NORTH CAROLINA
Department of Transportation

NCDOT Specifications & QMS Updates

Matt Hilderbran, PE, CPM
Mark Biggerstaff, PE

1/30/2023

Connecting people, products and places safely and efficiently with customer focus, accountability and environmental sensitivity to enhance the economy and vitality of North Carolina

Topics

- Staff Update
  - Materials and Tests Unit
  - Central Construction Unit
- 2022/2023 QMS Updates
- 2024 NCDOT Standard Specifications for Roads and Structures
  - Division 6 – Asphalt Pavements
  - Division 10 – Materials
- Best Paving Practices
- Questions / Discussion

You become an inspirational leader when you have the humility to build a team with people more talented than you.

Leadership First

Todd Whittington
State Materials Engineer

Brian Hunter
State Laboratory Operations Engineer

Central Laboratories
Mehdi Haeri

Asphalt Materials Laboratory: **Charles Colgate**
- Asphalt Job Mix Formulas; Binder; Emulsion; Terminals & Plants; Tack/Prime Coats

Geomaterials Laboratory: **C. K. Su**
- Soil; Borrow; ABC; Aggregates; Select Materials; Geosynthetics; Quarries

Structural Materials Laboratory: **Joshua Law**
- Concrete Mix Designs; Cementitious Materials; Admixtures; Epoxies; Plastics

Regional Laboratories
Johnny Hammonds

Asheville – Burgaw – Fayetteville – Lexington
Matthews – Statesville – Williamston

Kinston – McLeansville – Merry Hill
Lincolnton – Whittier – Wilkesboro

Analytics & Accreditation: **Tim Bollinger**

Product Evaluation: **Daniel Snoke**

Resource Conservation: **Steven Bolyard**

Clark Morrison
State Pavement Design Engineer

- Pavement Design – Asphalt & PCCP *(Central & Division-Let)*
- Pavement Investigation Analysis *(DCP, Coring, & FWD)*
- Pavement Alternate Scope & Review
- Life Cycle Cost Analysis
- Pavement Treatment Options
- Training on Pavement Design
- Roadway History & Traffic Data
- Municipal Pavement Design Review

Matthew Hilderbran
State Field Operations Engineer

Quality Systems
Sam Frederick
- Project Materials Testing/Inspection
- Technician Certification/Assessments
- Facility Approval/Auditing
- FHWA Project Certification
- Area Materials Engineers; Technical Trainers; Section Materials Specialists; Pavement Specialists

Manufactured Products
Cabell Garbee
- Coatings & Corrosion
- Pipe, Precast & Prestressed
- Gray Iron Castings, Guardrail, Signs
- Welding Certification/Inspection

Data Collection & Investigations
Joseph Barbour
- Storm Drain Pipe Systems - Inspections
- Pavement Coring, Subgrade, and Surface Testing
- Pavement Preservation Training

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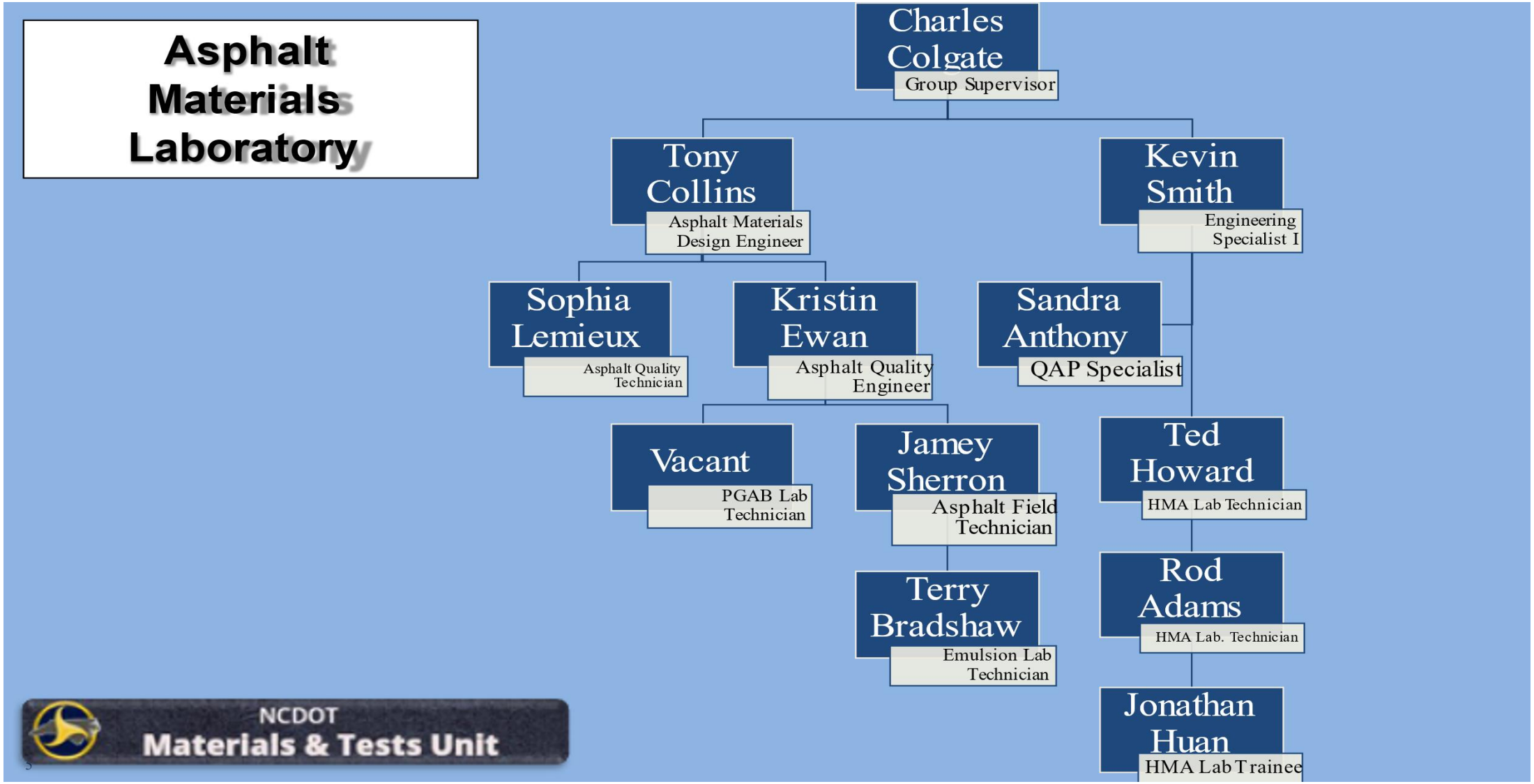
M & T – Asphalt Materials Group



M & T – Asphalt Materials Group

Tony D. Collins
Asphalt Materials Design Engineer

- Supervises the Asphalt Binder and Emulsion Laboratories
- Reviews and approves asphalt mix designs and JMF changes
- Evaluates new asphalt products submitted to NCDOT via NTPEP and NCDOT PEP
- Research committee chair and member
- AASHTO/NTPEP Binder Supplier committee member
- Reviews AASHTO ballots
- 2024 NCDOT Spec. Book committee member
- Member NCDOT NCAT test track sponsor team

Asphalt Materials Design Engineer	Tony Collins	tdcollins@ncdot.gov	919-329-4063

M & T – Asphalt Materials Group

Kristin Ewan
Asphalt Quality Engineer

- Manages Quality Program for Emulsified Asphalt
- Manages Quality Program for Performance Graded Binder
- Manages PG Binder and Emulsion Laboratory Accreditations
- 2024 NCDOT Spec. Book committee member

Asphalt Quality Engineer	Kristin Ewan	keewan@ncdot.gov	919-329-4101

M & T – Asphalt Materials Group

Sophia Lemieux
Asphalt Quality Technician

- Assists with managing PG binder accreditation
- Troubleshoots binder related problems
- Compiles proficiency sample data for submission to AASHTO
- Performs assessments of M&T liquid asphalt laboratory technicians
- Assists with management of the PG Binder QC/QA program
- Oversees in-house and external laboratory audits
- Performs tests on PG binder and new bituminous products

Asphalt Testing Technician	Sophia Lemieux	srlemieux@ncdot.gov	919-329-4105

M & T – Asphalt Materials Group

Jamey Sheron (CEI)
Asphalt Field Technician

- Certifies producer laboratory and sampling technicians
- Inspections of binder and emulsion plants/terminals
- Conducts IA sampling and testing
- Conducts QA sampling and testing

M & T – Asphalt Materials Group

Terry Bradshaw (CEI)
Emulsion Testing Technician

- Performs tests on asphalt emulsions, IA and QA
- Assists with laboratory inspections and audits
- Performs standardizations on laboratory equipment and accessories

M & T – Asphalt Materials Group

VACANT
Asphalt Binder Testing Technician

- Perform tests on asphalt binders, IA and QA
- Assist with laboratory inspections and audits
- Performs standardizations on laboratory equipment and accessories


DANGER

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State Materials Engineer

Brian Hunter
State Laboratory Operations Engineer

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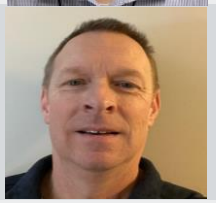
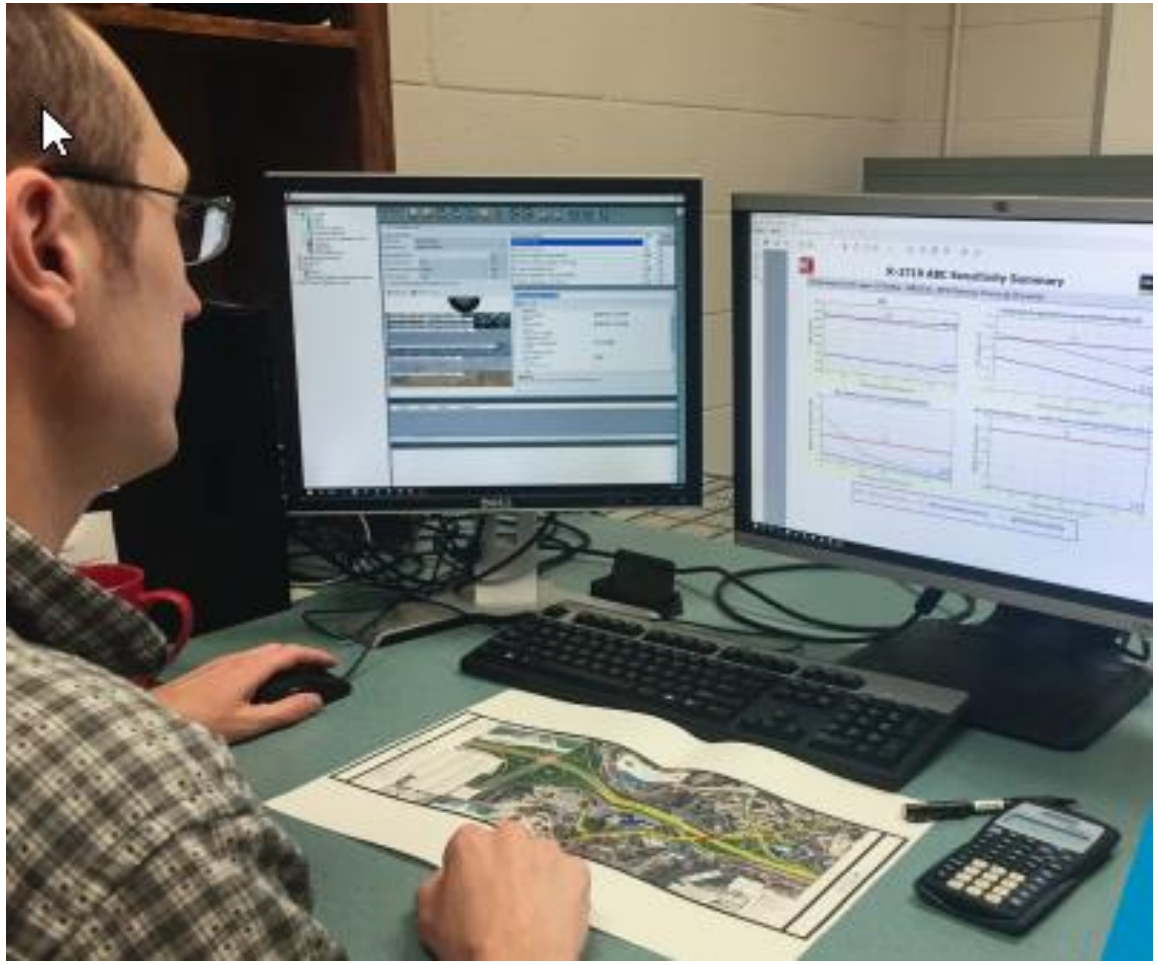
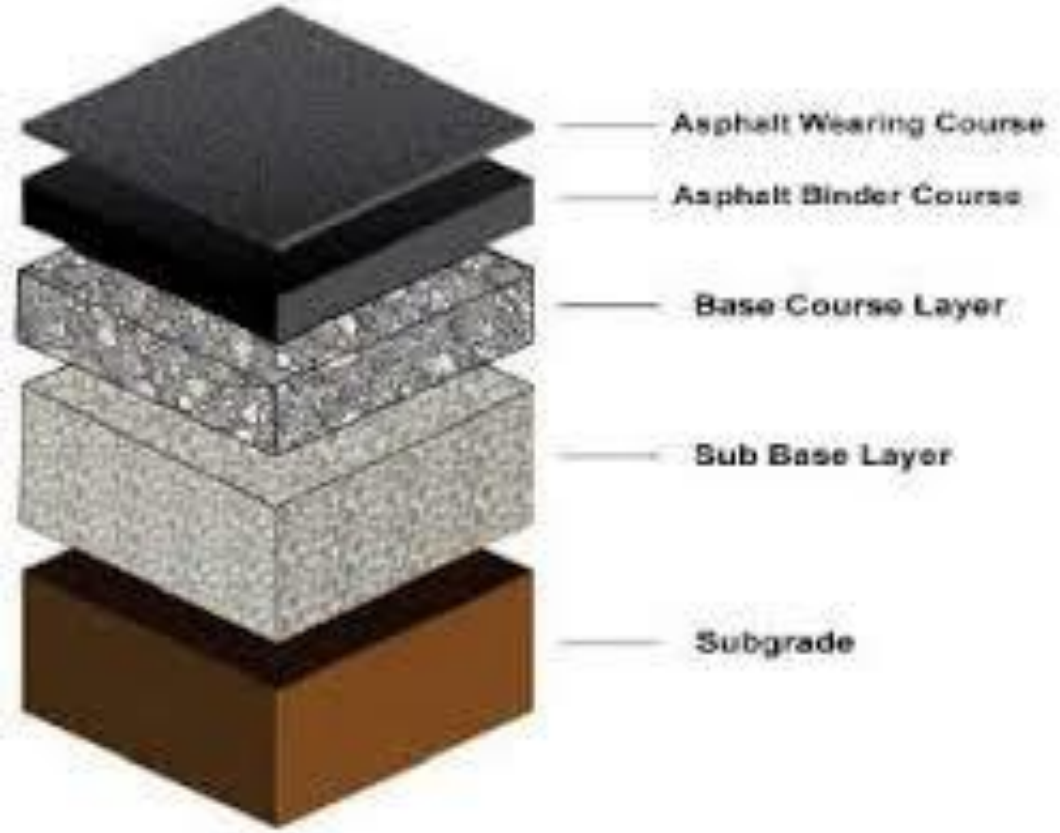
M & T – Pavement Design Section

