

# Project Update

#### ACPTP 2022-4

### Quality Control and Quality Acceptance of Concrete Airport Pavement

January 12, 2023



### Tara Cavalline, PhD, PE UNIV. NORTH CAROLINA CHARLOTTE



### Tom Van Dam, PhD, PE Jeff Stempiphar, PhD, PE NICHOLS CONSULTING ENGINEERS

### Gerald Voigt, PE SQUARE ONE PAVEMENT CONSULTING





#### Jim Lafrenz, PE TIGERBRAIN ENGINEERING

Doug Johnson, PE CONSULTANT (Fmr. FAA Engineer)



Mike Boyle HI-WAY PAVING

### Well-Rounded Team Experience

	Tech	nical Kn Exper	owledge ience	and	Qu Develo	ality Ass Specifi pment/I	Technology Transfer				
Research Team Members	Planning / Operations / Owner Considerations	Concrete Pavement Design	Concrete Pavement Construction	Quality Systems Approaches	Quality Assurance Programs and Plans	Quality Control Plans and Implementation	FAA Circular Review / Recommendations	UFGS Specifications Review / Recommendations	Guidance Document Development	Technology Transfer and Training	
Tara Cavalline – UNC Charlotte		Х	Х	Х	Х	Х			Х	Х	
Jerry Voigt – SQ1		Х	Х	Х	X	Х	Х	Х	Х	X	
Tom Van Dam - NCE	Х	Х	Х	Х	X	Х	Х		Х	X	
Jeff Stempihar - NCE	Х	Х	Х	Х	X	Х	Х		Х	Х	
Jim Lafrenz - Tigerbrain		Х	Х	Х	Х	Х	Х	Х	Х	Х	
Michael Boyle – Hi-Way			Х			Х					
Doug Johnson – Fmr. FAA	Х	Х	Х	Х	Х	X	Х	Х			

### Gaining Additional Perspectives SMArT (Subject Matter Advisory Team)

Туре	Company	Location	Panel Member	Title
Contractor	ACME Paving	Spokane, WA	Bryan White	
Contractor	AJAX Paving Industries	Troy, MI	Pete Mann	Senior Project Manager
Contractor	Boh Brothers	New Orleans, LA	Tim Lewellen	Group Mgr Airfield Paving
Contractor	Golden Triangle Construction Co., Inc.	Imperial, PA	Chuck Niederriter	СОО
Contractor	Plote Construction, Inc.	Hoffman Estates, IL	Casey Kozak	Concrete QC Manager
Association	Southwest Concrete Pavement Assn.	Seal Beach, CA	Charles Stewart	Executive Director
Engineering Firm	C&S Companies	Phoenix, AZ	Lance McIntosh, PE	Aviation Svc. Group Mgr
Engineering Firm	Michael Baker	Norcross, GA	Quintin Watkins, PE	Vice President
Engineering Firm	Talbert, Bright & Ellington	Charlotte, NC	Andy Shook, PE	Project Manager
Engineering Firm	TTL Associates, Inc.	Plymouth, MI	Jeffrey Elliott, PE	Vice President
Airport/Owner	Charlotte-Douglas Intl. Airport (CLT)	Charlotte, NC	Ashton Watson, PE	Airport Engineer

Additional SME's have been invited to participate.

We are in process of scheduling interviews, pending their time and availability.

### **Team Organizational Structure**



### Our Overall Philosophy...

Quality construction requires that knowledgeable people follow a robust quality system.

2

Construction is a manufacturing process performed under unique project conditions. Process control is central to QC.



Good process control requires a clear understanding of technical fundamentals and the project requirements. The guidance we develop as part of this work will clarify use of quality systems for all stakeholders.

It will help contractors to:

- Implement QC essentials
- Use data to drive their process improvements where it makes sense, and
- Proactively inform their process control decisions

### Our Project Approach



**QC Best Practice Manual** 

Model QC Plan

2

3

Training Course (Modules)

Each of these three objectives is considered essential to achieve a successful project outcome for FAA and the Military Tri-Services

#### **QC Best Practice Manual**

Model QC Plan

2

3

#### Training Course (Modules)

The **best practices manual** will provide comprehensive guidance to all stakeholders on the QC and QA process.

