25 Years of QC/QA

An Overview of IDOT's Implementation of Quality Management Contracts for PCC

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Quality Management Contracts

- In general…
  - These contracts make Industry responsible for sampling, testing, and documenting specification compliance; thus, reducing the DOT's burden in those areas to focus on verification and independent assurance.
- Origins?
  - Primarily an issue for Hot Mix Asphalt
    - The amount of sampling and testing was overwhelming to the point that samples collected during the summer construction season were not being tested until the winter downtime.
  - Has continued to evolve for HMA as Contractors became more proficient and claimed ownership of their product
    - QC/QA: Quality Control/Quality Assurance (<1, 200 tons)
    - QCP: Quality Control for Payment (1,200 – 7,999 tons)
    - PFP: Payment for Performance (≥8,000 tons)

Implementing QC/QA

- For Portland Cement Concrete
  - First standardized in 1992 concurrent with QC/QA for HMA
  - Applicable to all cast-in-place concrete, including 'lean concrete base' and controlled low-strength material
  - Currently implemented in 6 of 9 Districts (~85% of IDOT's total PCC)
    - Used a "multi-year phased-in" approach starting in the mid-'90s
    - First focused on larger projects
  - Included in projects as recurring special provisions
    - Special Provision for QC/QA of Concrete Mixtures
    - Special Provision for QC of Concrete Mixtures at the Plant

QC/QA Infrastructure

- In addition to the special provisions, QC/QA requires establishing a basic foundation for providing and maintaining quality
  - Personnel training and qualifications
    - "Qualifications and Duties of Concrete Quality Control Personnel"
    - Aggregate and PCC Technician Courses
  - Means and methods
    - Plant/Field Sampling and Testing Schedules for Contractor and DOT
    - "Manual of Test Procedures for Materials"
    - "Required Sampling and Testing Equipment for Concrete"
    - "Development of Gradation Bands on Incoming Aggregate at Mix Plants"
    - "Method for Obtaining Random Samples for Concrete"
  - Documentation
    - "Quality Control Plan for Concrete Production"
    - Calibration of Concrete Testing Equipment Worksheets
    - Sampling and Testing Worksheets

QC/QA Infrastructure
Qualified Personnel and Training

The Department maintains a computer database of Qualified Personnel who have successfully completed the appropriate Quality Management courses.

- QC Manager (cost to train: $1,970-2,255)
  - One of the Aggregate courses and both PCC Levels I & II
- Jobsite Mix Sampling & Testing (cost to train: $105-985)
  - Concrete Tester (supervised by a Level I or II)

  Or
  - PCC Level I
- Mix Design (cost to train: $2,385-2,670)
  - One of the Aggregate courses and all PCC Levels I, II, & III
- Strength Testing Only? (cost to train: $640-985)
  - PCC Level I

  Or
  - ACI Concrete Strength Testing Technician Certification
- Gradation Testing Only?
  - Aggregate Gradation Technician (taught by the Districts)
  - Supervised by PCC Level II (or Mixture Aggregate Technician or Aggregate Technician)

QC/QA Infrastructure
Qualified Laboratories

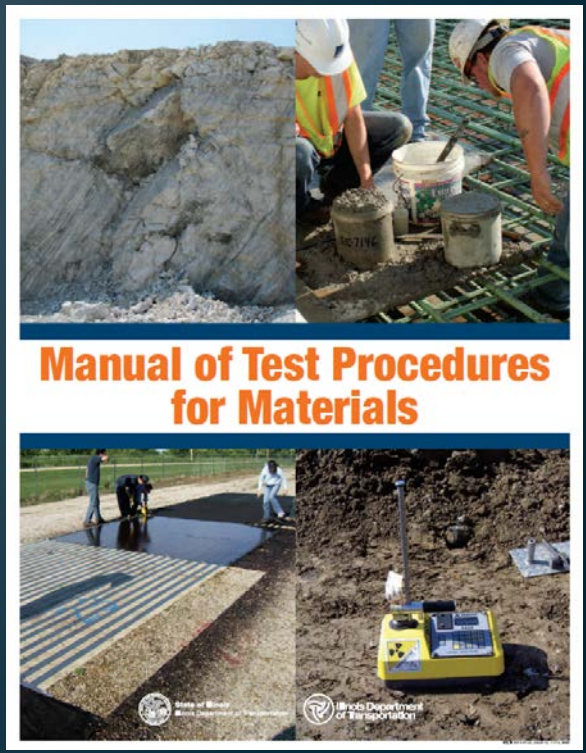
- Policy Memorandum for "Minimum Private Laboratory Requirements for Construction Materials Testing or Mix Design"
  - Governs the minimum qualifications for materials QC/QA laboratories operated by Contractors, Producers, and Consultants
- Establishes procedures for…
  - Evaluating and approving Private Labs
  - Inspecting test equipment and testing procedures
- Why?
  - To ensure that Private Labs are equipped and maintained at a uniformly high level of quality
- More specifically?
  - Contactor test results are used in the acceptance process
  - Federal Regulations (23 CFR 637) require the Department to establish a program for "qualifying" laboratories involved in tests which are used for acceptance