State Pavement Design Engineer	Clark Morrison, PhD, PE	csmorrison@ncdot.gov	919-329-4018	
Design/Analysis Engineer	Andrew Wargo, PhD, PE	adwargo@ncdot.gov	910-329-4017	
Design/Analysis Engineer	Shihai Zhang, PE	szhang2@ncdot.gov	919-329-4014	
Design/Analysis Engineer	Josh Holland, PE	jholland@ncdot.gov	704-380-6090	
Design/Analysis Engineer	VACANT	-	-	

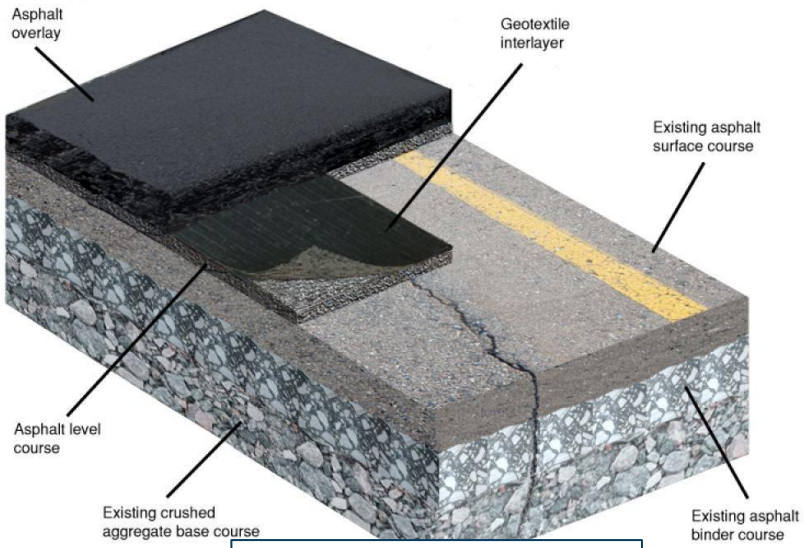



Asphalt Wearing Course
Asphalt Binder Course
Base Course Layer
Sub Base Layer
Subgrade

Pavement Distresses

- Alligator (Fatigue) Cracking
- Bleeding
- Block Cracking
- Shoving
- Depression
- Joint Reflection Cracking
- Longitudinal Cracking
- Patching
- Polished Aggregate
- Potholes
- Raveling
- Rutting
- Slippage Cracking
- Stripping
- Transverse (Thermal) Cracking
- Bleeding and Pumping

Longitudinal Joint Cracking



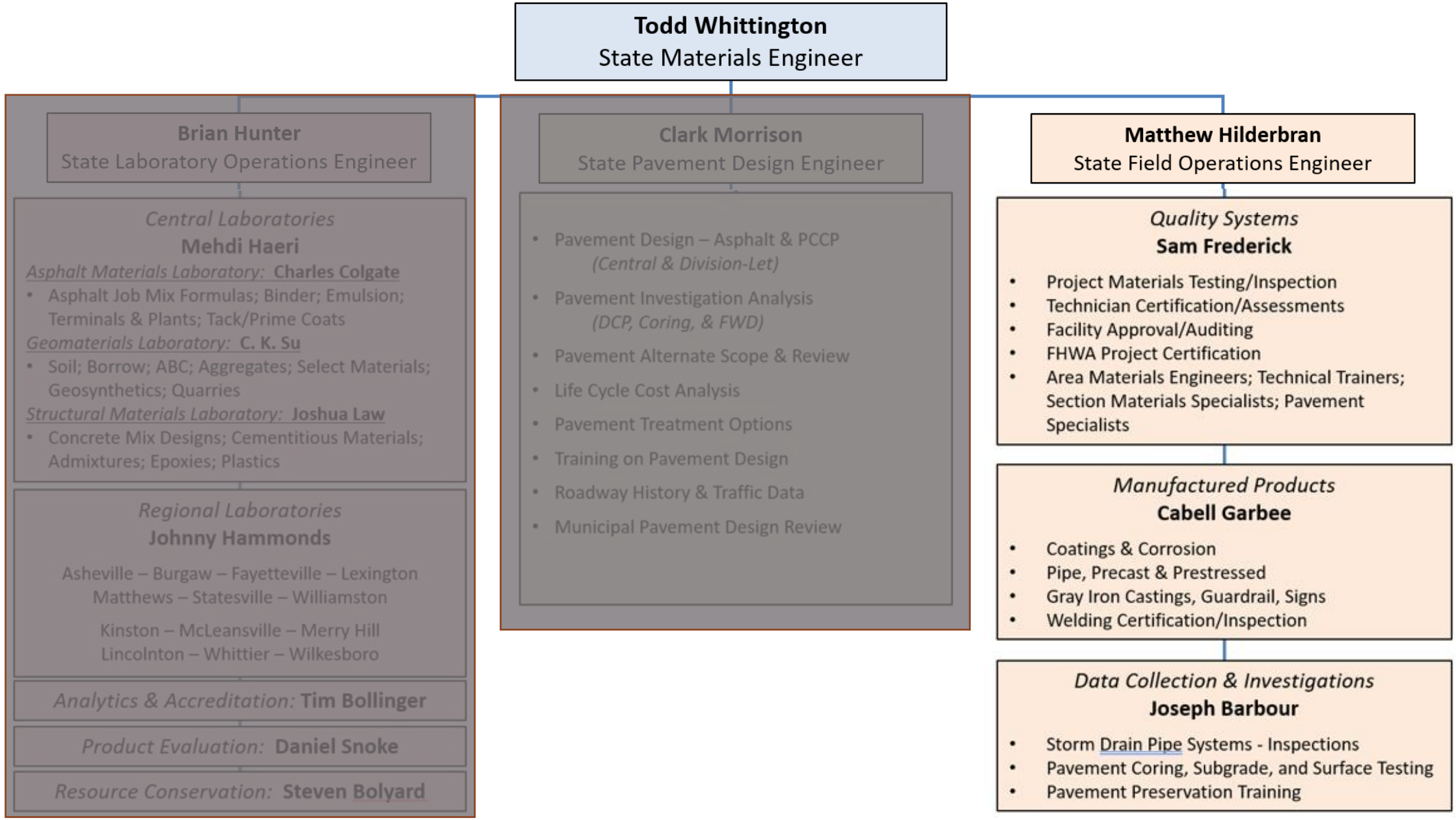
Cracking

Shoving

Delamination

Dynamic Cone Penetrometer

Falling Weight Deflectometer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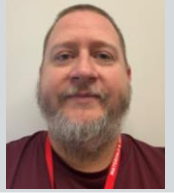
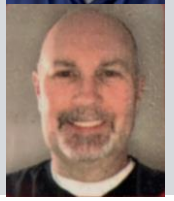
M & T – Pavement Specialists

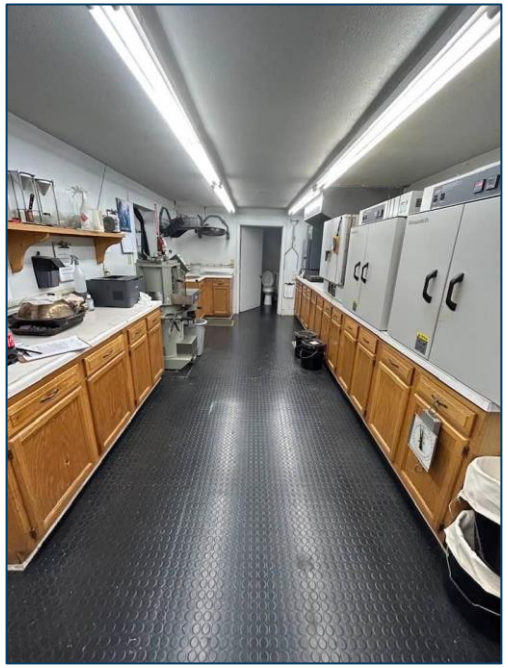
- Main point of contact for asphalt specific questions
- Direct asphalt runner's daily activities
- Provide verbal approvals and/or forwarding JMF change request to our Asphalt Mix Design Engineer
- Direct DR (Dispute resolution) samples
- Direct cutting of sublots
- Evaluate and recommend mix penalties
- Lab and Plant audits (done yearly)
- Perform and conduct Technician assessments
- Asphalt Plant / Lab Certifications
- Perform investigations for when asphalt test results fail
- Attend preconstruction meetings & assist with QMS classes
- Periodically check contactors plant site, lab equipment, as well as monitoring graphs & QC data
- Etc.

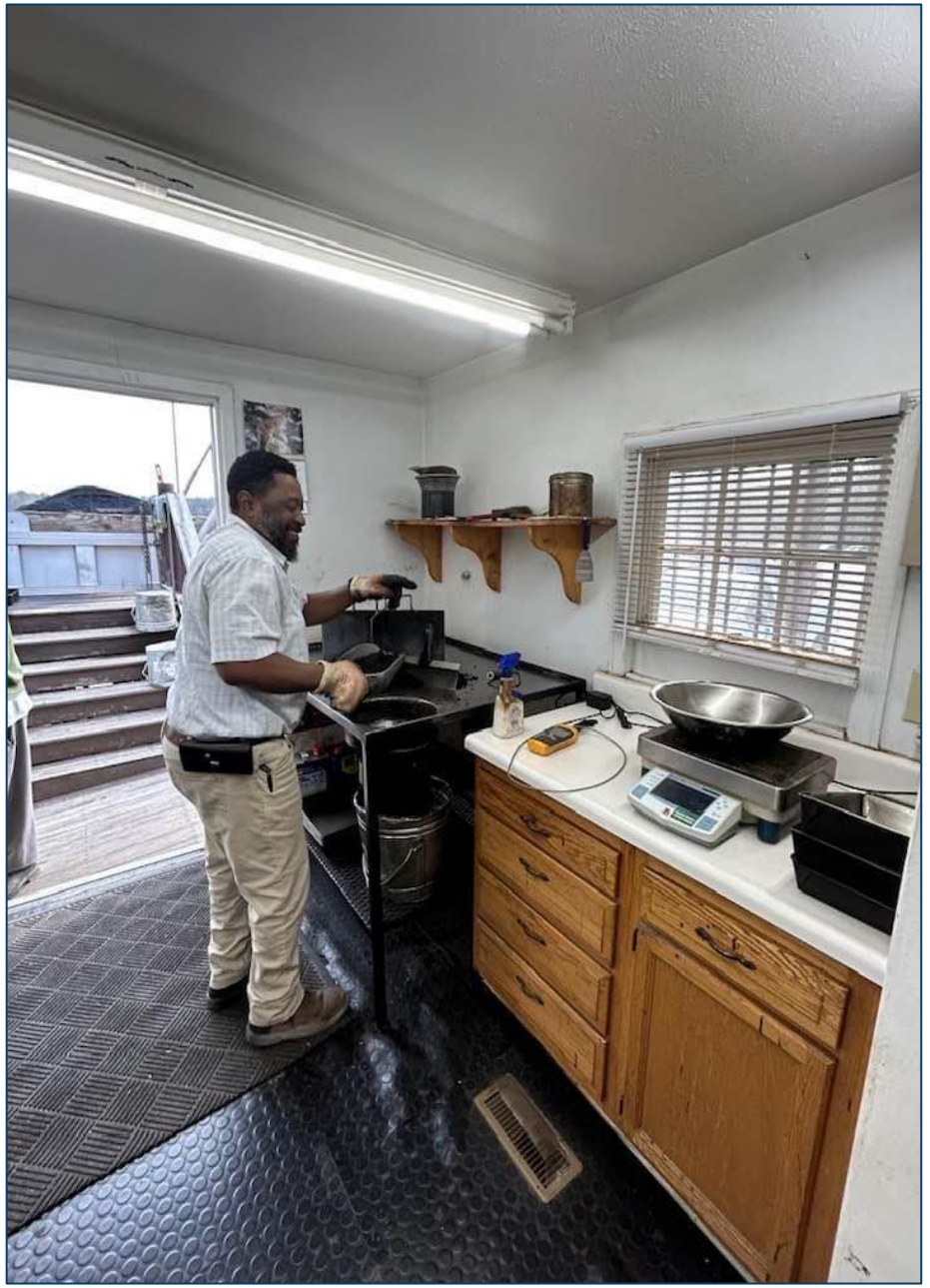
M & T – Pavement Specialists

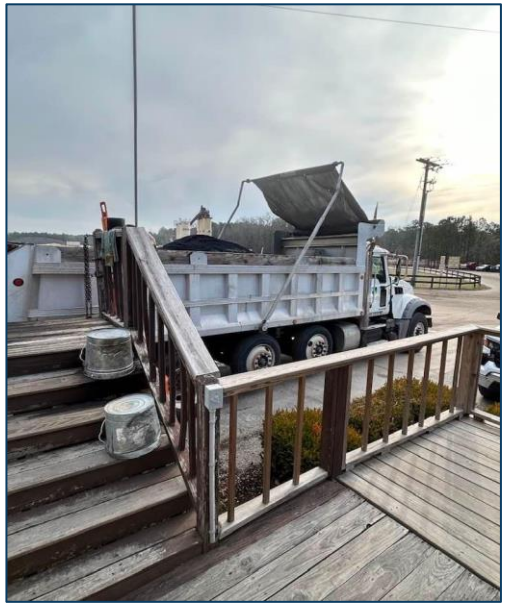
Division 1, 2, 4	Donnie Best	dgbest@ncdot.gov	252-361-1939	
Division 3, 5, 6	Jerry “Red” Simmons	jwsimmons1@ncdot.gov	910-995-6198	
Division 7, 8	Norm Abrams	naabrams@ncdot.gov	336-215-7120	
Division 9, 10	Ryan Richardson	rwrichardson@ncdot.gov	704-507-4235	
Division 11, 12	Jeff Canter	jdcanter@ncdot.gov	336-957-1052	
Division 13, 14	Dan Hunter	drhunter@ncdot.gov	828-421-7584	

M & T – Pavement Specialists

Pavement Specialist Supervisor	John Flowers	jtflowers@ncdot.gov	919-810-2961	
Asst. Pavement Specialist – Div. 1, 2, 3, 4, 6	David Mercer	dpmercer1@ncdot.gov	910-290-5451	
Asst. Pavement Specialist – Div. 11, 12	Thomas Paschal	tepaschal1@ncdot.gov	336-609-4982	



