- Alternate Project Delivery
- Construction Division
- Location and Design
- Materials
- Project Management
- Right of Way/Utilities
- Structure and Bridge

Highway operations
- Maintenance division
- Operations program
- Traffic Engineering
- Northern Virginia Land Use Permits
- Land Use Permits

Assurance and Compliance Office
- About the Assurance and Compliance Office

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- Information Technology Division
- Virginia Transportation Research Council
- Knowledge Management
Materials Division

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The Materials Division is organized into a Central Office and nine District Offices. The District Materials Engineer represents the State Materials Engineer in matters pertaining to sampling, inspection, field-testing, construction, and maintenance materials, and soil survey and pavement design. The Division is broken into three major areas: Preliminary Engineering, Operations and Support Services.

Materials Division Documents and Downloads

New Products Information

Materials Certification Schools Information

Personnel and Areas of Expertise
Phone (804) 328-3100
Virginia Calibration Methods (VCMs):

[Virginia Calibration Methods](#) (pdf 440kb) 8/25/15

Virginia Test Methods (VTMs):

[Virginia Test Methods](#) (pdf 9mb) 10/16/15

VDOT Forms including Materials TL (Test Log) Forms

[VDOT Forms](#) (Link)

[TL-131](#) (160 KB) 1/24/14
Virginia Department of Transportation  
Tack Application Rate Report  

METHOD B: Tack Yield Calculation Method, VTM 137

<table>
<thead>
<tr>
<th>District</th>
<th>Tack Manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>UPC</td>
<td>Material Type</td>
</tr>
<tr>
<td>Project Number</td>
<td>Target Application Rate</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Temp, F</th>
<th>Area, ft²</th>
<th>Volume, gal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test No.</td>
<td>Date</td>
<td>County</td>
</tr>
</tbody>
</table>

* (f) = ((d)-(e)) x (0.00025 x (60- (t)) +1)  
**Application Rate = (f)x9 / (c)
CORRECTION EQUATION

CORRECTED GAL. =

(GAL USED) \times \left( 0.00025 \times (60 - \text{TEMP}) + 1 \right)
SAMPLE PROBLEM

KNOWN FACTORS

Length of roadway: 5,280 If
Width of roadway: 12’
Material type: Non-tracking
Temp. of tack: 165 degrees (F)
Gauge reading (beginning): 1000 gal.
Gauge reading (end of day): 296 gal.

EQUATION

\[ \left( (\text{Gauge reading (beg)} - (\text{Gauge reading (end)})) \right) \times \left( 0.00025 \times (60 - \text{temp of tack}) + 1 \right) = \text{Gals. Used} \]

\[ \left( 1000 - 296 \right) \times \left( 0.00025 \times (60 - 165) + 1 \right) = \text{Gals. Used} \]

\[ \left( 704 \right) \times \left( 0.00025 \times (-105) + 1 \right) = \text{Gals. Used} \]

\[ \left( 704 \right) \times (0.97375) = \text{Gals. Used} \]

685.52 = Corrected Gallons Used
### METHOD B: Tack Yield Calculation Method, VTM 137

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Date</th>
<th>County</th>
<th>Route</th>
<th>Dir.</th>
<th>Temp. of Tack (t)</th>
<th>Temp. of Tack (t)</th>
<th>Length, ft. (a)</th>
<th>Width, ft. (b)</th>
<th>Applied Area (c) = (a) X (b)</th>
<th>Gauge reading @ beginning (d)</th>
<th>Gauge reading @ end (e)</th>
<th>Gallons used* (f)</th>
<th>Inspector or Signature</th>
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<tbody>
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<td></td>
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<td>165</td>
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<td>12</td>
<td>63,360</td>
<td>1,000</td>
<td>296</td>
<td>686</td>
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</table>

* (f) = ((d)-(e)) x {0.00025 x (60- (t)) +1}

**Application Rate = (f)x9 / (c)
<table>
<thead>
<tr>
<th>No.</th>
<th>Crop of Seed (lb)</th>
<th>Weight (lb)</th>
<th>Length (in)</th>
<th>Applied Acre (no. x 30 x 100)</th>
<th>Longe loading at beginning (g)</th>
<th>Longe loading at end (g)</th>
<th>Stimete, gph</th>
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</thead>
<tbody>
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<td>166</td>
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</tbody>
</table>
More Oversight of Tacking Operations

- VDOT is now able to confirm application rates and make adjustments according to actual data

- (c) Referee System

- When a new asphalt course is placed on a milled or non-milled surface, the Contractor shall take steps to ensure an adequate bond is made between the new material and the existing surface. If the Engineer suspects the Contractor is failing to apply good bond promoting procedures or adequately tacking the existing surface per the manufacturer’s recommendations, the Engineer may core a minimum of 10 locations to determine the shear and tensile strength at the interface.
The Engineer will determine these locations by using a stratified random selection process. The Department will test cores in the Department’s laboratory in accordance with VTM-128. For the surface to be acceptable, the average results for shear and tensile strength specified herein must be met. The Department will test a minimum of 5 cores for shear strength and at least 5 cores for tensile strength.

1. **Milled surfaces**: The average shear strength must meet or exceed 100 psi with no single core having a shear strength less than 50 psi. The average tensile strength of the remaining cores must meet or exceed 40 psi with no single core having a tensile strength less than 20 psi.

2. **Un-milled surfaces**: The average shear strength must meet or exceed 50 psi with no single core having a shear strength less than 30 psi. The average tensile strength of the remaining cores must meet or exceed 30 psi with no single core having a tensile strength less than 20 psi.
The Engineer will reduce the payment for the asphalt concrete tonnage placed in the area of dispute by 10% if the minimum shear or tensile strength requirements in that area are not met.
Take-Aways

A good working relationship with the inspection staff will be a necessity in making this revised specification a success.

Plate Test (Method A): It is suggested to be done within the first 300 feet of the paving operation for that day.

Distribution of the TL-143 will be needed. If using the digital form in the field, make sure the cells do not get unlocked.

Training will be needed for our Superintendents and Distributor drivers.
KEEP CALM AND TACK ON
Questions