

## 604.01

### Section 604. CONTRACTOR QUALITY CONTROL FOR CONCRETE

**604.01 Description.** Provide quality control for concrete production and placement adequate to produce work of acceptable quality. Conduct quality control sampling, testing, and inspection during all phases of the concrete work which meets or exceeds the minimum rates specified.

The Engineer will not sample or test for quality control or assist in controlling the Contractor's production operations. Provide personnel and testing equipment capable of performing the tests, interpreting results, and adjusting the mix. Continual production of nonconforming work at a reduced price, in lieu of making adjustments to bring work into conformance, is not permitted.

**604.02 Materials.** Not specified.

#### **604.03 Quality Control Considerations.**

**A. Concrete Quality Control Plan.** Provide and maintain a concrete quality control plan, listing all personnel, equipment, supplies, and facilities necessary to obtain samples, conduct tests, and otherwise control the quality of the product to meet specifications. The concrete quality control plan must be administered by a qualified full-time employee of, or consultant engaged by, the Contractor. This individual must have full authority to take all actions necessary for the successful implementation of the quality control plan.

Submit the quality control plan, for the appropriate items, to the Engineer for review a minimum of ten working days before the start of related work. Do not begin concrete placement before acceptance of the quality control plan by the Engineer. The Engineer will notify the Contractor of any objections within five days of receipt of the plan.

Specify a random method of sampling that assures all material being produced has an equal chance of being selected for testing. The method described in the *Materials Quality Assurance Manual* is an acceptable method. Specify what actions will be taken when test results identify concrete that does not meet the specifications. Provide the Engineer the opportunity to witness all sampling and testing. Certify in writing to the Engineer that the testing equipment to be used is properly calibrated. Include calibration data and correction factor information in the quality control plan.

Maintain complete records of all quality control tests and inspections. Document what action was taken to correct deficient concrete. Furnish the original and one copy of these records to the Engineer within 24 hours after the date covered by the record. Furnish reports in a format acceptable to the Engineer.

Include on all quality control test reports or other records sufficient information to allow the test results to be correlated with the items of work represented. If this work is covered by the Department's Concrete Quality Assurance program, all records must include the lot identification number that coincides with the quality assurance lot identification number. The Engineer may withhold acceptance of the concrete for failure to provide properly documented and timely quality control test results.

**B. Qualifications.** The quality control plan administrator must meet one or more of the following criteria: a professional engineer licensed in the State of Michigan; an individual certified by the National Institute for Certification of Engineering Technologies (NICET) at Level III or above for concrete; or an individual certified as a Concrete Technician Michigan Level II through a program certified by the Michigan Concrete Association Board of Examiners or the Michigan Concrete Paving Association.

Individual(s) performing designated tests must be certified concrete technician(s) through a program certified by the Michigan Concrete Association (Michigan Level I or II) or through the Michigan Concrete Paving Association (Level I or II-three year certification).

Furnish the name(s) and credentials of the quality control staff to the Engineer before the start of concrete sampling and testing.

**C. Sampling and Testing.** The following are the minimum concrete quality assurance sampling and testing requirements.

When directed by the Engineer, sample and test all material that appears inconsistent with similar material being sampled, unless the material is removed and replaced or corrected.

1. **Concrete Yield Determination.** After the start of the first concreting operation for each mix design and immediately after the specified slump and entrained air have been attained, determine unit weight. Make this determination under the direction of the Engineer. The average of the unit weight from three different batches will be the

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unit weight of the concrete. Determine the actual yield using this unit weight and adjust the mix design to correct the actual yield to correspond to the theoretical yield.

As work progresses, verify the actual yield. If the yield based on a single unit weight determination differs from the theoretical yield (adjusted for differences in air content) more than +2 percent or -0 percent, make two additional unit weight determinations. Use the average of the three determinations as the unit weight of the concrete. Determine the yield from the average unit weight, and again adjust the mix design to correct the actual yield to correspond to the theoretical yield.

2. **Concrete Temperature, Slump and Air Content Determination.** Conduct sampling and testing for temperature, slump, and air content on the first load, and on subsequent loads if directed by the Engineer, for each grade of concrete delivered to the work site each day. Do not begin concrete placement until quality control tests verify that the concrete meets specifications.

During concrete placement, test for temperature, slump and air content of the concrete at a minimum of once per hour. Quality control tests may coincide with the tests required for acceptance cylinders. If this occurs, the tests do not need to be duplicated. Instead, the quality control test results for temperature, slump, and air content, will be recorded for the quality assurance test cylinders.

3. **Concrete Strength Determination.** Determine the concrete strength on samples taken at least once every 200 cubic yards of a specific mix design, except that no less than one or more than four samples, evenly spread throughout the day, need to be taken for one day's production of the mix. Compressive or flexural strength may be used for strength determination. A single strength test will consist of two cylinders or two beams.
4. **Concrete Containing Fly Ash.** Provide a certified concrete technician Michigan Level II to perform all testing for Grade D concrete containing fly ash. Verify that the air content of each load or batch is within the specified range before placing concrete in the bridge deck.

5. **Test Procedure Specifications.** The following ASTM test methods will apply.

- C 31 Making and Curing Concrete Test Specimens in the Field
- C 39 Compressive Strength of Cylindrical Concrete Specimens
- C 78 Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading)
- C 138 Unit Weight, Yield and Air Content (Gravimetric) of Concrete
- C 143 Slump of Hydraulic Cement Concrete
- C 172 Sampling Freshly Mixed Concrete
- C 173 Air Content of Freshly Mixed Concrete by the Volumetric Method
- C 231 Air Content of Freshly Mixed Concrete by the Pressure Method
- C 293 Flexural Strength of Concrete (Using Simple Beam with Center-Point Loading)

The Department's established procedures for sampling and testing are acceptable alternatives.

**604.04 Measurement and Payment.** Separate payment will not be made for providing and maintaining an effective quality control program. All costs associated with this work will be included in the applicable unit prices for the concrete item.