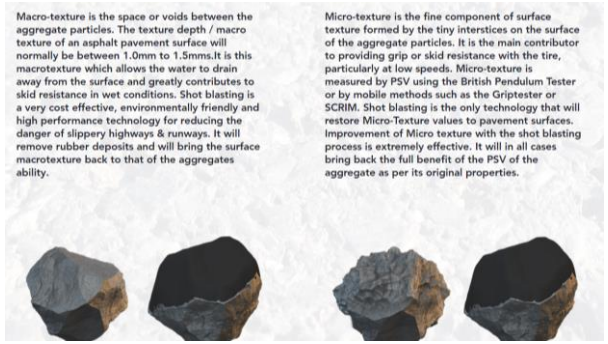


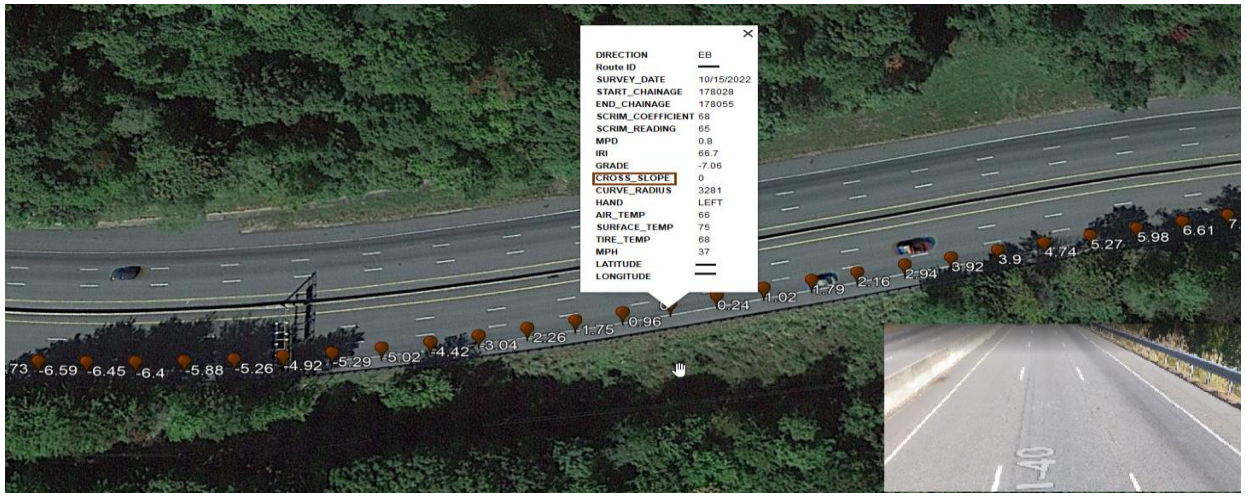



LYNYRD SKYNYRD

M & T – Data Collection & Investigation Section

- Friction/Texture/Skid Resistance –
  - Grinding, Grooving, Shotblasting
  - Contracted with Skidabrader, LLC
  - Contracted with KPR Engineering – Spot Safety CFMD
  - Contracted with WDM International – Cross Slope, MPD, Grade, Texture





State Data Collection & Investigation Engineer

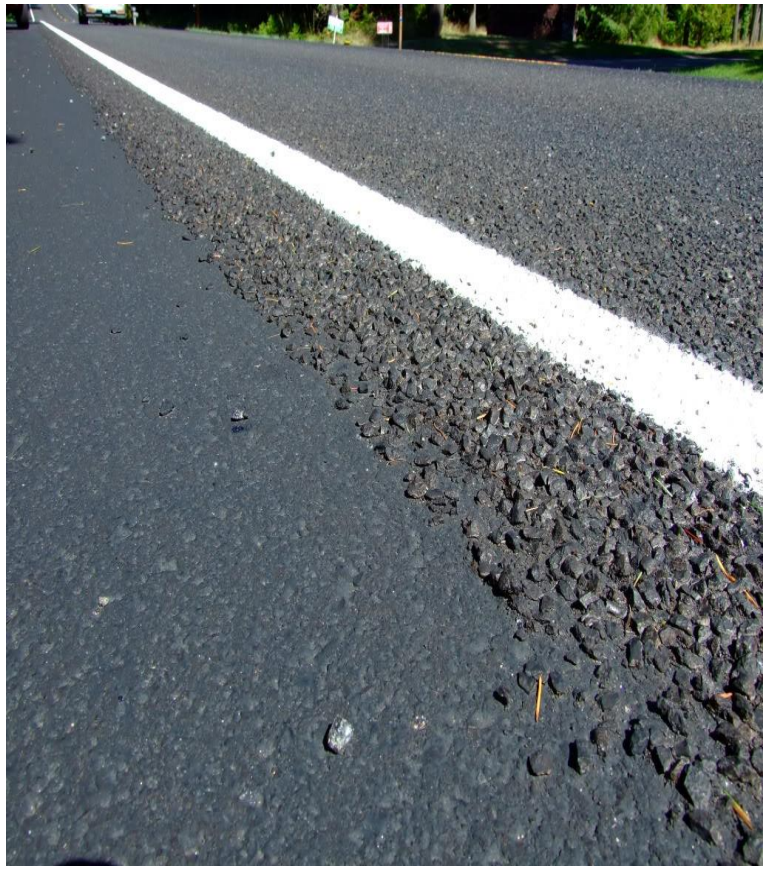
Joseph Barbour, PE

jdbarbour2@ncdot.gov

919-920-6278

M & T – Asphalt Surface Treatments / Pavement Preservation

Pavement preservation treatments	
hot-mixed asphalt overlays	*cape seal*
chip seal	*microsurfacing*
crack sealing	*slurry seal*
fog seal	



- 2022 - Workshop Updates (450 of attendees – 28 Workshops)
  - 2023 - Contractor Specific Workshops
  - 2023 – Pavement Preservation Best Practices Manual
- 2023 - Special Provisions
  - Microsurfacing
  - Slurry Seal
  - Pavement Texturing

Pavement Preservation Engineer | Garrett Lee | gllee@ncdot.gov | 919-500-3445

M & T – Material Certification & Material Acceptance

The Compliance & Assurance Engineer for the Materials and Tests Units primary responsibility is assisting the State Quality Systems Engineer in the certification of federally-funded and state-funded projects. This is done to ensure that accurate and sufficient documentation is available to verify the quality of materials and products used on transportation construction projects.

Quality Systems Engineer	Sam Frederick, PE	sjfrederick@ncdot.gov	984-272-5545	
Compliance and Assurance Engineer	Michael Ricker	mdricker@ncdot.gov	828-385-2645	

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CCU – Recent Staff Changes

➢ **Wiley W. Jones III, PE**	State Construction Engineer	September 2022
➢ **Marcus Kiser, PE**	Area Construction Engineer Division 7	November 2022
➢ **Christopher Fine, PE**	Area Construction Engineer Division 10	October 2022
➢ **Aaron Griffith, PE**	Regional Bridge Construction Engineer – Western	August 2022

Construction Unit Regions And Area Engineers

B.C. Skeens, PE (Brian)
Assistant State Construction Engineer
(Western Region - Divisions 7, 9 - 14)
3931 NC 226 S
Marion, NC 27852
Office: 828-803-6131
Cell: 828-803-1461

W.W. Jones III, PE (Wiley)
State Construction Engineer
1543 Mail Service Center
Raleigh, NC 27699-1543
Office: 919-707-2400

Vacant
Assistant State Construction Engineer
(Eastern Region - Divisions 1 - 6, and 8)
1543 Mail Service Center
Raleigh, NC 27699-1543
Office: 919-707-2403
Cell:

A.E. Griffith, PE (Aaron)
Regional Bridge Construction Engineer
(Western Region - Divisions 7, 9 - 14)
PO Box 14996 Greensboro, NC 27415-4996
CS 02-16-44
Cell: 336-215-9170

A.V. Earwood, PE (Aaron)
Regional Bridge Construction Engineer
(Eastern Region - Divisions 1 - 6, and 8)
1543 Mail Service Center
Raleigh, NC 27699-1543
Cell: 919-730-5138

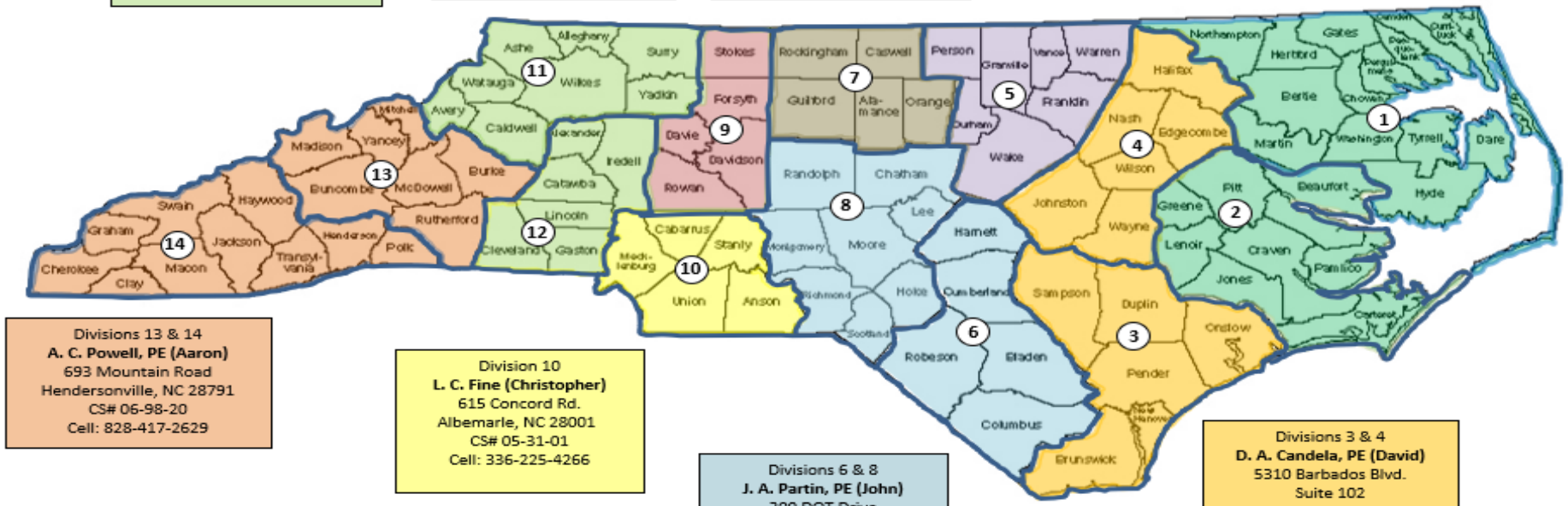
Divisions 11 & 12
M.A. Biggerstaff, PE (Mark)
3931 NC 226 S
Marion, NC 28752
Cell: 828-803-9954

Division 9
V.G. Davis, PE (Vickie)
1580 Henderson Grove
Church Road
Salisbury, NC 28147
CS# 05-31-01
Cell: 704-202-0945

Division 7
M.K. Kiser, PE (Marcus)
1151 North MLK Junior Blvd.
Winston-Salem, NC 27514
CS# 02-16-44
Cell: 336-215-9170

Division 5
T.B. Brooks, PE (Troy)
1543 Mail Service Center
Raleigh, NC 27699-1543
Office: 919-707-2420
Cell: 336-972-4627

Divisions 1 & 2
R. S. Hall, PE (Randy)
209 South Glenburnie Road
New Bern, NC 28560
CS# 16-00-04
Cell: 252-402-9957
Office: 252-514-4759



Divisions 13 & 14
A. C. Powell, PE (Aaron)
693 Mountain Road
Hendersonville, NC 28791
CS# 06-98-20
Cell: 828-417-2629

Division 10
L. C. Fine (Christopher)
615 Concord Rd.
Albemarle, NC 28001
CS# 05-31-01
Cell: 336-225-4266

Divisions 6 & 8
J. A. Partin, PE (John)
300 DOT Drive
Asheboro, NC 27204
CS# 13-62-07
Cell: 336-847-1226

Divisions 3 & 4
D. A. Candela, PE (David)
5310 Barbados Blvd.
Suite 102
Castle Hayne, NC 28429
CS# 04-08-04
Cell: 910-524-4931

CCU – Area Construction Engineers

Divisions 1, 2	Randy Hall, PE	rshall1@ncdot.gov	252-402-9957
Divisions 3, 4	David Candela, PE	dacandela@ncdot.gov	910-524-4931
Division 5	Troy Brooks, PE	tbbrooks2@ncdot.gov	336-972-4627
Divisions 6 & 8	John Partin, PE	jpartin@ncdot.gov	336-847-1226
Division 7	Marcus Kiser, PE	mkkiser@ncdot.gov	336-215-9170
Division 9	Vickie Davis, PE	vdavis@ncdot.gov	704-202-0945
Division 10	Christopher Fine, PE	lcfine@ncdot.gov	336-225-4266
Divisions 11 & 12	Mark Biggerstaff, PE	mabiggerstaff@ncdot.gov	828-803-9954
Divisions 13 & 14	Aaron Powell, PE	apowell@ncdot.gov	828-417-2629

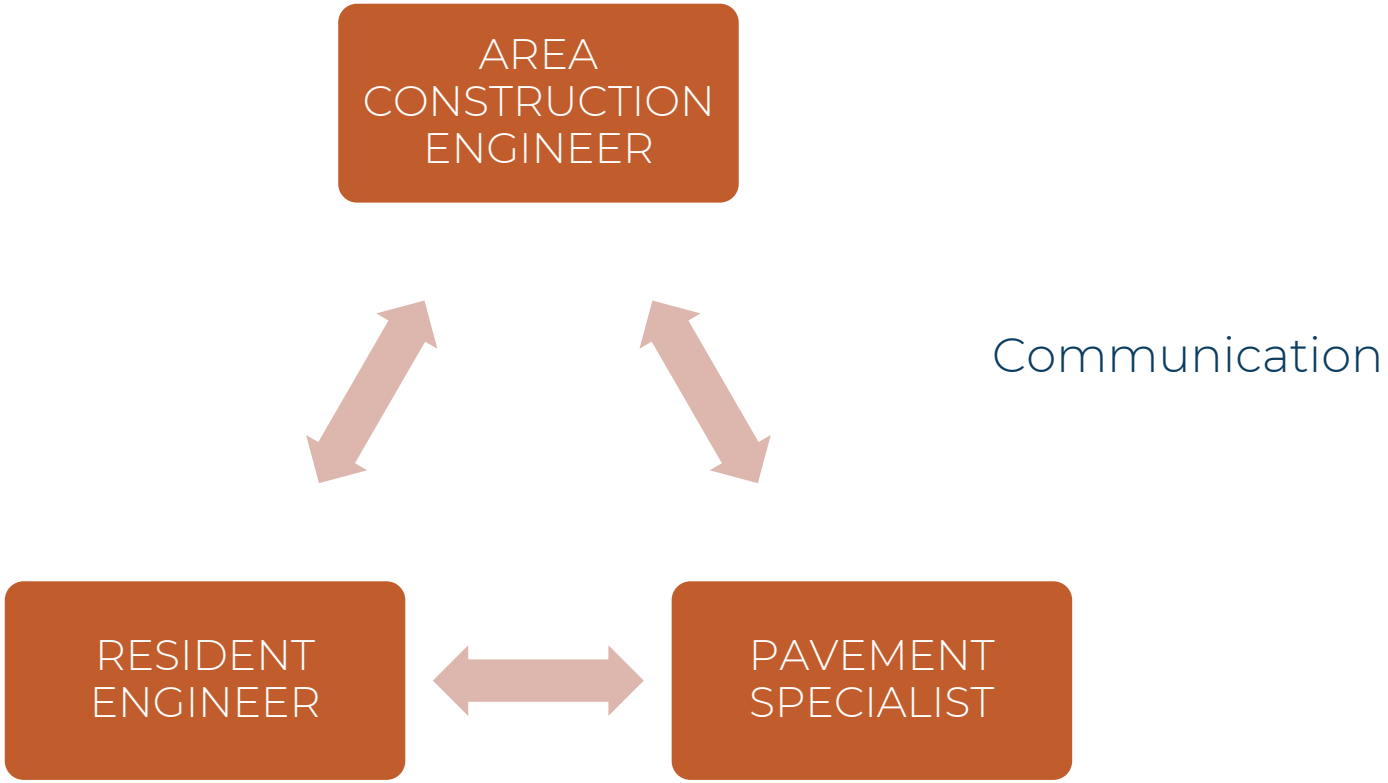
Area Construction Engineers (ACEs)

- **Key Roles and Responsibilities (Asphalt Related)**
  - Resource for NCDOT staff engaged in Contract Administration
    - Main point of contact for Division staff on construction or contract administration issues and questions.
  - Project final inspections and final acceptance.
  - Yearly project record reviews. (includes review of asphalt related documents)
  - Review and approve all contract Pay Adjustments.

