

710 General Concrete QMP

710.1 Description

- (1) This section describes contractor QC testing requirements common to all concrete classes under 700. Exceptions and additional requirements for concrete testing are specified in:
 - [715](#) for class I concrete used in structures and pavement.
 - [716](#) for class II and class III concrete used in ancillary applications.

710.2 Small Quantities

- (1) The department defines small quantities as follows:
 - As specified in [715.1.1.2](#) for class I concrete.
 - Less than 50 cubic yards of class II ancillary concrete placed under a single bid item.
- (2) For contracts with only small quantities of material subject to testing, modify the requirements of 710 as follows:
 1. The contractor may submit an abbreviated quality control plan as allowed in 701.1.2.3 that also includes concrete mix design documentation from 710.4.
 2. Provide one of the following for aggregate process control:
 - Documented previous testing dated within 120 calendar days. Provide gradation test results to the engineer before placing material.
 - Non-random start-up gradation testing.

710.3 Certification Requirements

- (1) Have a certified PCC technician I, or ACT-PCC working under a certified technician, on the project site, prepared and equipped to perform required sampling and testing whenever placing concrete.

710.4 Concrete Mixes

- (1) The contractor is responsible for mix performance.
- (2) At least 7 business days before producing concrete, document that materials conform to [501](#) unless the engineer allows or individual QMP specifications provide otherwise. Include the following:
 1. For mixes: quantities per cubic yard expressed as SSD weights and net water, water to cementitious material ratio, air content, and SAM number.
 2. For cementitious materials and admixtures: type, brand, and source.
 3. For aggregates: absorption, SSD bulk specific gravity, wear, soundness, freeze thaw test results if required, and air correction factor. Also include aggregate production records dated within 2 years if using those results in the design. Submit component aggregate gradations, aggregate proportions, and target combined blended aggregate gradations using the following:
 - [DT2220](#) for combined aggregate gradations.
 - [DT2221](#) for optimized aggregate gradations.
 4. For optimized concrete mixtures:
 - Complete the worksheets within [DT2221](#) according to the directions.
 - Ensure the optimized aggregate gradations and the optimized mix design conform to WisDOT specifications and pass the built-in tests within [DT2221](#).
 - Verify slip-form mixture workability and conformance to specifications through required trial batching.
 - Submit the completed [DT2221](#) to the engineer electronically. Include the trial batch test results with the mix design submittal.
- (3) Document mix adjustments daily during concrete production.
- (4) Prepare and submit modifications to a concrete mix to the engineer for approval 3 business days before using that modified mix. Modifications requiring the engineer's approval include changes in:
 1. Source of any material except for the following:
 - Water: Concrete plants with multiple water sources are not required to provide a mix change if all other components of the mix design are the same source and all water sources are approved per CMM 850.
 - Fly Ash: For class I pavement and cast-in-place barrier and class II concrete mixes a source change for fly ash of the same class does not constitute a mix design change.
 2. Quantities of cementitious materials.
 3. Addition or deletion of admixtures. Minor admixture dosage adjustments required to maintain air content or slump do not require engineer review or approval.
- (5) When the department requires high early strength concrete, use one of the following:

- Add at least 95 pounds but no more than 280 pounds of cement per cubic yard to a previously accepted mix along with enough water to maintain workability without raising the w/cm.
 - Use type III cement.
- (6) When the department allows high early strength concrete for contract convenience, the contractor may increase the cement content up to 280 pounds of cement per cubic yard.
- (7) Submit concrete mix designs into MRS as specified in [701.1.2.7](#).

710.5 Sampling and Testing

710.5.1 General

- (1) Sample fresh concrete at the point of placement. Use the test methods specified in table 701-1.

710.5.2 Slump

- (1) Provide material conforming to the slumps specified in [501.3.7.1](#). The contractor need not test slump for concrete placed by slip-form methods unless the engineer requests. For other placement methods, test slump whenever an air content test is performed, strength specimens are made, and as the engineer directs.

710.5.3 Air Content

- (1) Provide material conforming to the air contents specified in [501.3.2.4.2](#). On each day of production, test each mix design at start-up and as frequently as practicable until concrete is conforming and concrete production is under control. Subsequently, test at the QC testing frequency specified in individual QMP specifications and as the engineer directs.
- (2) If an individual air test is outside the spec limits, notify the engineer and test as often as practicable on subsequent loads until the air content is conforming.

