Recommendations & Barriers to Uniform New England Quality Assurance of Asphalt Pavement Projects (NETC QR 15-4)

Kacie Ferraro[1], Dr. Jo Sias Daniel[2], Dr. Eshan Dave[2]

[1]Rye Junior High School, Rye, NH; [2]University of New Hampshire Department of Civil & Environmental Engineering

Abstract

A Quality Assurance (QA) system is a practice used to maintain the desired level of quality throughout every stage of the process of production. The goal of project NETC QR 15-4 is to provide suggestions and identify barriers to unifying the Quality Assurance (QA) procedures for asphalt concrete pavement projects in the six New England states. There are already many commonalities amongst existing New England QA practices, which indicates that a uniform specification is possible. However, many differences exist as well as barriers to change. These challenges will need to be identified and discussed by both DOT representatives and contractors to develop effective recommendations for best practices in the industry of asphalt pavement construction.

Introduction/Background

In the paving industry, QA is used throughout manufacturing and construction to ensure durable, safe, and economical roads. It coordinates the efforts of the:

- Federal highway Administration (FHWA),
- Agencies (state Departments of Transportation),
- Producers (materials manufacturers),
- Construction contractors,
- Consultants, and more.

Quality Assurance is executed in three primary stages:

- *Quality/Process Control-* Contractors test materials & newly constructed product to monitor project during construction to meet specified quality parameters
- *Independent Assurance-* Third party consultants test to periodically verify contractor and/or agency test results
- *Acceptance-*The agency tests the final product for conformity to specified quality parameters and to evaluate contractor pay factors related to construction. The project will either be accepted or rejected (and mandatorily replaced).

A uniform QA practice across New England would:

- simplify the region's collaborative Northeast Transportation Technician Certification Program (NETTCP),
- allow QA resources to be shared across state borders,
- and streamline operational requirements for producers and construction contractors.

Methods

The NETC QR 15-4 project is structured to consist of 7 tasks. This poster summarizes the results of the first two tasks.

Task 1 (State of the Practice/Literature Review) Methods:

- Review of current state of practice using published standard & provisional specifications
- Initial Survey of agencies using Qualtrics, including minimum quality specifications for each QA stage
- Interview of each New England DOT representative to clarify aspects of published specifications, responses from survey, and details as compared to other states

Task 2 (Kick-Off Meeting) Methods:

- Regional Kick-Off presentation & discussion of initial data analysis and comparisons of current QA practice regionally with Project TAC team, Administrative Coordinator, and representatives from each N.E. DOT

Results

Volumetric Binder & Quality Control Attributes Testing Itemized by QA Phase per State

Contractor QC Tests

Attribute	CT	MA	ME	NH	RI	VT
Aggregate Gradation	✓	✓	✓	✓		✓
Air Voids	✓	✓	✓	✓		✓
Binder Content	✓	✓	✓	✓		✓
Mix Temperature	✓	✓	✓	✓		✓
Aggregate Angularity	✓	✓	✓			✓
In-place Density for Mat	✓	✓	✓	✓		
Maximum Theoretical Specific Gravity	✓	✓	✓	✓		
Voids in Mineral Aggregates (VMA)	✓	✓	✓			✓
Cross Slope		✓	✓	✓		
In-place Density at Joint	✓	✓	✓			
Pavement Thickness		✓	✓	✓		
Voids Filled with Asphalt (VFA)	✓	✓	✓			
Ride Smoothness		✓	✓			
Surface Temperature		✓	✓			

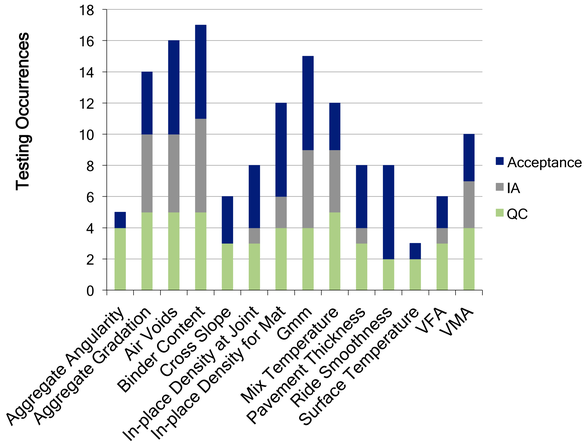
IA Tests

Attribute	CT	MA	ME	NH	RI	VT
Binder Content	✓	✓	✓	✓	✓	✓
Aggregate Gradation		✓	✓	✓	✓	✓
Air Voids	✓	✓	✓		✓	✓
Maximum Theoretical Specific Gravity	✓	✓	✓		✓	✓
Mix Temperature	✓	✓			✓	✓
Voids in Mineral Aggregates (VMA)	✓		✓			✓
In-place Density for Mat		✓			✓	
In-place Density at Joint					✓	
Pavement Thickness		✓				
Voids Filled with Asphalt (VFA)			✓			
Aggregate Angularity						
Cross Slope						
Ride Smoothness						
Surface Temperature						