Asphalt Pay Adjustments

- The Area Construction Engineer reviews and approves all asphalt pay adjustments.
  - Primarily to ensure consistency across the state.

- Ultimately, the decision is made with input from the Resident Engineer's Office and Pavement Specialist.



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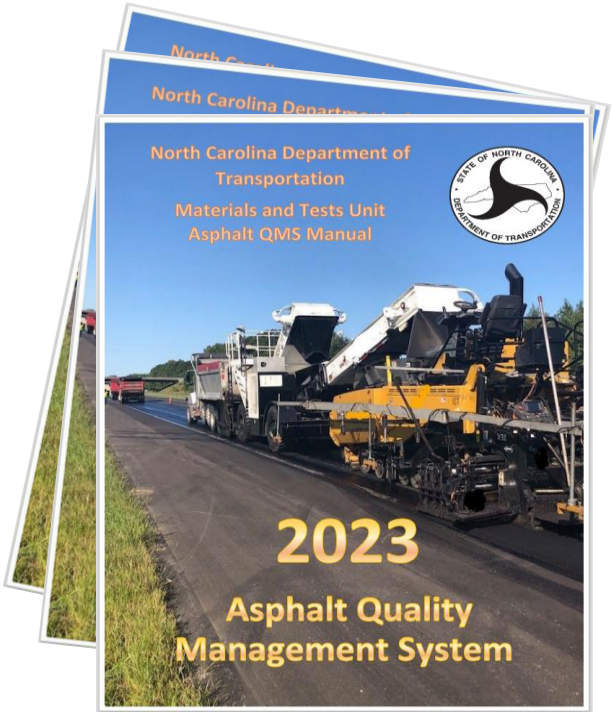
2022/2023 Asphalt QMS Updates

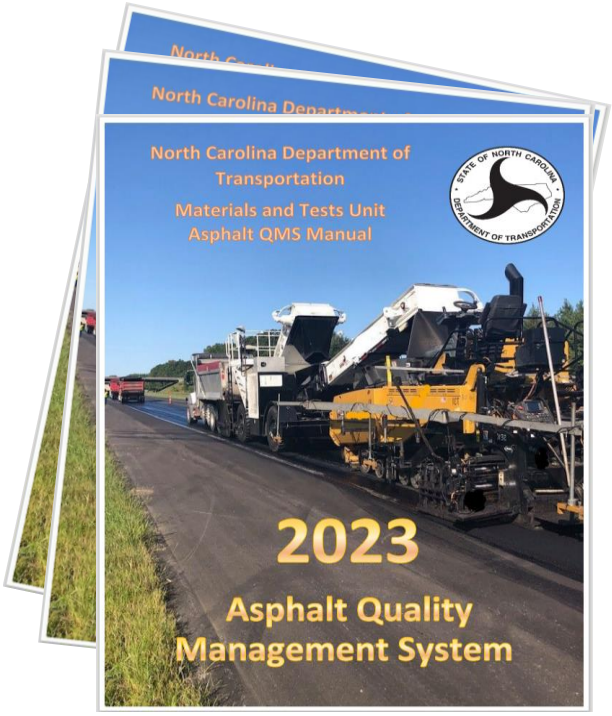
Section 1:	**Quality Management System (QMS) for Asphalt Pavements**	
Page No.	*Subsection*	*Change*
1-7	1.3.7	Bullet # 8 the addition of the word Probation
1-8	1.3.8	Bullet # 8 Removed Sentences: *If a class is full at the time of registration, the enrollee will be given the option of adding their name to the class waitlist. Waitlist assignments are made on a first come, first-served basis.*
1-12	FHWA Notice	Changed Chris Peoples as NCDOT Chief Engineer
Section 2:	**Materials Used In Asphalt Paving**	
Page No.	*Subsection*	*Change*
2.4.7	2-5	Bullet (A) Silicone: Added web site: A listing of approved sources of silicone may be obtained through the M&T Lab approved products list. https://apps.ncdot.gov/vendor/approvedproducts/Default.aspx
2.5.2	2-8	Source of Aggregate: Added web site: A listing of approved sources of silicone may be obtained through the M&T Lab approved products list. https://apps.ncdot.gov/vendor/approvedproducts/Default.aspx
Section 3:	**Asphalt Pavement Design**	
Page No.	*Subsection*	*Change*
N/A	N/A	N/A

Section 4:	**Asphalt Mix Design and Job Mix Formulas**	
Page No.	*Subsection*	*Change*
4-6	4.4.6	Corrected Imaged Diagram showing Air Voids and Voids in Mineral Aggregate.
4-14	4.9.2	Updated Job Mix Formula Example: Using current numbering and (Tony Colins) Asphalt Design Engineer



2022/2023 Asphalt QMS Updates

Section 5:	**Asphalt Plant Equipment**	
Page No.	*Subsection*	*Change*
5-1	5.3	Changed in 1st paragraph: This certification is effective from the date of issuance and expires with Current air permit expiration date and is subject to continued compliance.
Section 6:	**Asphalt Plant Operations**	
Page No.	*Subsection*	*Change*
6-14	6.5.9	(E) Setting the Batch weights (1) AGGREGATE SCALES: Corrected Figure 6-14 Numbering
6-16	6.5.9	(E) Setting the Batch weights (2) ASPHALT BINDER SCALES: Corrected Figure 6-15 Numbering
6-17	6.6.3	Weight Measurement of Aggregate and RAP/RAS Corrected Figure 6-16 Numbering
6-18	6.6.4	Asphalt Binder Meter System: Corrected Figure 6-17 Numbering
6-21	6.6.8	Surge-Storage Bins (Silos): Corrected Figure 6-18 Numbering



2022/2023 Asphalt QMS Updates

Section 7:	Asphalt Mixture Sampling and Testing	
Page No.	*Subsection*	*Change*
7-2	7.2	Changed in 1st and 2nd paragraph: Deleted (metric tons)
7-9	7.3.1	QMS Plant Sampling Schedule Table: Added to Frequency of Test column/ COMBINED AGGREGATE MOISTURE CONTENT Row Minimum of once daily "***or after significant rain event*** " at Drum Mix Plants
7-10	7.3	Changed in 4th paragraph and Box Accumulation Increment: Deleted (metric tons)
7-11	7.3	Bullet III Sub-bullet B: Correction 1012-1 (F)
7-11	7.3	Bullet III Sub-bullet C: Correction 1012-1 (E)
7-11	7.3	Bullet III Sub-bullet D: Addition or after significant rain event
7-18	7.4.2	Bullet B Sub-bullet 1.(b.): Removed Mix Changes Allowed with Pavement Specialist's Approval: Gmm, Gmb, Gsb, or Gse
7-18	7.4.2	Bullet B Sub-bullet #3: Removed Same source & Replaced with an aggregate from the same approved source
7-18	7.4.2	Bullet B Sub-bullet #5 : Changed to Any change in anti-strip type or manufacturer's formulation with no change in anti-strip dosage rate. The anti-strip additive must be on the NCDOT QPL. **Note:** Additional TSR testing will be required within 7 calendar days after beginning production for each plant. No additional TSRs will be required if the contractor has passing TSRs with the new anti-strip additive and a given set of materials from previous production tests.
7-18	7.4.2	Bullet B Sub-bullet #6 : Changed to Any change in anti-strip dosage rate with no change in anti-strip type or manufacturer. The anti-strip additive must be on the NCDOT QPL. **Note:** New TSR testing is required prior to production. (Mix Design TSRs meet this requirement). An additional TSR will be required within 7 calendar days after beginning production. The requirement for a new Mix Verification and new production TSRs may be waived for JMFs with an increased dosage rate and no history of TSR problems.
7-18	7.4.2	Bullet C Sub-bullet #2 : Changed to Any change in: Gmm, Gmb, Gsb, or Gse
7-18	7.4.2	Bullet C Sub-bullet #6 : Added *"to better control mix properties [JMF change required]."*
7-19	7.4.2	Bullet C Addition Sub-bullet 8 : Any change in anti-strip type, manufacturer, or dosage rate that does not meet B.5 or B.6 above. **NOTE:** New TSR testing is required prior to production. (Mix Design TSRs meet this requirement). An additional TSR will be required within 7 calendar days after beginning production. The requirement for a new Mix Verification and new production TSRs may be waived for JMFs with an increased dosage rate and no history of TSR problems.
7-19	7.4.2	NOTES: Bullet # 2 Changed to The Department may allow TSR testing for each plant at the following minimums: one TSR for Surface, one TSR for Intermediate, and one TSR for Base. This can only be allowed where a given set of materials have shown a good history of TSR results
7-19	7.4.2	NOTES: Addition Bullet #5: Any changes to volumetric or gradation data should be fully documented on the QMS-6 for and supported by test data (mix verification, test reports, etc.)
7-19	7.4.2	NOTES: Addition Bullet #6: For Approved Verbal JMF changes, the Pavement Specialist must

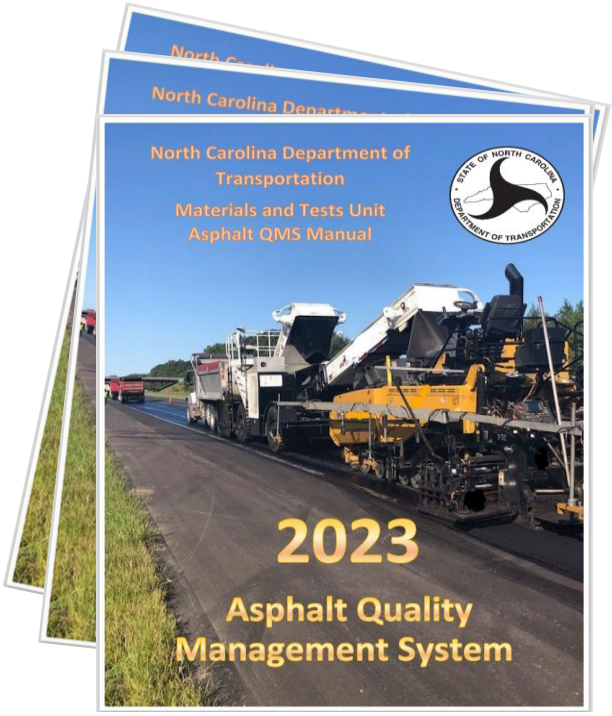
2022/2023 Asphalt QMS Updates

7-19	7.4.2	NOTES: Bullet # 2 Changed to The Department may allow TSR testing for each plant at the following minimums: one TSR for Surface, one TSR for Intermediate, and one TSR for Base. This can only be allowed where a given set of materials have shown a good history of TSR results
7-19	7.4.2	NOTES: Addition Bullet #5: Any changes to volumetric or gradation data should be fully documented on the QMS-6 for and supported by test data (mix verification, test reports, etc.)
7-19	7.4.2	NOTES: Addition Bullet #6: For Approved Verbal JMF changes, the Pavement Specialist must follow-up via email with the Asphalt Mix Design Engineer and include all supplemental documentation provided by the contractor.
7-39	7.11.3	Note: Correction Table 610-1
7-52	7.16.1	Deletion Bullet D Sub-bullet #3 : When a change is made using an anti-strip additive from the NCDOT QPL with **no change** in dosage rate
7-52	7.16.1	Deletion Bullet D Sub-bullet #4 : When a change is made using an anti-strip additive from the NCDOT QPL with **any change** in dosage rate:

Section 8:	**Recycling of Asphalt Pavements**	
Page No.	*Subsection*	*Change*
8-8	8.8	Removal of MILLING ASPHALT PAVEMENT DIAGRAM
8-8	8-8	Addition: Revision to the 2018 Standard Specifications/ Section 607
Section 9:	**Roadway Paving Operations**	
Page No.	*Subsection*	*Change*
9-18	9.6.1	Changed in 5th paragraph: Deleted (millimeter)

2022/2023 Asphalt QMS Updates

Section 10:	**Roadway Inspection and Testing of Asphalt Pavements**	
Page No.	*Subsection*	*Change*
10-1	10.1.2	Added Sub-bullet i): Verify Contractor has an active QMS Roadway Technician on project site.
10-15	10.3.4	Table 10-1 Core Method Minimum Number of sample column/ Control Strip 5 Core Samples (6-Inch Dia.)
10-15	10.3.4	Table 10-1 Core Method Minimum Number of sample column/ Test Section 1 Core Sample per test section w/ minimum 3 core samples per lot (6-inch Dia.)
10-15	10.3.4	Table 10-1 Nuclear / Non-Nuclear Method Minimum Number of sample column/ Control Strip 5 Core Samples 10 Nuclear Gauge Readings (25 non-nuclear) (6-inch Dia.)
10-27	10.4.1	Changed in 1st paragraph: replaced Soils Lab with Field Operation Group or the web site
10-29	10.4.7	Bullet 6 : Changed The gauge readings taken at each check core will be averaged and will replace the gauge readings taken at the original core site.
10-33	10.4.9	Last paragraph removed : If a correlated target density is not used within 17 calendar days, the contractor will use a calculated target density based on the current moving average of the maximum specific gravity for that mix type to evaluate test sections until an acceptable correlated target has been established. The density results based on the calculated target will be recalculated once a control strip has been constructed and an acceptable correlated target is established.
10-35	10.4.12	Removed : Gold copy and White copy
10-39	10.5.4	B. Verification Test Section Bullet #2 a: replace Soils Lab with Technical Trainer
10-39	10.5.4	B. Verification Test Section Bullet #5 b. ii.: replace Soils Lab with Technical Trainer
10-39	10.5.4	C. QA Test Section Test Section Bullet #2.: replace Soils Lab with Technical Trainer
10-45	10.6.5	1st Paragraph: added (or 7.14)
Section 11:	**Pavement Smoothness / Rideability**	
N/A	N/A	N/A
Section 12:	**Records and Reports**	
Page No.	*Subsection*	*Change*
12-65	#6b.	Deleted Item 6b. referencing QA comparison cores – QA Comparison cores no longer used.
12-65	#6d.	Deleted Item 6d. referencing Longitudinal joint cores – Longitudinal joint cores not used.