()1

The manual will distinguish between QC and QA roles, responsibilities, activities, and authorities, ensuring all parties are operating on the same page during each stage of the concrete paving process.

### **Current Vision of QC Manual**

CH 1	Introduction	<ul> <li>Goal of quality systems for concrete airport pavements - terminology and definitions</li> <li>Overview of QA and the role of QC within the QA system</li> <li>Acceptance, independent assurance, and dispute resolution</li> </ul>
СН 2	Quality Assurance Essentials	<ul> <li>Role of owner/operator, role of QA personnel</li> <li>QA specifications, quality parameters/tests, approaches and best practices</li> <li>Activities and meeting s and before each phase of work (subgrade, subbase, base, pavement)</li> </ul>
СН 3	Tools for Quality Acceptance	<ul> <li>Recordkeeping, forms, check sheets, spreadsheets</li> <li>Statistical approaches with tutorial</li> <li>Analysis of risk allocation</li> </ul>
СН 4	Quality Control Essentials	<ul> <li>QC requirements, introduction to QC Plans and Role of QC personnel</li> <li>Process control and required QC activities</li> <li>Test/inspection data and frequencies</li> </ul>
СН 5	QC Plan Essentials	<ul> <li>Components of a QC plan, QC plan outline</li> <li>Example QC plan provisions</li> <li>QC plan implementation and use</li> </ul>
CH 6	Tools for Quality Control	<ul> <li>Overview of recordkeeping, forms, check sheets, spreadsheets</li> <li>Control charts, statistical approaches with tutorial, discussion of action and suspension limits</li> <li>Discussion on how to use a feedback loop of data in a process control environment</li> </ul>
СН 7	Independent Assurance	<ul> <li>Role of independent assurance</li> <li>Statistical approaches with tutorial</li> </ul>
CH 8	Dispute Resolution	<ul> <li>How to handle discrepancies between agency and contractor data</li> <li>Dispute resolution including appropriate remedial actions</li> <li>Definition of authority and responsibility for enforcing requirements</li> </ul>
Appendix	Model QC Plan	

# Our SMArT and project technical panel members are helping us identify priorities/gaps/issues based on...



- Project experiences
- Local/Regional differences
- Case studies
- Test cases (CLT-Hi Way)

What we are learning may help further shape our vision of the QC Manual, framework and training

### Five Known Gaps and Issues We Affirmed So Far

01

#### **Test Section or Control Strip Confusion**

P-501-4.1 and 32 13 14.13 (Section 1.4.6) language is not always interpreted in the same way by different inspectors, which can lead to confusion on what is required to move to production paving.

02

#### No Straight Edge Standard for Surface Evenness/Edge Slump

Neither P-501-4.11e nor 32 13 14.13 (Section 2.1.1.1) provides requirements for a straightedge to meet any minimum standards nor for how or where to conduct tests / take or apply readings.



#### **Error Prone Concrete Flexural Beams**

Beams are often the source of disputes, and how they are prepared, handled, and cured is often at issue. Correlation to compressive strength during mix design could facilitate less problem-prone testing.



#### **Subjective Factor Qualification Inconsistencies**

QA personnel require clear guidance on whether to apply accept/reject or stop/go decisions for defects, such as surface "bug holes," "sliver spalls," and others.



#### **Misunderstanding of How to Combine Certain Pay Factors**

P-501-6.6B includes five acceptance criteria: strength, thickness, grade, smoothness, and repairs. Confusion exists on how to combine certain factors for lot payments.

**QC Best Practice Manual** 

Model QC Plan

2

3

#### **Training Course (Modules)**

02

The <u>Model QC Plan</u> will include examples for quality processes specifically for concrete airfield sites applicable to FAA P-501 and UFGS 32 13 14.13

The model will be a "go by" for contractors to follow on future projects

We will include spreadsheet tools and examples for statistical analysis

### Current Vision of Model QC Plan



#### Format/Contents

- Guidance on format and contents of a QC/QA plan (CQCP).
- Will include recommendations on what is considered core content and contents that may vary by project size or complexity.

### Integration w/Suppliers

- Guidance for developing a CQCP, including contents and performance criteria to be measured.
- Will identify and include means to integrate material supplier and subcontractor QC into the CQCP.

