MICHIGAN DOT
State Report Answers
April 26-28, 2011 TTCC/NCC Meeting

Theme: QC/QA Requirements for Pavements

1. Summarize your state's current QC/QA requirements for pavements.

Current 2003 Standard Specification for Construction

Contractor Quality (Process) Control:

The contractor is responsible for all quality control activities necessary to deliver a concrete pavement in accordance with plans and specifications, including,

- Developing and maintaining QC Plan.
- Developing concrete mixture proportions for each grade of concrete.
- Conducting quality control, sampling, testing, and inspection during all phases of the concrete work.

The department will not sample or test for quality control or assist in controlling the contractor's production operations.

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Quality Assurance (Acceptance):

The contractor will,

- Sample and test the fresh concrete for acceptance.
- Mold, transport and cure the concrete strength test cylinders at their designated facility.
- Transport the cylinders to the designated department lab immediately prior to 28 day acceptance testing.

The department will then test the cylinders at 28 days and administer payment.

Acceptance is also based on the quality of materials and workmanship necessary to deliver an acceptable product.

Upcoming 2012 Standard Specifications for Construction

Contractor Administered Quality (Process) Control:

The contractor retains responsibility for all quality control activities necessary to deliver a concrete pavement in accordance with plans and specifications, as follows,

- Prepare, implement, and maintain a QC plan specific to the project.
- Develop concrete mix designs and JMF's, as specified.

- Provide quality oversight for production testing and control of construction processes.
- Conduct QC sampling, testing, and inspection during all phases of the concrete work at the minimum frequency, or at an increased frequency sufficient to ensure that the work conforms to specification requirements.
- Initiate corrective action necessary to maintain the quality and uniformity of the work.
- Provide curing facilities equipped to ensure the proper environment for the department's QA concrete strength test specimens during initial cure.

Department Administered Quality Assurance (Acceptance):

The department will be responsible for administering the quality-based acceptance and will institute any actions necessary toward its successful implementation, as follows,

- Monitor the contractor's adherence to the QC plan.
- Inspect field placed materials.
- Develop and administer a QA plan.
- Conduct acceptance sampling and testing.
- Retain continual custody of all acceptance test specimens.

2. **Identify any differences in QC/QA requirements on projects with accelerated schedules?**

There are currently no differences in the QC/QA requirements between non-accelerated and accelerated progress schedules. If any modifications to QC/QA requirements were to be made, they would be via project-specific special provision.

3. Summarize the requirements for allowable time between batching and placement for agitated and non-agitated concrete mixes.

- **Batch Mixing -** Measure mixing time from the time all cement and aggregates are in the mixer until the start of concrete discharge. For multi-compartment mixers the mixing time includes the transfer time between drums. Charge the ingredients into the mixer so some water enters before the cement and aggregate, and all the water enters the drum before ⅓ of the required mixing time elapses.
- **Central Mixed Concrete -** Mix each batch of central-mixed concrete 45 seconds for turbine mixers and 60 seconds for revolving drum and pugmill mixers, or as otherwise specified in the quality control plan. For revolving drum and pugmill mixers with a capacity of 1 cubic yard or less, mix for at least 90 seconds.
- **Truck Mixed Concrete -** Mix each batch of truck mixed concrete for more than 70 revolutions at mixing speed.

Elapsed Time - Produce and deliver ready-mixed concrete as central-mixed or truck-mixed concrete. The department considers central-mixed concrete completely mixed in a central mixer and transported to the project in a truck agitator, a truck mixer, or department-approved non-agitating equipment. The department considers truck-mixed concrete completely mixed at the plant site in a truck mixer with a department-approved revolution counter.

Charging begins when the cement contacts the mixing water or damp aggregates.

For agitating units and truck mixers, if the time from charging the mixer to complete discharge may exceed 30 minutes, continuously agitate the concrete.

Do not exceed the time limits specified in Table 601-1 from the time of charging the mixer to complete concrete discharge.