2022/2023 Asphalt QMS Updates

7.4.2 **Allowable Mix Adjustments**

Listed below are allowable mix adjustments during normal production, the extent of these adjustments allowed, and designation as to who is authorized to make and/or approve these changes. These allowable adjustments only apply during normal production of asphalt mixes. (See Section 7.4.1 above for allowable changes during the plant mix verification process). **Any mix placed without a properly approved Job Mix Formula will be subject to removal.**

*A. Mix Changes Allowed by QC without Prior Pavement Specialist Approval **(QA Notification Required):***

1. Cold feed blend change of ± 10% or less from the original JMF target blend percentage per aggregate. [Deletion of a sole source aggregate is not allowed. Blend changes to RAP/RAS are not allowed.]
2. Change in source of asphalt binder. All binder grades must come from sources certified under the Department's PG Asphalt Binder QC/QA Program (proper delivery documents are required).
3. Use of a new source recycled product. Gradation & binder content must meet Section 1012. [All mix properties must meet all Specification requirements.]

NOTE: Above changes shall be documented by QC and documentation sent to the Asphalt Materials Design Engineer. These changes will not require a change in the JMF Number, but a comment will be made on the JMF.

B. Mix Changes Allowed with Pavement Specialist's Approval:

1. Change of JMF Control Data
   a. Gradation requirements
   ~~b. G_{sa}, G_{sb}, G_{se}, or G_{mb}~~
   b. % asphalt binder content change of ± 0.1 – 0.5 % from original JMF target.

   NOTE: For mixes where the recycled binder replacement percentage (RBR%) exceeds 30% of the total binder in the mix, a percent virgin asphalt binder content reduction of up to 0.2% can be made. Percent minimum VMA in the mix is required and approved methods will be referenced to determine if an increase in percent recycled contributed binder from the **ORIGINAL JMF** will be allowed. Supporting documentation shall be provided.
2. Per aggregate cold feed blend change of 10 – 15 % of original JMF target.
3. Addition or deletion of an aggregate from the same approved source ~~same source~~ to better control mix properties [JMF change required].
4. Change in JMF mixing temperature of up to plus or minus 15°F (8°C).

~~5. Use of a new source recycled product if gradation & binder content do not meet Section 1012. [All mix properties must meet all Specification requirements.]~~

5. Any change in anti-strip type or manufacturer's formulation with no change in anti-strip dosage rate. The anti-strip additive must be on the NCDOT QPL.

   Note: Additional TSR testing will be required within 7 calendar days after beginning production for each plant. No additional TSRs will be required if the contractor has passing TSRs with the new anti-strip additive and a given set of materials from previous production tests. ~~conducted within the past 12 months~~
6. Any change in anti-strip dosage rate with no change in anti-strip type or manufacturer. The anti-strip additive must be on the NCDOT QPL.

   Note: New TSR testing is required prior to production. (Mix Design TSRs meet this requirement). An additional TSR will be required within 7 calendar days after beginning production. The requirement for a new Mix Verification and new production TSRs may be waived for JMFs with an increased dosage rate and no history of TSR problems.

~~**NOTE:** No additional TSRs will be required if the contractor has passing TSRs with the new anti-strip additive and a given set of materials from previous production tests.~~

C. Mix Changes Only Allowed with Asphalt Mix Design Engineer's Approval:

1. Percent asphalt binder content change of greater than 0.5 % from original JMF target.

   NOTE: For mixes where the recycled binder replacement percentage (RBR%) exceeds 30% of the total binder in the mix, a percent virgin asphalt binder content reduction of up to 0.2% can be made. Percent minimum VMA in the mix is required and approved methods will be referenced to determine if an increase in percent recycled contributed binder from the **ORIGINAL JMF** will be allowed. Supporting documentation shall be provided.
2. Any change in: ~~G_{sa}, G_{sb}, G_{sb}, or G_{se}~~
3. Per aggregate cold feed blend change greater than ±15 % of original JMF target. [A 0.45 power chart with original and new gradations is required.]
4. Grade of asphalt binder being used.

2022/2023 Asphalt QMS Updates

5. Any % RAP/RAS change from original JMF target.
6. Deletion of a sole source aggregate to better control mix properties [JMF change required].
7. Change in JMF mixing temperature greater than plus or minus 15°F (8°C).
8. Any change in anti-strip type, manufacturer, or dosage rate that does not meet B.5 or B.6 above.

   Note: New TSR testing is required prior to production. (Mix Design TSRs meet this requirement). An additional TSR will be required within 7 calendar days after beginning production. The requirement for a new Mix Verification and new production TSRs may be waived for JMFs with an increased dosage rate and no history of TSR problems.

NOTES:

1. Items B.1 thru B.3 or C.1 thru C.4 require mix verification prior to normal production*
2. ~~If Item B.6 occurs, a TSR shall be required prior to normal production*~~
2. The Department may allow TSR testing for each plant at the following minimums: one TSR for Surface, one TSR for Intermediate, and one TSR for Base. This can only be allowed where a given set of materials have shown a good history of TSR results.
3. The following items may require rut testing prior to approval of mix change.*
4. Notify appropriate Pavement Specialist of ALL requests for mix changes.
5. Any changes to volumetric or gradation data should be fully documented on the QMS-6 for and supported by test data (mix verification, test reports, etc.)
6. For Approved Verbal JMF changes, the Pavement Specialist must follow-up via email with the Asphalt Mix Design Engineer and include all supplemental documentation provided by the contractor.

***Unless otherwise approved by the Asphalt Materials Design Engineer or his representative.**

2022/2023 Asphalt QMS Updates

From Section 7.16.1.D. (page 7-51):

D. Additional TSR Testing is Required:

(1) When Warm Mix Asphalt (WMA) is being produced using new WMA technologies or NCDOT-Approved WMA Technologies with "Trial Approval" status:

a) One TSR prior to initial production for each plant at the following minimums: one TSR for Surface mixes, one TSR for Intermediate mixes, and one TSR for Base mixes; and

b) One TSR for every 15,000 tons for each JMF, with the first production TSR coming within 7 calendar days after beginning production of each new mix design.

(2) When Warm Mix Asphalt (WMA) is being produced using Approved WMA Technologies with "Limited Approval" (or higher) status:

One TSR within 7 calendar days after beginning production of each new mix design.

~~(3) When a change is made using an anti-strip additive from the NCDOT QPL with no change in dosage rate:~~

~~a) A change will be made on the JMF to reflect the change in anti-strip additive.~~

~~b) A comment will be added to the JMF noting the change.~~

~~c) The JMF Number will remain the same.~~

~~d) Additional TSRs will be required within 7 calendar days after beginning production for each plant.~~

~~NOTE: No additional TSRs will be required if the contractor has passing TSRs with the new anti-strip additive and a given set of materials from previous production tests.~~

~~(4) When a change is made using an anti-strip additive from the NCDOT QPL with any change in dosage rate:~~

~~a) New TSR testing is required prior to production. (Mix Design TSRs meet this requirement).~~

~~b) Once acceptable TSR results are submitted, an updated JMF No. will be issued.~~

~~[JMF No. will be updated, ex: " 151" will be updated to " 122" for a dosage reduction].~~

~~c) An additional TSR will be required within 7 calendar days after beginning production.~~

~~NOTE: The requirement for a new Mix Verification and new production TSRs may be waived for JMFs with an increased dosage rate and no history of TSR problems.~~

(3) When deemed necessary by the Engineer.

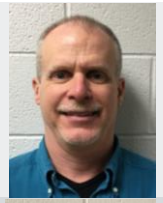
NOTE: The Engineer may allow TSR testing for each plant at the following minimums: one TSR for Surface, one TSR for Intermediate, and one TSR for Base. This can only be allowed where a given set of materials have shown a good history of TSR results.

M&T 2023 Certification Courses

https://connect.ncdot.gov/resources/Materials/Pages/default.aspx

2023 – 39 Classes – 1530 Seats Available

- Introduction to Asphalt
- QMS Level 1
- QMS Level 2
- QMS Mix Sampling
- QMS Roadway Tech 1
- QMS Density Gauge Operator
- QMS Mix Design

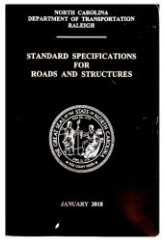
Field Services Engineer	James 'Jim' Sawyer, PE	jsawyer@ncdot.gov	919-329-4170	
Administrative Specialist	Vicki Hudgins	vhudgins@ncdot.gov	919-329-4241	

Topics

- Staff Update
  - Materials and Tests Unit
  - Central Construction Unit
- 2022/2023 QMS Updates
- 2024 NCDOT Standard Specifications for Roads and Structures
  - Division 6 – Asphalt Pavements
  - Division 10 – Materials
- Best Paving Practices
- Questions / Discussion

2024 NCDOT Standard Specifications Timeline cont.

- November 2021 through November 2022 - Meetings held with Division committees to identify 2024 Standard Specifications changes.
- November 2022 through February 2023 – Individual Divisions of the Specifications distributed to outside agencies for review and comments.
  - Carolina Asphalt Pavement Association (CAPA) – Reviews All Divisions
  - Carolinas Associated General Contractors (CAGC) – Reviews All Divisions
  - American Traffic Safety Services Association (ATSSA) – Reviews Divisions 9, 11, 12, 17 and related Division 10 sections
  - American Concrete Pavement Association (ACPA) – Reviews Divisions 7
- January 2023 through April 2023 – Comment responses and any additional changes made since initial review will be redistributed for review and response.
- May 2023 – The *2024 Standard Specifications* to be released electronically.
- June 2023 – send to publisher for printing.
- September 2023 – printed copies will be distributed.
- January 2024 – The *2024 Standard Specifications* applied to all project lettings.



2024 Roadway Standard Drawings Timeline

- All Divisions are currently ready or nearly ready for distribution. Still actively working on Division 8, but all Divisions anticipated complete by March.

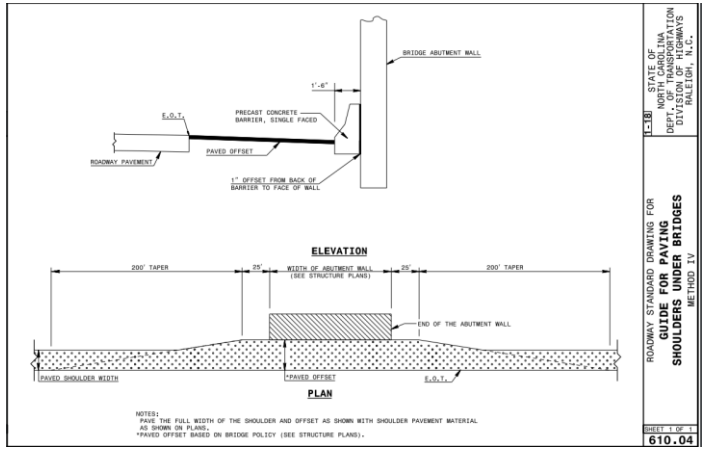
- For the first time, the *Roadway Standard Drawings* will be reviewed by outside agencies prior to final publication. These agencies are the same as the reviewers for the Standard Specifications.
  - Carolina Asphalt Pavement Association (CAPA) – Reviews All Divisions
  - Carolinas Associated General Contractors (CAGC) – Reviews All Divisions
  - American Traffic Safety Services Association (ATSSA) – Reviews Divisions 9, 11, 12, 17 and related Division 10 sections
  - American Concrete Pavement Association (ACPA) – Reviews Divisions 7

- June 2023 – send to publisher for printing.

- Late Summer – The *2024 Roadway Standard Drawings* available on-line.

- September 2023 - printed copies will be distributed.

- January 2024 – The *2024 Roadway Standard Drawings* applied to all projects.



ANY QUESTIONS?

Topics

- Staff Update
  - Materials and Tests Unit
  - Central Construction Unit
- 2022/2023 QMS Updates
- 2024 NCDOT Standard Specifications for Roads and Structures
  - Division 6 – Asphalt Pavements
  - Division 10 – Materials
- Best Paving Practices
- Questions / Discussion

Division 6 – Asphalt Pavements

- Section 607: Milling Asphalt Pavement
  - *Section 607*
    - *Integrated provision SP6 R02R Incidental Milling.*
  - *Article 607-2*
    - *Integrated provision SP6 R59 Milling Asphalt Pavement.*

Division 6 – Asphalt Pavements

- Section 609: Quality Management System for Asphalt Pavements
  - *Article 609-3*
    - Added reference where further direction can be found on the *Allowable Mix Adjustment Policy*.

609-3 FIELD VERIFICATION OF MIXTURE AND JOB MIX FORMULA ADJUSTMENTS

Conduct field verification of the mix at each plant within 45 calendar days before initial production of each mix design, when required by the *Allowable Mix Adjustment Policy* as defined in Section 7.4 of the *Asphalt QMS Manual* and when directed by the Engineer as deemed necessary.

  - *Article 609-8*
    - Removal from the NCDOT Certified Asphalt Laboratory List was repetitively noted, replaced the first instance with technician certification revocation and removal.

Division 6 – Asphalt Pavements

- Section 609: Quality Management System for Asphalt Pavements
  - *Article 609-9*
    - *Integrated provision SP6 R65 Asphalt Concrete Plant Mix Pavements.*

TABLE 609-3
LIMITS OF PRECISION FOR TEST RESULTS

Mix Property	Limits of Precision
25.0 mm sieve (Base Mix)	± 10.0%
19.0 mm sieve (Base Mix)	± 10.0%
12.5 mm sieve (Intermediate & Type P-57)	± 6.0%
9.5 mm sieve (Surface Mix)	± 5.0%
4.75 mm sieve (Surface Mix)	± 5.0%
2.36 mm sieve (All Mixes, except S4.75A)	± 5.0%
1.18 mm sieve (S4.75A)	± 5.0%
0.075 mm sieve (All Mixes)	± 2.0%
Asphalt Binder Content	± 0.5%
Maximum Specific Gravity (G_{mm})	± 0.020
Bulk Specific Gravity (G_{mb})	± 0.030
TSR	± 15.0%
QA retest of prepared QC Gyratory Compacted Volumetric Specimens	± 0.015
Retest of QC Core Sample	± 1.2% (% Compaction)
Comparison QA Core Sample	± 2.0% (% Compaction)
QA Verification Core Sample	± 2.0% (% Compaction)
Density Gauge Comparison of QC Test	± 2.0% (% Compaction)
QA Density Gauge Verification Test	± 2.0% (% Compaction)

Division 6 – Asphalt Pavements

- Section 610 – Asphalt Concrete Plant Mix Pavements
  - *Section 610 –*
    - *Integrated provision SP6 R65 Asphalt Concrete Plant Mix Pavement.*

TABLE 610-3
MIX DESIGN CRITERIA

Mix Type	Design ESALs millions[A]	Binder PG Grade	Compaction Levels G_{mm} @		Max. Rut Depth (mm)	Volumetric Properties[B]			
			N_{ini}	N_{des}		VMA % Min.	VTM %	VFA Min.-Max.	%G_{mm} @ N_{ini}
S4.75A	< 1	64 - 22	6	50	11.5	16.0	4.0 - 6.0	65 - 80	≤ 91.5
S9.5B	0 - 3	64 - 22	6	50	9.5	16.0	3.0 - 5.0	70 - 80	≤ 91.5
S9.5C	3 - 30	64 - 22	7	65	6.5	15.5	3.0 - 5.0	65 - 78	≤ 90.5
S9.5D	> 30	76 - 22	8	100	4.5	15.5	3.0 - 5.0	65 - 78	≤ 90.0
I19.0C	–ALL	64 - 22	7	65	-	13.5	3.0 - 5.0	65 - 78	≤ 90.5
B25.0C	ALL	64 - 22	7	65	-	12.5	3.0 - 5.0	65 - 78	≤ 90.5
	Design Parameter					**Design Criteria**			
All Mix Types	Dust to Binder Ratio ($P_{0.075}$ / P_{be})					0.6 - 1.4[C]			
	Tensile Strength Ratio (TSR)[D]					85% Min[E]			

A. Based on 20 year design traffic.
B. Volumetric Properties based on specimens compacted to N_{des} as modified by the Department.
C. Dust to Binder Ratio ($P_{0.075}$ / P_{be}) for Type S4.75A is 1.0 - 2.0.
D. NCDOT-T-283 (No Freeze-Thaw cycle required).
E. TSR for Type S4.75A & B25.0C mixes is 80% minimum.