710.5.4 Concrete Temperature

- (1) Measure concrete temperature of the same sample used for air content testing and report the results along with the air content.

710.5.5 Strength

- (1) Cast all 6" x 12" cylinders or all 6" x 6" x 21" beams in a set from the same sample. Do not cast more than one set of specimens from a single truckload of concrete. Mark each specimen to identify the lot and subplot or location on the project it represents.
- (2) Provide facilities for initial curing. For up to 48 hours after casting, maintain the temperature adjacent to the specimens in the range of 60 to 80 F and prevent moisture loss. Between 24 and 48 hours after casting, transport the specimens to a department-qualified laboratory for standard curing until testing at 28 days.
- (3) Determine the 28-day strength of specimens in psi. Test specimens to failure. Use a testing machine that automatically records the date, time, rate of loading, and maximum load of each specimen. Provide a printout of this information for each specimen tested.

710.5.6 Aggregate Testing During Concrete Production

710.5.6.1 General

- (1) The department will accept gradation based on the results of department-performed acceptance testing.
- (2) The department and contractor must obtain samples using the same method. When belt sampling, contractor personnel shall obtain samples for the department under the direct observation of department personnel. Define the sampling method in the contractor's quality control plan or in the contractor's abbreviated quality control plan.

710.5.6.2 Contractor Control Charts

710.5.6.2.1 General

- (1) Test aggregate gradations during concrete production except as allowed for small quantities under [710.2](#). Perform required contractor testing using non-random samples.
- (2) Sample aggregates from either the conveyor belt or from the working face of the stockpiles.
- (3) Sample aggregates within 2 business days before placement for each mix design. Include this gradation on the control charts.
- (4) Report gradation test results and provide control charts to the engineer within 1 business day of obtaining the sample. Submit results to the engineer and electronically into MRS as specified in [701.1.2.7](#).

- (5) Conduct aggregate testing at the minimum frequency shown based on the anticipated daily cumulative plant production for each mix design. The contractor's concrete production tests can be used for the same mix design on multiple contracts.

TABLE 710-1 CONTRACTOR GRADATION TESTING FREQUENCY - CLASS I

| DAILY PLANT PRODUCTION RATE FOR WisDOT WORK | MINIMUM FREQUENCY |
|--|-------------------|
| Gradation Report Before Placement | |
| 1000 cubic yards or less | one test per day |
| more than 1000 cubic yards | two tests per day |

TABLE 710-2 CONTRACTOR GRADATION TESTING FREQUENCY - CLASS II

| MINIMUM FREQUENCY |
|--|
| Gradation Report Before Placement |
| One test per calendar week of production |

710.5.6.2.2 Optimized Aggregate Gradation Control Charts

- (1) Determine the complete gradation using a washed analysis for both fine and coarse aggregates. Report results for the following:
 - 1 1/2", 1", 3/4", 1/2", 3/8", #4, #8, #16, #30, #50, #100, and #200 sieves.
 - Sum of volumetric percentages retained on #8, #16, and #30 sieves.
 - Sum of volumetric percentages retained on #30, #50, #100, and #200 sieves.
- (2) Calculate blended aggregate gradations using the mix design batch percentages for the component aggregates. Ensure the blended aggregate gradation conforms to the volumetric percent retained of the optimized aggregate gradation limits specified in table 501-4.
- (3) Throughout the contract, construct a 4-point running average of the volumetric percent retained for each sieve to determine if the blended aggregate gradation is within the tarantula curve limits specified in table 501-4.

710.5.6.2.3 Combined Aggregate Gradation Control Charts

- (1) Determine the complete gradation using a washed analysis for both fine and coarse aggregates. Report results for the 1 1/2", 1", 3/4", 1/2", 3/8", #4, #8, #16, #30, #50, #100, and #200 sieves.
- (2) Calculate blended aggregate gradations using the mix design batch percentages for the component aggregates. Ensure the blended aggregate gradation conforms to the percent passing by weight requirements of the combined aggregate gradation limits specified in table 501-4.
- (3) Throughout the contract, construct a 4-point running average of the percent passing by weight for each sieve to determine if the blended aggregate gradation is within the combined aggregate gradation limits specified in table 501-4.