QC/QA Infrastructure
Equipment Needs

- Proportioning
  - Aggregate Moisture Test Equipment
- Sampling
  - Wheelbarrow or Similar Equipment
  - Shovel
- Testing
  - Slump Kit
  - Air Meter Kit and Calibration Equipment
  - Unit Weight Kit, Calibration Equipment
  - Thermometer
  - Hand Scoop
  - Trowel or Wood Float
  - Tamping Rod or Vibrator
  - Mallet
  - Plastic Cylinder Molds
- Curing
  - Moist Cabinet or Moist Room
    - Recording Thermometer
    - RH Measuring Device and Logbook, or Recording Device
  - Water Storage Tank
    - Max/Min Thermometer and Logbook, or Recording Thermometer
- Aggregate Sampling & Testing
  - Electronic Balance
  - Sieve Shaker
  - Sample Splitters
  - Sieves
  - Drying Oven
  - Double Electric Hot Plates or Gas Burners
  - Sink, Faucet, and Water Supply
  - Drying Pans
  - Holding Pans

QC/QA Infrastructure
Required Publications

- IDOT's Manual of Test Procedures for Materials
  - Available to download on IDOT's website
  - Updated annually
  - Primarily includes Illinois Test Procedures and IDOT modifications to standard test procedures published by AASHTO and ASTM
- Also includes the following Quality Management documents:
  - Required Sampling & Testing Equipment
  - Development of Gradation Bands for Incoming Aggregate at Mix Plants
  - Method for Obtaining Random Samples
  - And more…



QC/QA Infrastructure
Required Publications

- Current copies of all AASHTO and/or ASTM test procedures performed
  - Comprehensive access to these test procedures is available electronically
  - Local Industry associations have also started offering access as part of membership

ASTM

Single Registered User **Online Basic**		$3539
Single Registered User **Online Plus**		$4247
Multi-User (LAN) **Online Basic**		$7078
Multi-User (LAN) **Online Plus**		$8494
2017 Print Volumes ISBN 978-1-6822-1223-3	2017	$3150
2016 Print Volumes ISBN 978-1-6220-4882-3	2016	$3044

AASHTO

SINGLE-USER LICENSE
Code: HM-WB1
List Price: $775

TWO-USER LICENSE
Code HM-WB2 List Price: $1,160

THREE-USER LICENSE
Code HM-WB3 List Price: $1,550

QC/QA Infrastructure
Documentation: Quality Control Plan

- Submitted a minimum 45 calendar days prior to production
  - Engineer must respond within 15 calendar days of receipt
  - Mixture production cannot begin until Plan is approved
  - Amendments may be proposed, and are subject to mutual agreement
- Identifies qualified personnel and roles
- Details sampling and testing regimen
- Details procedures for failing tests and defective work
- Outlines communication procedures amongst personnel
- Identifies methods for field documentation
- Identifies pre-pour meeting schedule(s)
- Identifies mix designs and mixture components, and details verification testing of same (including responsible labs)

QC/QA Special Provisions

- Defines roles
  - Level I, II, and III PCC Technicians and Concrete Tester
  - Aggregate, Mixture Aggregate, and Gradation Technicians
- Establishes basic laboratory requirements
  - References Policy Memo, required sampling and testing equipment, forms for maintaining equipment calibration and verification, etc.
- Establishes need for Contractor's QC Plan
- Details Contractor's duties and responsibilities for QC
  - Including hierarchy of technician roles
  - Required Plant sampling and testing
  - Required Field sampling and testing
- Details Engineer's duties and responsibilities for QA and Independent Assurance
- Establishes criteria for comparing QC and QA test results of split samples
- Outlines process for reconciling conflicting split sample test results
- Defines acceptance by the Engineer

QC/QA Special Provisions
Reconciling Split Sample Test Results

- If one party's split sample test results are not within specification limits while the other's is within, retests shall be performed for:
  - Slump, Air Content, or Aggregate Gradation
  - If either retest is still failing, both parties shall investigate the sampling method and test procedure, equipment (condition and calibration), etc.
  - If unresolved, the Contractor shall reject* the material (if not yet placed) or, if already placed, the Engineer will consider it unacceptable.

QC/QA Special Provisions
Acceptance by the Engineer

- Acceptance by the Engineer is based on the following:
  - Contractor's compliance with all contract documents for quality control
  - Validation of contractor's QC test results by comparison with the Engineer's QA results.
  - Comparison of the Engineer's Independent Assurance results with specification limits.

- In consideration of the above, the Engineer may suspend mixture production, reject materials, or take other appropriate action if the Contractor does not control the quality.

Implementing QC/QA

- Some of the hurdles cited by Districts and Industry:
  - Cost/Time – staff, equipment, and training for contractors and producers is expensive and takes time
  - Culture – redistributing roles and responsibilities amongst DOT, contractor, and producer staff initially resulted in increased conflicts
  - District Buy-In – early stages of adoption requires dedication and 'hand-holding' that might appear contradictory to the basis of QC/QA

Implementing QC/QA

- Benefits cited once fully implemented:
  - Increased knowledge amongst contractors and producers
    - "They become trusted, knowledgeable, expert practitioners of their mix—much more than the majority of IDOT REs who may only see PCC occasionally."
  - Increased product accountability by contractors and producers
    - "They can make mixes more specifically designed to suit their material sources and economics—rather than a one-size fits all approach when the DOT creates cookie cutter designs."
  - Improved working relationship between DOT and contractor
    - "With good QC/QA staff, we have tremendously positive working relationships—we are a combined team working together to make things better for all."

Lessons Learned and Current Perspective

- It is critical that the DOT provides support early during implementation
  - Redistributing responsibilities and duties DOT staff have taken for granted can lead to breakdowns in understanding
- It is critical that the DOT encourages contractor, consultant, and producer buy-in
  - Provides a better working relationship amongst all parties
- Lack of DOT initiative can severely hamper implementation
  - Tentative first steps can send the wrong message
- Dealing with non-compliant material still presents problems
  - Too many factors vying for priority? Conflict of philosophies between Construction and Materials? Impact on the user?

Questions?