Division 6 – Asphalt Pavements

- Section 610 – Asphalt Concrete Plant Mix Pavements
  - *Section 610*
    - *Integrated provision SP6 R65 Asphalt Concrete Plant Mix Pavement.*

TABLE 610-5
BINDER GRADE REQUIREMENTS (BASED ON RBR%)

Mix Type	%RBR ≤ 20%	21% ≤ %RBR ≤ 30%	%RBR ≥ 30%
S4.75A, S9.5B, S9.5C, I19.0C, B25.0C	PG 64-22	PG 64-22[A]	PG 58-28
S9.5D, OGFC	PG 76-22[B]	n/a	n/a

A. If the mix contains any amount of RAS, the virgin binder shall be PG 58-28.
B. Maximum Recycled Binder Replacement (%RBR) is 18% for mixes using PG 76-22 binder.

Division 6 – Asphalt Pavements

- Section 610 – Asphalt Concrete Plant Mix Pavements
  - *Section 610*
    - *Integrated provision SP6 R65 Asphalt Concrete Plant Mix Pavement.*

TABLE 610-6
PLACEMENT TEMPERATURES FOR ASPHALT

Asphalt Concrete Mix Type	Minimum Surface and Air Temperature
B25.0C	35°F
I19.0C	35°F
S4.75A, S9.5B, S9.5C	40°F[A]
S9.5D	50°F

A. For the final layer of surface mixes containing recycled asphalt shingles (RAS), the minimum surface and air temperature shall be 50°F.

Division 6 – Asphalt Pavements

- Section 610 – Asphalt Concrete Plant Mix Pavements
  - *Section 610*
    - *Integrated provision SP6 R65 Asphalt Concrete Plant Mix Pavement.*

610-10 DENSITY REQUIREMENTS

TABLE 610-7
DENSITY REQUIREMENTS

Mix Type	Minimum % G_{mm} (Maximum Specific Gravity)
S4.75A	85.0[A]
S9.5B	90.0
S9.5C, S9.5D, I19.0C, B25.0C	92.0

A. Compaction to the above specified density will be required when the S4.75A mix is applied at a rate of 100 lbs/sy or higher.

Division 6 – Asphalt Pavements

- Section 610 – Asphalt Concrete Plant Mix Pavements
  - *Section 610*
    - *Integrated provision SP6 R65 Asphalt Concrete Plant Mix Pavement.*

610-8 SPREADING AND FINISHING

Apply tack coat in accordance with Section 605.

Mixtures produced simultaneously from different plant sources cannot be intermingled by hauling to the same paver on the roadway unless the mixtures are being produced from the same material sources and same JMF.

As referenced in Section 9.6.3 of the *Asphalt QMS Manual*, use the automatic screed controls on the paver to control the longitudinal profile. Where approved by the Engineer, the Contractor has the option to use either a fixed or mobile string line.

Perform this work in accordance with and using equipment meeting Section 9 of the *Asphalt QMS Manual*.

Use a material transfer vehicle (MTV) when placing all asphalt concrete plant mix pavements which require the use of asphalt binder grade PG 76-22 and for all types of OGFC, unless otherwise approved by the Engineer. Use a MTV for all surface mix regardless of binder grade on Interstate, US routes, NC Routes (primary routes) that have 4 or more lanes and median divided. Where required above, use the MTV when placing all full width travel lanes and collector lanes. Use MTV for all ramps, loops, Y-line that have 4 or more lanes and are median divided, full width acceleration lanes, full width deceleration lanes, and full width turn lanes that are greater than 1,000 feet in length. Use a MTV meeting Section 9.5(E) of the *Asphalt QMS Manual*.

Division 6 – Asphalt Pavements

- Section 610 – Asphalt Concrete Plant Mix Pavements
  - *Article 610-1*
    - Added “NCDOT approved” before WMA additives.
  - *Article 610-9*
    - Added “bridges” to the list where the Engineer may prohibit or restrict vibratory roller.

Division 6 – Asphalt Pavements

- Section 610 – Asphalt Concrete Plant Mix Pavements
  - *Article 610-13(A)*
    - Profile data filter clarification. (Butterworth high-pass filter)
    - Inertial Profiler operator requirements changed to a M&T certification process.
    - Added block and bounce tests prior to each day's data collection and during operation with the presence of the Engineer.
    - Pay Incentive / DE incentive

TABLE 610-8
MRI PRICE ADJUSTMENT PER 0.10-MILE SECTION

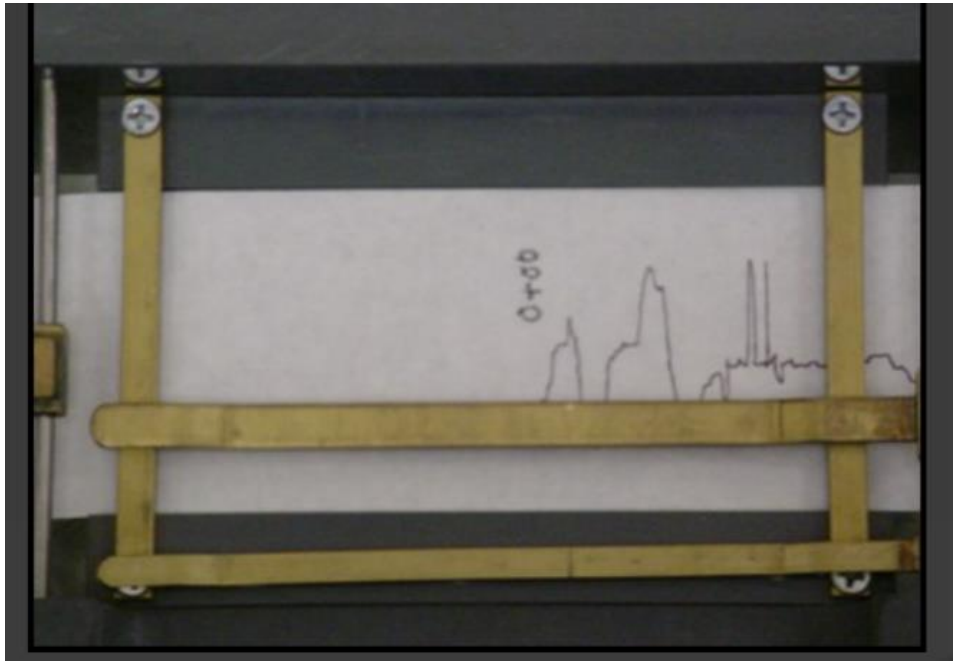
MRI after Completion (Inches Per Mile)	Price Adjustment Per Lane (0.10-Mile Section)
45.0 and Under	$200.00
45.1-55.0	PA = 600 – (10 * MRI)
55.1-70.0	Acceptable (No Pay Adjustment)
70.1-90.0	PA = 650 – (10 * MRI)
Over 90.1	Corrective Action Required

https://connect.ncdot.gov/resources/Materials/Data-Collection-and-Investigations/Pages/default.aspx

State Data Collection & Investigation Engineer | Joseph Barbour, PE | jdbarbour2@ncdot.gov | 919-920-6278

Division 6 – Asphalt Pavements

- Section 610 – Asphalt Concrete Plant Mix Pavements
  - *Article 610-13(B)*
    - Calibration of Hearne Straightedge in accordance with Section 11.1.4 of the Asphalt QMS Manual.
    - CSI determined by the Engineer in accordance with Section 11.1.5 of the Asphalt QMS Manual.
    - Removed references to the previous NC Hearne Straight Edge procurement.



Division 6 – Asphalt Pavements

- Section 650 – Open-Graded Asphalt Friction Course
  - *Article 650-5*
    - *Integrated provision SP6 R63 Open Graded Asphalt Friction Course.*

Apply tack coat in accordance with Section 605 and the following:

(A) Use Asphalt Binder Grade PG 58-28, Grade PG 64-22 tack coat material or an approved non-tracking hot applied (NTHA) asphalt tack coat material.

(B) Uniformly apply the asphalt binder tack coat material at an applied rate of0.06 to 0.08 gal/sy, or as directed by the Engineer.

Spread and finish the friction course as specified in Article 610-8. Roll the friction course as specified in Article 610-9.

Division 6 – Asphalt Pavements

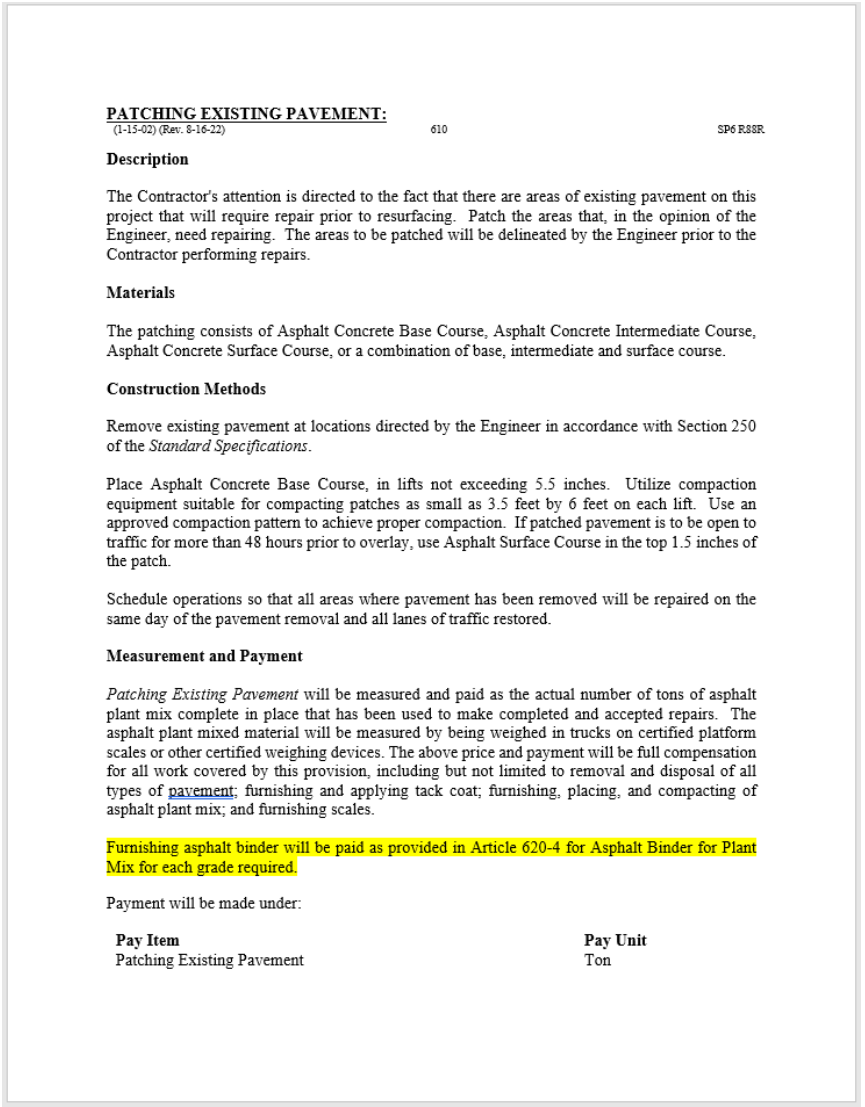
- Section 652 – Permeable Asphalt Drainage Course
  - *Article 652-3(B)*
    - Added Asphalt Binder Grade to Table 652-1.

TABLE 652-1
PERMEABLE ASPHALT DRAINAGE COURSE
GRADATION AND MIX DESIGN CRITERIA

Sieve Size (mm)	Total Percent Passing	
	Type P-78M	Type P-57
37.5	-	100
25.0	-	95 - 100
19.0	100	-
12.5	95 - 100	25 - 60
9.50	75 - 100	-
4.75	20 - 45	10 - 20
2.36	3 - 15	5 - 10
0.075	1.0 - 3.0	1.0 - 3.0
Asphalt Binder Content, %	2.5 - 3.5	2.0 - 3.0
Asphalt Binder Grade	PG 64-22	PG 64-22
Mixing Temperature at Plant	240 - 270°F	260 - 290°F

Division 6 – Asphalt Pavements

- Section 654 – Asphalt Plant Mix, Pavement Repair
  - *Article 654-4*
    - Removed 2nd paragraph and replaced with *'Furnishing asphalt binder will be paid as provided in Article 620-4 for Asphalt Binder for Plant Mix for each grade required.'*
    - This change aligns with provision SP6 R88R, Patching Existing Pavement.



PATCHING EXISTING PAVEMENT:
(1-15-02) (Rev. 8-16-22) 610 SP6 R88R

Description

The Contractor's attention is directed to the fact that there are areas of existing pavement on this project that will require repair prior to resurfacing. Patch the areas that, in the opinion of the Engineer, need repairing. The areas to be patched will be delineated by the Engineer prior to the Contractor performing repairs.

Materials

The patching consists of Asphalt Concrete Base Course, Asphalt Concrete Intermediate Course, Asphalt Concrete Surface Course, or a combination of base, intermediate and surface course.

Construction Methods

Remove existing pavement at locations directed by the Engineer in accordance with Section 250 of the *Standard Specifications*.

Place Asphalt Concrete Base Course, in lifts not exceeding 5.5 inches. Utilize compaction equipment suitable for compacting patches as small as 3.5 feet by 6 feet on each lift. Use an approved compaction pattern to achieve proper compaction. If patched pavement is to be open to traffic for more than 48 hours prior to overlay, use Asphalt Surface Course in the top 1.5 inches of the patch.

Schedule operations so that all areas where pavement has been removed will be repaired on the same day of the pavement removal and all lanes of traffic restored.

Measurement and Payment

Patching Existing Pavement will be measured and paid as the actual number of tons of asphalt plant mix complete in place that has been used to make completed and accepted repairs. The asphalt plant mixed material will be measured by being weighed in trucks on certified platform scales or other certified weighing devices. The above price and payment will be full compensation for all work covered by this provision, including but not limited to removal and disposal of all types of pavement; furnishing and applying tack coat; furnishing, placing, and compacting of asphalt plant mix; and furnishing scales.