710.5.6.3 Department Acceptance Testing

- (1) Department testing frequency is based on the quantity of each mix design placed under each individual WisDOT contract.
- (2) The department will split each sample, test for acceptance, and retain the remainder for a minimum of 10 calendar days.
- (3) The department will obtain the sample and deliver to the regional testing lab in the same day. The department will report gradation test results to the contractor within 1 business day of being delivered to the lab. The department and contractor can agree to an alternative test result reporting timeframe. Document alternative timeframes in the contractor's quality control plan.
- (4) Additional samples may be taken at the engineer's discretion due to a changed condition.

TABLE 710-3 DEPARTMENT GRADATION TESTING FREQUENCY

| CONCRETE CLASSIFICATION | MINIMUM DEPARTMENT FREQUENCY |
|---|--|
| Small Quantity: Class I: Pavement Class I: Structures Class I: Cast-in-Place Barrier | 1 test on first day of placement |
| Class I: Pavement | 1 test per placement day for first 5 days of placement. If all samples are passing, reduced frequency is applied. |
| | Reduced frequency: 1 test per calendar week of placement |
| Class I: Structures | 1 test per 250 CY placed - Minimum of 1 test per contract for substructure - Minimum of 1 test per contract for superstructure |
| Class I: Cast-in-Place Barrier | 1 test per 500 CY placed |
| Class II | No minimum testing |

710.5.7 Corrective Action**710.5.7.1 Optimized Aggregate Gradations**

- (1) If the contractor's 4-point running average or a department test result of the volumetric percent retained exceeds the tarantula curve limits by less than or equal to 1.0 percent on a single sieve size, notify the other party immediately and do the following:

Option A:

1. Perform corrective action documented in the QC plan or as the engineer approves.
2. Document and provide corrective action results to the engineer as soon as they are available.
3. Department will conduct two tests within the next business day after corrective action. Department will provide test results to contractor after each test is complete.
4. If blended aggregate gradations are within the tarantula curve limits by the second department test:
 - Continue with concrete production.
 - Include a break in the 4-point running average.
 - For Class I Pavements: The department will discontinue reduced frequency testing and will test at a frequency of 1 test per placement day. Once 5 consecutive samples are passing at the 1 test per placement day frequency, the reduced frequency testing will be reapplied.
5. If blended aggregate gradations are not within the tarantula curve limits by the second department test:
 - If the contract does not require optimized aggregate gradation under [501.2.7.4.2.1\(2\)](#), stop concrete production and submit either a new optimized aggregate gradation mix design or a combined aggregate gradation mix design.
 - If the contract requires optimized aggregate gradations under [501.2.7.4.2.1\(2\)](#), stop concrete production and submit a new optimized aggregate gradation mix design.

Option B:

1. Submit a new optimized aggregate gradation mix design.
 2. Restart control charts for new mix design.
- (2) If the contractor's 4-point running average or a department test result of the volumetric percent retained exceeds the tarantula curve limits by more than 1.0 percent on one or more sieves, stop concrete production and submit a new mix design.
- (3) Both the department and contractor must sample and test aggregate of the new mix design at the frequency specified in [710.5.6.1](#).

710.5.7.2 Combined Aggregate Gradations

- (1) If the contractor's 4-point running average or a department test result of the percent passing by weight exceeds the combined aggregate gradation limits by less than or equal to 1.0 percent on a single sieve size, do the following:
1. Notify the other party immediately.
 2. Perform corrective action documented in the QC plan or as the engineer approves.
 3. Document and provide corrective action results to the engineer as soon as they are available.
 4. The department will conduct two tests within the next business day after corrective action is complete.

5. If blended aggregate gradations are within the combined aggregate gradation limits by the second department test:
 - Continue with concrete production.
 - Include a break in the 4-point running average.
 - For Class I Pavements: The department will discontinue reduced frequency testing and will test at a frequency of 1 test per placement day. Once 5 consecutive samples are passing at the 1 test per placement day frequency, the reduced frequency testing will be reapplied.
 6. If blended aggregate gradations are not within the combined aggregate gradation limits by the second department test, stop concrete production and submit a new mix design.
- (2) If the contractor's 4-point running average or a department test result of the percent passing by weight exceeds the combined aggregate gradation limits by more than 1.0 percent on one or more sieves, stop concrete production and submit a new mix design.
 - (3) Both the department and contractor must sample and test aggregate of the new mix design at the frequency specified in [710.5.6.1](#).