Agency Acceptance Tests

Attribute	CT	MA	ME*	NH	RI	VT
Air Voids	✓	✓	✓	✓	✓	✓
Binder Content	✓	✓	✓	✓	✓	✓
In-place Density for Mat	✓	✓	✓	✓	✓	✓
Maximum Theoretical Specific Gravity	✓	✓	✓	✓	✓	✓
Ride Smoothness	✓	✓	✓	✓	✓	✓
Aggregate Gradation			✓	✓	✓	✓
In-place Density at Joint	✓		✓		✓	✓
Pavement Thickness	✓	✓		✓	✓	
Cross Slope	✓			✓		✓
Mix Temperature	✓				✓	✓
Voids in Mineral Aggregates (VMA)	✓		✓			✓
Voids Filled with Asphalt (VFA)	✓		✓			
Aggregate Angularity					✓	
Surface Temperature					✓	

Volumetric Binder & Quality Control Attributes Testing Summary



Observations from Attributes Testing Itemization & Summary:

- Some attributes (*Binder Content, Air Voids, Gmm, Aggregate Gradation*) are tested at every stage of the QA process and/or by most states. This consensus makes them not an area of focus.
- Some attributes are tested less often or by only one or few states (*Surface Temperature, Aggregate Angularity, Cross Slope*), which creates an opportunity for internal and interstate discussion about the rationale behind the test and if it is essential to quality assurance.
- Some states require significantly more testing specifically during QC than others (MA & ME vs. RI). This potential barrier to change is an essential topic of discussion amongst not only the states, but the contractors that have been selected to participate in this project.
- Some states require significantly more or less testing, overall. Fiscal and personnel-based concerns must be considered as discussion continues.
- Some state agencies conduct validation testing during QC, others witness QC testing and some conduct no validation prior to acceptance. One of the most significant differences in current QA practice, this is an essential topic of further discussion.

Potential Barriers to Change

Feasibility Concerns	**Operational**	Capacity of facility for increased testing & specs Significant geographic differences between states Industry understanding of process control
	Procedural	Optimal specifications, procedures, & documentation "Proof of process" that change = improvement
	Personnel	Personnel reassigned/added for changed needs Qualified applicants in the industry
Working Relationships	**Contractors**	Feasibility of and resistance to change in practice Push back to increased DOT presence in QC plant Response to changes in pay factors
	Internal Stakeholders	Fiscal considerations Political obstacles

Discussion

What agencies want to keep:

- Sampling of cores for in-place density testing
- Volumetric design process determines job mix formula
- Gradation and AC content used to control production
- Random sampling & statistical acceptance
- Minimum QC testing & QC plan requirements (VT)
- Dispute resolution & IA program (ME)
- Certification requirements for agency & QC staff and laboratory quality & accreditation system (ME)

Where agencies want to improve:

- Sample at paver instead of hauling unit (CT)
- Sample behind the paver instead of at the plant to evaluate in-situation characteristics (VT)
- Performance testing (VT)
  - Hamburg & SCB/IFIT testing with pay factors
- Frequency of acceptance testing binder (MA)
  - Especially related to failure of large intervals
- Greater presence at contractor plan facilities as well as improved QC/production requirements (ME)
  - More frequent plant inspections
  - improved PC by material producers

Topics for Continued Discussion

- Quality/Process Control testing differences
- Acceptance testing differences
- Validation and IA testing differences
- Pay Factors
- Industry Qualifications

Conclusion/Summary

NETC QR 15-4 is still in its early stages and Tasks 1 & 2 have already highlighted some initial conclusions:

Best Practices:

- Sample mix design & roadway cores
- Volumetric design for job mix formula
- Random sampling & statistical acceptance

Priority Attributes to Test:

- Binder Content *(94% tested)*
- Air Voids *(89% tested)*
- Maximum Theoretical Specific Gravity *(83% tested)*
- Aggregate Gradation *(78% tested)*

These tasks have also revealed some preliminary potential barriers to developing uniform New England QA specifications, which will guide focus and discussion in the remaining tasks.

Next Steps:

- Summary of Kick-Off meeting and initial data to DOTs for internal discussion
- Further literature review: other regional or national specification trends
- Review Pay Factors
- Select & begin to interview contractors
- Investigate required certifications & staffing structure
- Further investigation of cross-border challenges

Acknowledgements

This research was supported with funding from the National Science Foundation's Research Experience for Teachers in Engineering Grant (ENG-1711781).