Furnishing asphalt binder will be paid as provided in Article 620-4 for Asphalt Binder for Plant Mix for each grade required.

Payment will be made under:

Pay Item	Pay Unit
Patching Existing Pavement	Ton

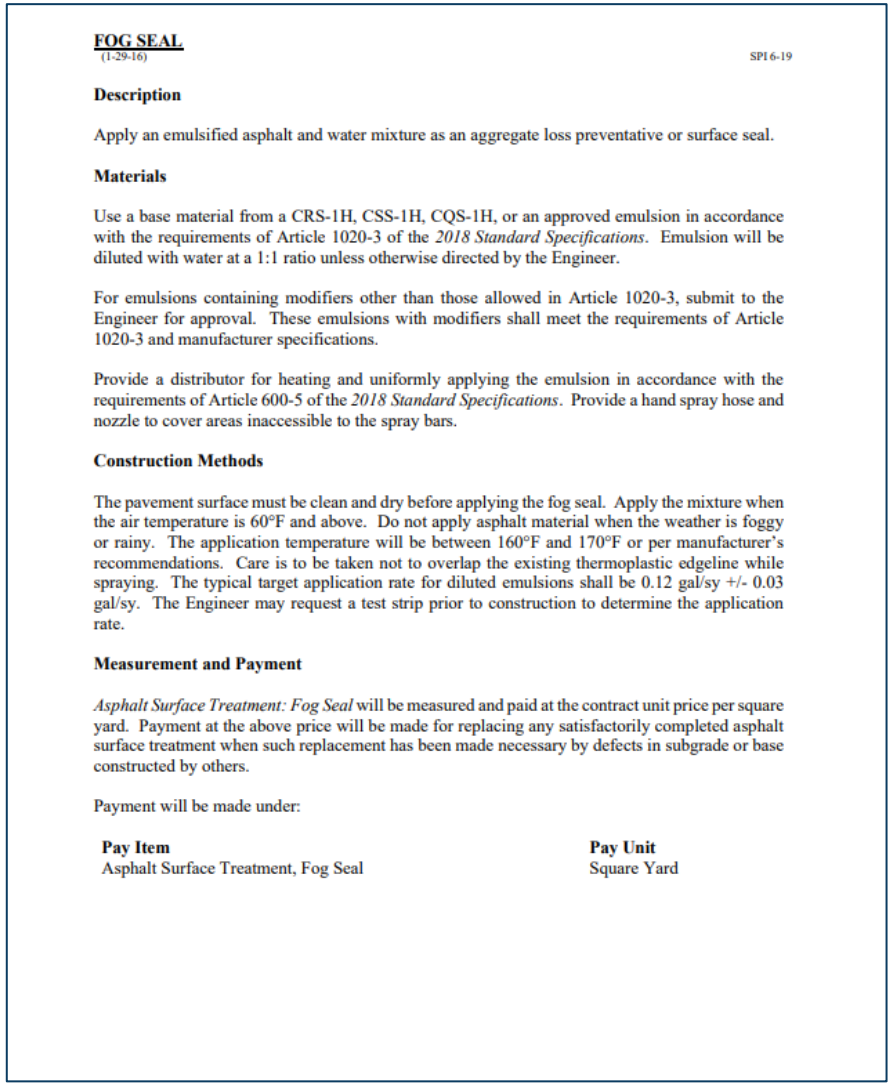
Division 6 – Asphalt Pavements

- Section 660 – Asphalt Surface Treatment

  - *Article 660-3*
    - Minimum surface and air temperatures changed to 55°F and rising. (previously 50°F)
  - *Article 660-8*
    - Increasing the minimum foot test section requirement to 500ft and added when to perform calibration and construction of the test strip.
  - *Article 660-8(A)* –
    - Place blotting sand in accordance with Section 818 when traffic is permitted on sections of the work in which the emulsion has not finished breaking. Aggregate is not an acceptable cover material on an AST Seal Coat.
    - Water spray bars on the rollers may be required
    - Smooth tread requirement when pneumatic tire rollers are used
    - Contractor is required to supply at no cost to the Department a suitable material if bleeding occurs on a completed section.
    - Emulsion and/or aggregate applications greater than 6 inches onto the shoulder will not be allowed. Contractor will be required to remove this material and replace vegetation if required at no cost to the Department.

Division 6 – Asphalt Pavements

- Section 660 – Asphalt Surface Treatment
  - *Article 660-8(C)*
    - Additional directives prior to traffic being allowed on the mat coat.
  - *Article 660-8(D)*
    - Application of the plant mix material should be placed after mat is seated or by the end of the day. No brooming shall be performed on the mat. No traffic shall be allowed on the mat until a second smaller emulsion and aggregate layer is applied or the plant mix material is applied.
    - Plant mix thickness on overlays shall be at least 1.5 inches.
  - *Article 660-8(E) & 660-12 –*
    - *Integrated provision SPI 6-19 Fog Seal.*



FOG SEAL
(1-29-16) SPI 6-19

Description

Apply an emulsified asphalt and water mixture as an aggregate loss preventative or surface seal.

Materials

Use a base material from a CRS-1H, CSS-1H, CQS-1H, or an approved emulsion in accordance with the requirements of Article 1020-3 of the *2018 Standard Specifications*. Emulsion will be diluted with water at a 1:1 ratio unless otherwise directed by the Engineer.

For emulsions containing modifiers other than those allowed in Article 1020-3, submit to the Engineer for approval. These emulsions with modifiers shall meet the requirements of Article 1020-3 and manufacturer specifications.

Provide a distributor for heating and uniformly applying the emulsion in accordance with the requirements of Article 600-5 of the *2018 Standard Specifications*. Provide a hand spray hose and nozzle to cover areas inaccessible to the spray bars.

Construction Methods

The pavement surface must be clean and dry before applying the fog seal. Apply the mixture when the air temperature is 60°F and above. Do not apply asphalt material when the weather is foggy or rainy. The application temperature will be between 160°F and 170°F or per manufacturer's recommendations. Care is to be taken not to overlap the existing thermoplastic edgeline while spraying. The typical target application rate for diluted emulsions shall be 0.12 gal/sy +/- 0.03 gal/sy. The Engineer may request a test strip prior to construction to determine the application rate.

Measurement and Payment

Asphalt Surface Treatment: Fog Seal will be measured and paid at the contract unit price per square yard. Payment at the above price will be made for replacing any satisfactorily completed asphalt surface treatment when such replacement has been made necessary by defects in subgrade or base constructed by others.

Payment will be made under:

Pay Item	Pay Unit
Asphalt Surface Treatment, Fog Seal	Square Yard

Division 6 – Asphalt Pavements

- Section 661 – Ultra-Thin Bonded Wearing Course
  - *Article 661-4 - Integrated provision SP6 R64 Ultra-Thin Bonded Wearing Course.*

(A) Equipment

(5) Use pavers equipped with an electronic screed control that will automatically control the longitudinal profile and cross slope of the pavement. Control the longitudinal profile through the use of either a mobile grade reference(s), including mechanical, sonic and laser grade sensing and averaging devices, an erected string line(s) when specified, joint matching shoe(s), slope control devices or the approved methods or combination of methods. Unless otherwise specified, use a mobile grade reference system capable of averaging the existing grade or pavement profile over at least a 30 feet distance, or by non-contacting laser or sonar type ski with at least three referencing stations mounted on the paver at a minimum length of 24 feet. Establish the position of the reference system such that the average profile grade is established at the approximate midpoint of the system. The transverse cross slope shall be controlled as directed by the Engineer.

Use an erected fixed stringline for both and longitudinal profile and cross slope control when required by the contract. When an erected fixed string line is required, furnish and erect the necessary guide line for the equipment. Support the stringline with grade stakes placed at maximum intervals of 25 feet for the finished pavement grade.

Use the 30 feet minimum length mobile grade reference system or the non-contacting laser or sonar type ski with at least three referencing stations mounted on the paver at a minimum length of 24 feet to control the longitudinal profile when placing the initial lanes and all adjacent lanes of all layers, including resurfacing and asphalt in-lays, unless otherwise specified or approved by the Engineer. A joint matching device (short 6 inch shoes) may be used only when approved by the Engineer.

Topics

- Staff Update
  - Materials and Tests Unit
  - Central Construction Unit
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- 2024 NCDOT Standard Specifications for Roads and Structures
  - Division 6 – Asphalt Pavements
  - Division 10 – Materials
- Best Paving Practices
- Questions / Discussion

Division 10 – Materials

- Section 1012 – Aggregate for Asphalt Pavements and Surface Treatments

  - *Article 1012 (F)*
    - Reclaimed Asphalt Pavement (RAP) Classification Clarifications
      - Millings (1.5”)
      - Processed RAP (1.0”)
      - Fractionated RAP (5/8”)

  - *Article 1012-5*
    - RAP Management During Production

(F) Reclaimed Asphalt Pavement (RAP)

(1) ~~Mix Design~~ RAP Classifications

During production, incorporate RAP from stockpiles or other sources tested for uniformity of gradation and binder content before use in an asphalt mix. ~~design.~~ Ensure that no deleterious material is allowed in any stockpile. When multiple stockpiles of recycled material are used during production, erect and maintain signs satisfactory to the Engineer properly identifying each stockpile. Use RAP that meets all requirements specified for the following classifications.

(a) Millings

Existing RAP that is removed from its original location by a milling process as specified in Section 607. Millings shall have ~~should be such that it has~~ a uniform gradation and binder content and all materials must ~~will~~ pass a 1-1/2 inch ~~2 inch~~ sieve before introduction into the plant mixer unit.

(b) Processed RAP

RAP that is processed ~~in some manner (possibly~~ by crushing, screening, and/or blending ~~use of a blending method)~~ to produce a uniform gradation and binder content. ~~in the RAP before use in a recycled mix.~~ Processed RAP ~~so all materials~~ shall have a uniform gradation and binder content and will pass a 1-inch sieve before introduction into the plant mixer unit.

(c) Fractionated RAP

RAP that is processed by crushing, screening, and/or blending into one ~~Fractionated RAP is defined as having 2~~ or two ~~more~~ ~~RAP~~ stockpiles. When only one fractionated RAP stockpile is used, the stockpile shall only contain material passing the 5/8-inch sieve. If a second coarse fraction is used, the coarse stockpile shall only contain material passing the 1-inch sieve and retained on the 5/8-inch sieve. ~~where the RAP is divided into coarse and fine fractions. Grade RAP so all materials will pass a 1 inch sieve. The coarse RAP stockpile shall only contain material retained on a 3/8 inch screen, unless otherwise approved. The fine RAP stockpile shall only contain material passing the 3/8 inch screen, unless otherwise approved.~~ The Engineer may allow the Contractor to use an alternate ~~to the 3/8 inch~~ screen to fractionate the RAP. The maximum percentages of fractionated RAP may be comprised of coarse, fine, or the combination of both. Use a separate cold feed bin for each stockpile of fractionated RAP introduced into the ~~mix~~ plant mixer unit.

(2) ~~Mix Production~~ RAP Management During Production

~~During mix production, use RAP that meets the criteria for one of the following categories:~~

~~(a) Mix Design RAP~~

~~RAP contained in the mix design stockpiles as described above may be used in all applicable JMFs. These stockpiles have been pretested; however, they are subject to required QC/QA testing in accordance with the *HMA/QMS Manual*.~~

~~(b) New Source RAP~~

~~Define~~ New source RAP is ~~as~~ any acceptable material that was not included in the stockpile or other source when samples were taken for mix design purposes. ~~Process new source RAP so all materials have a uniform gradation and binder content and will pass a 2 inch sieve before introduction into the plant mixer unit.~~

After a stockpile of millings, processed RAP, or fractionated RAP has been sampled and mix designs made from those samples, do not add new source RAP to the original stockpile without prior field testing to ensure gradation and binder uniformity. Sample and test new source RAP to ensure it meets one of the RAP Classifications in Subsection 1012-1(F)(1) before blending with the existing stockpile.

Store new source RAP in a separate stockpile until the material can be sampled and tested for comparison with the original recycled mix design data. New source RAP may also be placed against the existing stockpile in a linear manner provided it is sampled for mix design conformity before its use in the recycled mix.

Unprocessed RAP is asphalt material that was not milled and/or has not been processed to obtain a uniform gradation and binder content and is not representative of the RAP used during the applicable mix design. Unprocessed RAP shall not be incorporated into any JMFs before processing. Different sources of unprocessed RAP may be stockpiled together provided it is generally free of contamination and will be processed before use in a recycled mix. RAP contamination in the form of excessive dirt, debris, clean stone, concrete, etc. will not be allowed. Incidental amounts of dirt, concrete and clean stone may be acceptable. Unprocessed RAP may be processed and then classified as a new source RAP as described above.

Field approval of new source RAP will be based on Table 1012-3~~4~~ and volumetric mix properties in ~~on~~ the mix with the new source RAP included. Provided the Table 1012-3~~4~~ tolerances are met, volumetric properties of the new mix will then be performed. If all volumetric mix properties meet the mix design criteria for that mix type, the new source

Division 10 – Materials

- Section 1020 – Asphalt Materials and Additives
  - *Article 1020-3*
    - Emulsion subject to upcoming bituminous specialty products program.

1020-3 ASPHALT EMULSION

Use asphalt emulsion that meets the requirements in the Department's *Asphalt Emulsion QC/QA Program*. The program includes requirements for latex modified, polymer modified, and non-tracking tack emulsified asphalt products and producers. New emulsified asphalt products will need to go through the new products approval process.

Submit a QC Plan for asphalt emulsion that meets the Department's *Asphalt Emulsion QC/QA Program* to the Materials and Tests Unit.

  - *Article 1020-5*
    - Supply prime coat materials from pre-approved sources that are on the NCDOT APL

Topics

- Staff Update
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- 2024 NCDOT Standard Specifications for Roads and Structures
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  - Division 10 – Materials
- Best Paving Practices
- Questions / Discussion

Best Practices for Successful Paving Season

Tack Coat

- **Is Important Why?**
  - Tack coat is an integral part of the pavement structure.
  - Prevents slippage between layers of pavement.
  - Promotes bond between layers of pavement.
  - This bond ensures all layers work together. (Structural Performance)

NOT UNIFORM COVERAGE = QUESTIONABLE BOND

UNIFORM COVERAGE = GOOD BOND

Tack Coat cont.

- **Tack Coat Best Practices**
  - **Existing pavement surface must be CLEAN and DRY.**
  - **Proper RATE of application (Table 605-1)**
    - Table 605-1 can be found in Section 605 of the Standard Specifications, Asphalt QMS Manual, and the Tack Coat Best Practices Field Guide.
  - **UNIFORM coverage over the entire area to be paved.**
  - **Allow the tack to thoroughly BREAK and SET before paving or allowing haul trucks on the tack.**
    - Color Change **BROWN > BLACK**
    - Rice Krispy Test (Snap, Crackle, and Pop)
    - Heel Test

TACK COAT APPLICATION RATES

Application rates shall be based on the following chart for the existing surfaces on which tack coat is applied:

Existing Surface	Target Rate (gal/sy)
New asphalt	**0.04** (+/- 0.01)
Oxidized or Milled	**0.06** (+/- 0.01)
Concrete	**0.08** (+/- 0.01)

NOTES: The plus or minus 0.01 in the rate is provided for equipment variability.