Table 601-1
Time Between Charging Mixer and Placing Concrete (a)

Type of Unit	Concrete Temperature (ASTM C 1064)		
	<60 °F	**60 °F – 85 °F**	**>85 °F**
Open Top Trucks (b)	60	45	30
Open Top Agitating Units (b)	60	60	30
Closed Top Agitating Units and Truck Mixers	90	60	45
Truck Mixers and Closed Top Agitating Units with Concrete Containing Water-Reducing Retarding Admixture (c)	120	90	70

a. Times shown in this table are in minutes
b. Not allowed for structural concrete.
c. Superstructure concrete must meet the time limits for closed top agitating units and truck mixers.

4. Summarize acceptance and payment adjustment clauses related to QC/QA requirements.

- **Pavement Coring -** In-situ concrete pavement is cored to determine the thickness of the concrete pavement, and (where applicable) the location of reinforcement. Price adjustments to the in-situ quantity of pavement (as a result of deficiencies) will be applied to the contract item prior to further analysis for final payment.
- **Concrete Properties -** Initial approval of the fresh concrete is required prior to concrete placement and is based on the, temperature, slump, air content and aggregate gradation (if utilizing an optimized aggregate gradation). Final acceptance for payment of the concrete item is based on analysis of the quality index parameters (2003 – strength; 2012 - strength and plastic air content) made from the same fresh concrete sample as used for initial approval. Analysis for payment will be based on post-coring price adjustments.
- **Initial Pavement Acceptance - Special Provision for Pavement Acceptance for JPCP.** Pavement acceptance is also based on defined thresholds for in-situ distress (eg. cracking and associated spalling of pavement).
  - The Engineer will inspect the completed pavement for any visible indication of cracking any time prior to initial acceptance.
  - If cracking is found, an examination will be made of its extent and severity to determine an appropriate corrective action. Depending on the nature and severity, corrective action may consist of,
    - Crack repair
    - Pavement slab replacement in kind, or

- A contract payment adjustment of up to one hundred percent of the bid price.
- The smallest pavement unit area to be replaced or receiving a payment adjustment will be one slab length by one lane width.

- **Warranty - Special Provision for Materials and Workmanship Pavement Warranty.**
  - The contractor is responsible for correcting defects in the pavement caused by elements within the contractor's control (i.e., the materials supplied and the workmanship), during the warranty period.
  - The warranty term will be five years from the date of initial acceptance.
  - Since the department is responsible for the pavement design, the contractor assumes no responsibility for defects that are design related.
  - If a defect is attributable to both, the materials and/or workmanship, and the design, responsibility for correcting the defect will be shared by the department and the contractor; the contractor is responsible for the percentage of fault attributable to the workmanship and/or materials, and the department is responsible for the percentage of fault attributable to the design.
  - The contractor,
    - Shall warrant to the department that the warranted work will be free of defects in materials and workmanship. The warranty bond must be described on a form furnished by the department. The completed form must be submitted to the department prior to award of contract.
    - Is responsible for performing all warranty work including, but not limited to, maintaining traffic and restoring all associated pavement features, at the contractor's expense.
    - Is responsible for performing all temporary or emergency repairs, resulting from being in non-compliance with the warranty requirements, using department approved materials and methods.
    - Shall notify the department and submit a written course of action for performing the needed warranty work a minimum of ten calendar days prior to commencement of warranty work, except in the case of emergency repairs. The submittal must propose a schedule for performing the warranty work and the materials and methods to be used.
    - Shall follow a department approved maintaining traffic plan when performing warranty work. All warranty work must be performed under permit issued by the Region Utilities & Permits Engineer. The permit fee and an individual permit performance bond will not be required. The permit insurance requirements, however, will apply.
    - May be responsible for reimbursing the department a portion of any incentive payments paid to the contractor for early completion of the original work.
    - Shall furnish to the department, in addition to the regular performance and lien bond for the contract, supplemental performance and lien bonds covering any warranty work being performed. These supplemental bonds must be furnished prior to beginning any warranty work, using department approved forms. These supplemental bonds shall be in the amount required by the department to cover the costs of warranty work.
    - Shall complete all warranty work prior to conclusion of the warranty period, or as otherwise agreed to by the department.
    - Shall be liable during the warranty period in the same manner as contractors currently are liable for their construction related activities with the department pursuant to the standard specifications. This liability shall arise and continue only during the period when the contractor is performing warranty work.