#### Sampling/Testing

- Guidance on the development of an appropriate QC sampling and testing plan for conventional and PEM tests.
- Will include recommended statistically based techniques (where appropriate) and include examples.

#### **Process Control**

- Guidance including tools to evaluate the suitability of a materials/products, identification of trends, and assessing whether a process is in control.
- Will include the utility of plotting certain measures and correlation ratios, and their ability to assess material consistency.

#### **Use of Control Charts**

- Guidance on using control charts useful for both conventional and PEM tests, including
  - Recommended measures
  - Sampling Plan, and
  - Use of statistics to establish the line of central tendency, action limits, and suspension limits.
- Will include identifying trends, implementing corrective actions and criteria that must be met to resume full operations.

#### **QC Best Practice Manual**

Model QC Plan

2

3

#### **Training Course (Modules)**

03

The materials will focus on training agency and contractor staff to become fully conversant with all aspects of quality control and quality assurance of airfield construction.

- PowerPoint modules
- Instructor guidance
- Online training Synchronous (live) and adaptable for asynchronous (recorded for on-demand viewing)

### **Current Vision of Training Course**



#### **Fundamentals**

- QC versus QA
- P-501 & UFGS 32 11 14.13 similarities & differences
- Spec and statistical concepts
   all QC staff need to understand
- QC checks for QA requirements
- The Model QC Plan

#### What Impacts Quality

- Base & subgrade
- Stringline or stringless model
- Dowel & steel alignment
- Paver and concrete plant set-ups
- Crew member awareness, training & confidence

#### Aggregates/Mixtures

- Aggregate types
- Optimized gradations
- Deleterious materials
- Management & handling
- Issues at the quarry
- Stockpile management and the loader operator

#### **Production Issues**

- Mixture design & prequal
- Plant certification
- Paver to plant communication
- Hauling/Placing concrete
- · Paver set-up and maintenance
- Paving train sequence
- Slipform machine operations
- Finishing & texturing
- Curing
- Monitoring on the fly and asbuilt results

#### Putting it All Together

- Applying QC tools
- Setting up lots/sublots
- Creating control charts
- Observing production
- Properly reacting to trends on charts
- Records management & Submittal of QC data
- Determining pay factors based on combined test results
- What you should do if QC and QA sample testing results are not consistent

### Work Divided into 4 Tasks w/Subtasks



### Timeline

				2022	2		2023									2024															
	Task/Subtask and Description	Aug Sept Oct Nov Dec					Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
1	Literature Review																														
2	Work Plan																														
3.1	Solicit Input From SMArT																														
3.2	Address Gaps in Quality Systems																														
3.3	Address Gaps in Quality Control																														
3.4	Address Gaps in Quality Acceptance																														
3.5	Develop Best Practices Manual																					Y	A		Z	2					
3.6	Develop Training Materials																						-1			Z	2				
4.1	Draft Final Report																										Y	A			
4.2	Final Report																											7	X		
*	Draft literature review and work plan subm	itteo	d	*	Dra	ft m	anual	l sut	omit	ted t	o SN	ЛАr	Γan	d PT	P fo	r rev	view		*	Sub	mit c	lraft	fina	ıl rep	port						
$\mathbf{x}$	Meeting with PTP to review draft work pla	an Final manual submitted to PTP To review draft f									fina	l rep	ort																		
$\mathbf{x}$	Literature review and work plan finalized	$\swarrow$ Draft training materials to SMArT and PTP for review $\checkmark$ Fi										Final 508-compliant report submitted																			

Notes: Quarterly Progress Reports will be submitted to the PTP in months shown in Red. Site visits will occur as opportunities align with the project schedule.

Final training materials submitted to PTP

### Summary of Work Performed So Far

- SMArT and other stakeholders interviews:
  - 9 conducted (included 12 stakeholders)
  - Planning a couple more interviews, time permitting
  - Also obtained relevant information from interviews conducted as part of project ACPTP 2021-2, Performance Engineered Mixtures
  - Compiling and summarizing all stakeholder feedback
- Literature review
  - Nearing completion
  - Preparing side-by-side comparison of FAA and UFGS specifications on a project phase basis
- Revised work plan for panel approval
  - Update underway
  - Will be submitted with literature review to project panel in late February or March 2023



## Thank You

We are pleased to answer any questions...