Target rate of 0.06 for oxidized surface is to be used for any re-surfacing projects.

https://connect.ncdot.gov/projects/construction/Construction%20Documents/Tack%20Coat%20Best%20Practices%20Field%20Guide%202012.pdf

Tack Coat cont.

- LET'S BE HONEST, this is not close to acceptable.

- NOT UNIFORM coverage over the entire area to be paved.
- UNIFORM coverage over the entire area to be paved.

Joint Construction

- **Longitudinal Joints**
  - They are a weak point in the pavement and tend to show signs of deterioration the earliest.
  - Historically lower density due to unconfined edge on one side.
  - Point of entry for water.
  - Excessive hand work can lead to segregation and raveling.
- **Transverse Joints (starting and stopping is the hardest part)**
  - Weak point in the pavement.
  - Point of entry for water.
  - Can negatively impact ride quality.
  - Hand work can lead to segregation and raveling.
  - The GOAL is to have a smooth transverse joint with no mat defects from the start.

Longitudinal Joints

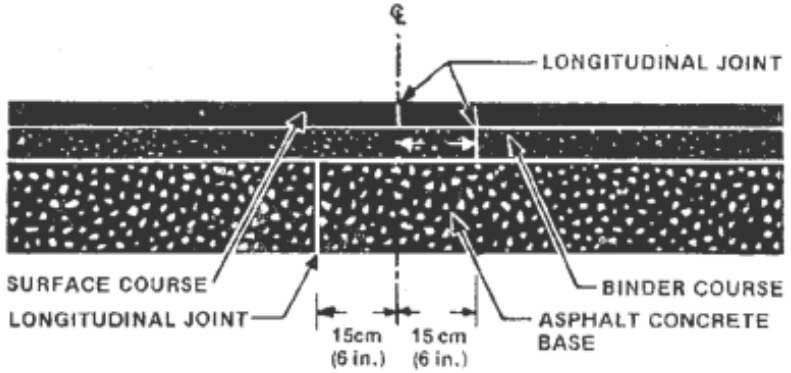
- **Longitudinal Joint Construction Best Practices (what we can do to help)**
  - **Properly TACK the joint.**
    - Creates the bond
    - Seals the joint
  - **Construct straight joints (good alignment)**
    - Appearance
    - Better Compaction
    - Pavement Markings (don't want them on the joint)
    - Less hand work along the joint

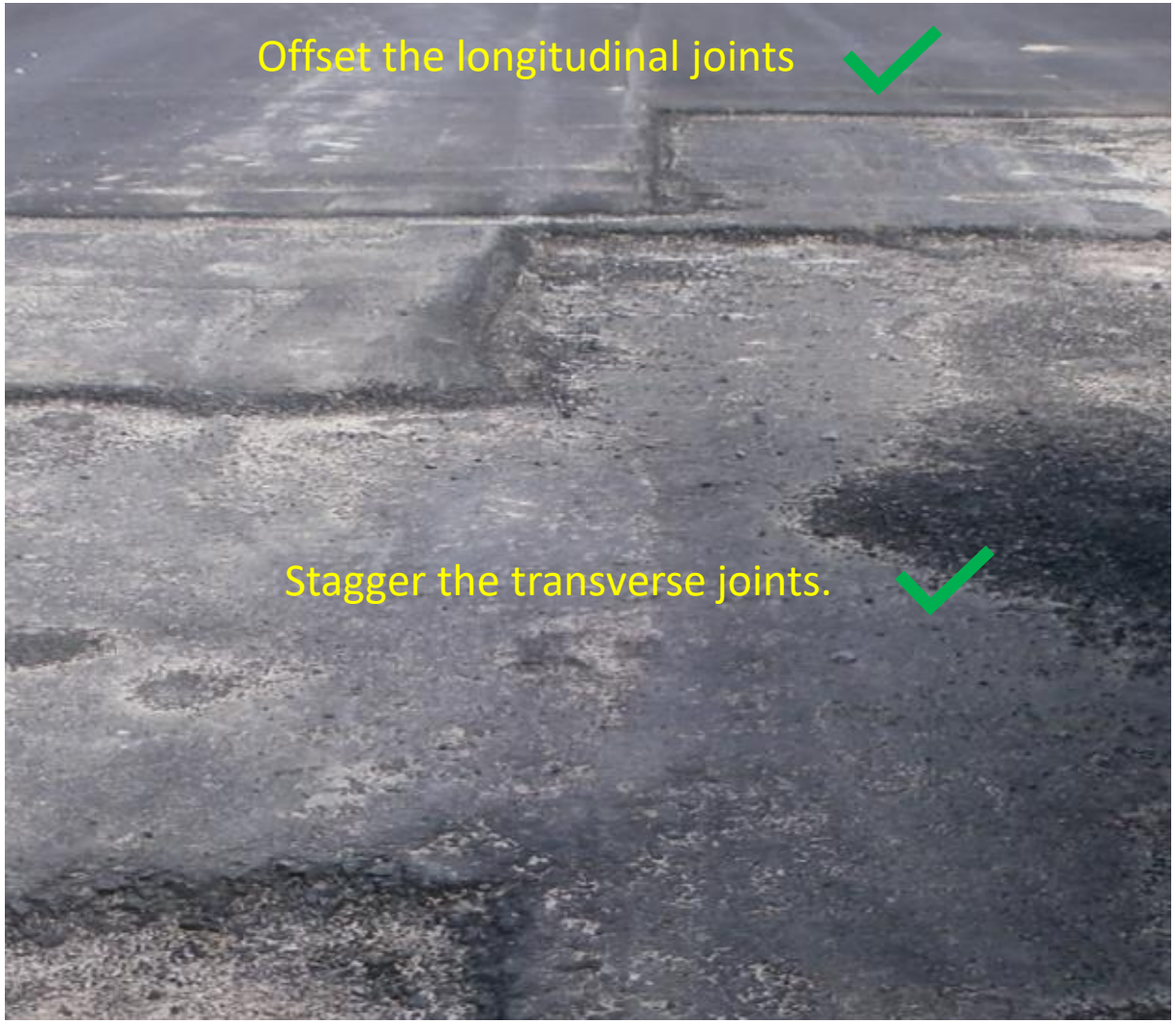
Good Straight Edge

Longitudinal Joints cont.

- **Offset from the layer below.**
  - Stronger
  - Eliminates a “shear plane”
  - Helps prevent water entry
  - Requires planning
    - Consider final traffic pattern
    - Pavement markings

Figure 9-22
Overlapping of Successive Courses To Prevent A Crack From Opening Along a Longitudinal Joint





Transverse Joints

- **Transverse Joint Construction Best Practices (what we can do to help)**
  - **Construct to a vertical edge.**
    - Better compaction
    - Consistent rolldown
  - **Properly TACK the joint.**
    - Creates the bond
    - Seals the joint

Poor starting point, not consistent depth at joint

Good Vertical Edge = consistent depth

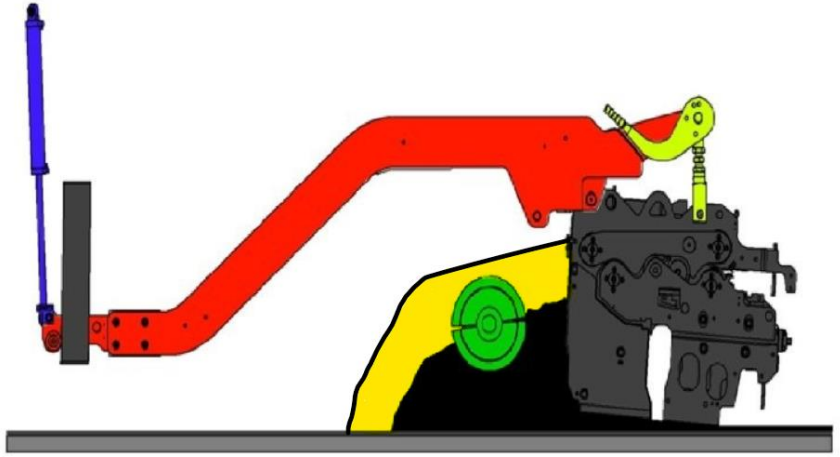
Transverse Joints cont.

- **Use Starting Blocks**
  - Establishes correct pre-compaction thickness at the joint.
  - Reduces hand work at the joint.
  - Rule of thumb: Allow for ¼” of compaction for each 1” in compacted thickness.

Transverse Joints cont.

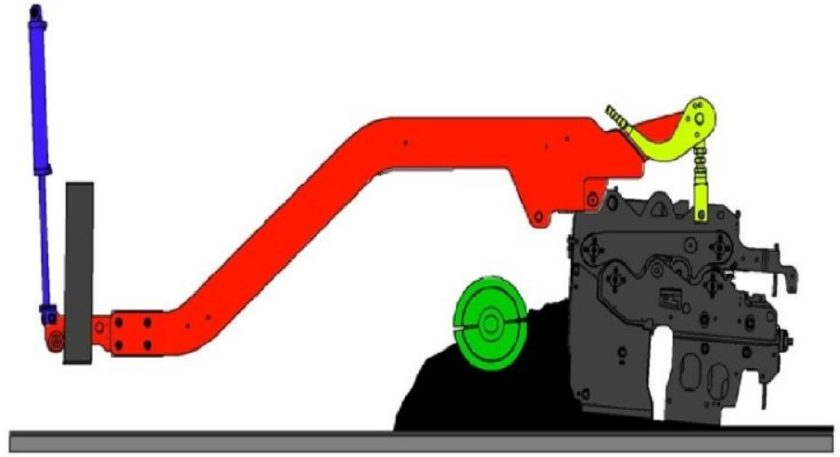
- **Proper Material Control**
  - Maintain the correct head of material.
  - Consistency is important!
    - Screeds operate primarily on resistance.
    - If the amount of material in front of the screed changes, the screed elevation will change.

More Material



Screed Rises

Less Material



Screed Lowers

  - This can have a big impact when getting started.
    - Typically, the material feed control is done manually when starting.
    - If the head of material is not kept consistent, it makes it much more difficult to achieve a good ride in the first 10'-50'. After automatic feed (and grade) controls are engaged, it becomes less of an issue.

Transverse Joints cont.

- **Check joint while it can still be adjusted.**
  - Use 10’ straight edge to check the joint while the mix is still HOT!
  - Check during initial rolling.
  - Adjustments can still be made if the mix is workable.
  - Specifications require testing of all transverse joints. Article 610-12

Continuous Laydown

- **Continuous Laydown Operation**
  - Strikes a balance between paver speed, production rate, and delivery rate.
  - The primary objective is to operate the paver as continuously as possible at a rate that results in properly placed mix.
  - In my experience, the controlling factor is typically production or delivery rate, not laydown.
    - If the paver cannot properly place the mixture at a rate equal to production and delivery rate, the production/delivery rate will need to be slowed, or other corrective measures taken.
    - More commonly, paver speed is allowed to exceed the delivery rate causing the paver to stop frequently and for extended periods of time. This can be corrected simply by reducing the paver speed.

Continuous Laydown cont.

- There is no advantage in the paver traveling at a speed that allows the mix to be placed faster than the mix can be delivered.

- There are multiple disadvantages:
  - When the paver stops, the material in the paver cools. Longer duration stops or cooler weather makes the situation worse.

  - Smoothness and surface texture can suffer.
    - Cooler mix in paver = more resistance = screed rises
    - Hotter mix from truck = less resistance = screed falls

    - Automatic grade controls can make this situation worse. As the screed climbs on the cooler mix, the grade control adjusts to correct the screed. When the warmer mix reaches the screed, the fall of the screed is compounded by the grade control's adjustments and the hotter mix. This can lead to a high spot followed by a low spot, before everything levels out.

    - The surface texture of the cooler mix is usually a more open texture.

Continuous Laydown cont.

- Density can also suffer.
  - Many factors impact asphalt density, and temperature is a major component.
  - The areas of cooler mix created by a stopped paver typically have lower density.
  - The goal is to have uniform density that meets or exceeds the minimum requirement for the mix type.
  - None of us want inconsistent density.
    - Longevity of the pavement is compromised.
    - Random sample locations may not provide truly representative results.

JUST KEEP MOVING FORWARD

Continuous Laydown cont.

WHAT SPEED SHOULD THE PAVER GO?

- There is an app for that.
- Slower than you might guess.

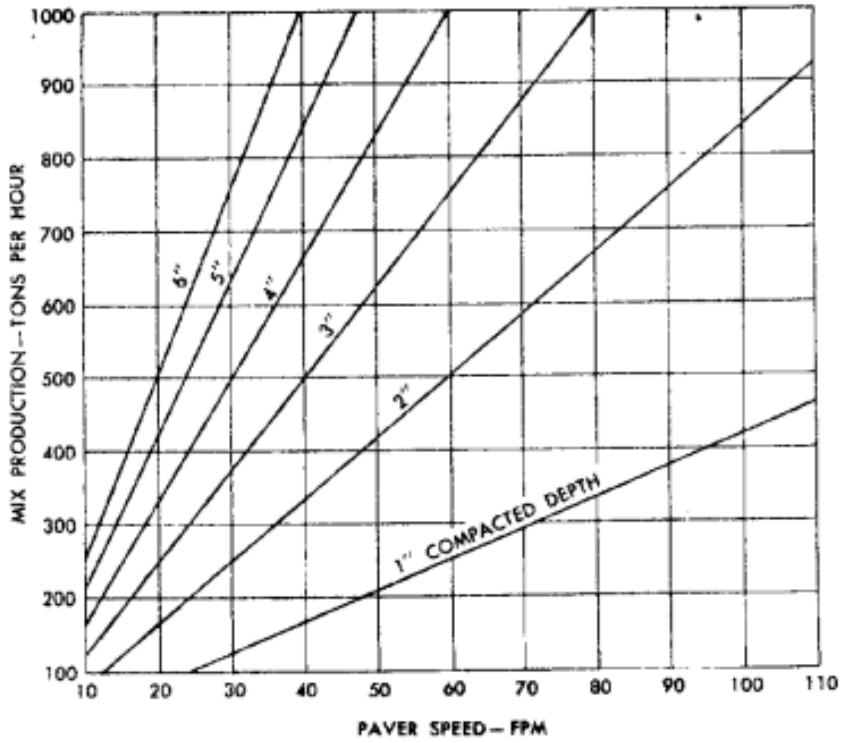
Using the basic chart from the QMS Manual

100 Tons per hour @ 1.5” = roughly 18 ft per minute

200 Tons per hour @ 1.5” = roughly 35 ft per minute*

*At 35 ft per minute, it should take approximately 5 minutes to unload a 20-ton load at 12’ wide.

Figure 9-5
Paving Machine Speeds Required to Handle Plant Production



NOTE: Paver speed based on spread 12-ft. wide and a compacted density of 140 lb. per cu. ft.

Uniform, continuous operation and forward speed of the paver produces the highest quality pavement. A smooth pavement with uniform density and surface texture is the ultimate goal.

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Questions

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