

Use on projects with 10,000 tons or greater, for all types of mixes.

Pilot QMP HMA Pavement Nuclear Density.

A Description

Replace standard spec 460.3.3.2(1) and 460.3.3.2(4) with the following:

- (1) This special provision describes density testing of in-place HMA pavement with the use of nuclear density gauges. Conform to standard spec 460 as modified in this special provision.
- (2) Provide and maintain a quality control program defined as all activities and documentation of the following:
 1. Selection of test sites.
 2. Testing.
 3. Necessary adjustments in the process.
 4. Process control inspection.
- (3) Chapter 4 of the department's construction and materials manual (CMM) provides additional detailed guidance for QMP work and describes required procedures. Obtain the CMM from the department's website at: <http://roadwaystandards.dot.wi.gov/standards/cmm/index.htm>

B Materials

B.1 Personnel

- (1) Perform HMA pavement density (QC, QV) testing with nuclear gauges under this provision using HTCP certified Nuclear Technician I operators.

B.2 Testing

- (1) Conform to ASTM D2950 and CMM 4-5-90 for density testing and gauge monitoring methods. Perform nuclear gauge measurements using gamma radiation in the backscatter position. Perform each test for 4 minutes of nuclear gauge count time.

B.3 Equipment

B.3.1 General

- (1) Furnish nuclear gauges from the department's approved product list at <http://www.atwoodsyste.ms.com/materials> that is used for necessary testing (QC, QV). The manufacturer or an approved calibration service will perform calibration of gauge within 12 months of time used on project. Retain a copy of the calibration certificate with the gauge.

B.3.2 Correlation of Nuclear Gauges

B.3.2.1 Correlation of QC and QV Nuclear Gauges

- (1) Select a representative section of the compacted pavement prior to or on the first day of paving for the correlation process. The section does not have to be the same mix design.

- (2) Correlate the 2 or more gauges used for density measurement (QC, QV). The QC and QV gauge operators will perform the correlation on 5 test sites jointly located. Record each density measurement of each test site for all gauges.
- (3) Calculate the average of the difference in density of the 5 test sites between the QC and QV gauges. Locate an additional 5 test sites if the average difference exceeds 1 lb/ft³ (16 kg/m³). Measure and record the density on the 5 additional test sites for each gauge.
- (4) Calculate the average of the difference in density of the 10 test sites between the QC and QV gauges. Replace one or both gauges if the average difference of the 10 tests exceeds 1 lb/ft³ and repeat correlation process from B.3.2.1(2).
- (5) Furnish one of the QC gauges passing the allowable correlation tolerances to perform density testing on the project.
- (6) Remove or replace a gauge if it fails to stay within the allowable tolerances set on the reference site. Re-correlation is not necessary if the gauge being used was tested in the original correlation process.

B.3.2.2 Correlation Monitoring

- (1) Establish a reference site at a location approved by the department. Clearly mark a flat surface of concrete or asphalt or other material that will not be disturbed during the duration of the project. Perform correlation monitoring of all QC and QV gauges at the reference site.
- (2) Conduct an initial 10 density tests using a gauge on the reference site and calculate the average value to establish a reference value. Use the reference value as a control to monitor the calibration of the gauge for the duration of the project.
- (3) Check the gauges on the reference site a minimum of one test per day if paving on the project and compare to the reference value. Maintain the reference site test data for each gauge at an agreed location.
- (4) Calculate difference in measured density versus reference values and investigate if the difference exceeds 1.5 lb/ft³. Conduct 5 additional tests at the reference site once the cause of deviation is corrected and record and calculate the average. Remove the gauge from the project if the average exceeds 1.5 lbs/ft³.

B.4 Quality Control Testing and Documentation

B.4.1 Lot and Sublot Requirements

B.4.1.1 Mainline Traffic Lanes, Shoulders, and Appurtenances

- (1) A lot consists of the tonnage placed each day for each layer and target density specified in standard spec 460.3.3.1. A lot may include partial sublots.

- (2) Divide the project into sublots. A subplot is 1500 lane feet for each layer and target density.
- (3) A subplot may include HMA placed on more than one day of paving. Test sublots at the pre-determined random locations regardless of when the HMA is placed. No additional testing is required for partial sublots at the beginning or end of a day's paving.
- (4) If a resulting partial quantity at the end of the project is less than 750 lane feet, include that partial quantity with the last full subplot of the lane. If a resulting partial quantity at the end of the project is 750 lane feet or more, create a separate subplot for that partial quantity.
- (5) Randomly select test locations for each subplot as specified in CMM 4-5-90 prior to paving and provide a copy to the engineer. Locate and mark QC density test sites prior to performing the tests. Perform density tests prior to opening the roadway to traffic.
- (6) Use Table 1 to determine the number of tests required at each station, dependent upon the width of the lane being tested. When more than one test is required at a station, offset the tests 10 feet longitudinally from one another to form a diagonal testing row across the lane.

Lane Width	No. of Tests	Transverse Location
5 ft or less	1	Random
Greater than 5 ft to 9 ft	2	Random within 2 equal widths
Greater than 9 ft	3	Random within 3 equal widths

Table 1

B.4.1.2 Side Roads, Crossovers, Turn Lanes, and Ramps

- (1) A lot represents a combination of the total daily tonnage for each layer and target density.
- (2) A subplot represents a turn lane, crossover, or ramp for each layer.
- (3) A subplot contains a maximum of 750 tons.
- (4) Perform the number of tests per subplot as specified in Table 2.

Side Roads, Turn Lanes, Crossovers, Ramps: Sublot/Layer tonnage	Minimum Number of Tests Required
25 to 100 tons	1
101 to 250 tons	3
251 to 500 tons	5
501 to 750 tons	7

Table 2

B.4.2 Pavement Density Determination

B.4.2.1 Mainline Traffic Lanes and Appurtenances

- (1) Calculate the average subplot densities using the individual test results in each subplot.
- (2) If all subplot averages are no more than one percent below the target density, calculate the daily lot density by averaging the results of each random QC test taken on that day's material.
- (3) If any subplot average is more than one percent below the target density, do not include the individual test results from that subplot when computing the lot average density and remove that subplot's tonnage from the daily quantity for incentive. The tonnage from any such subplot is subject to the disincentive pay factors in standard spec 460.5.2.2.

B.4.2.2 Mainline Shoulders

B.4.2.2.1 Width Greater Than 5 Feet

- (1) Determine the pavement density as specified in B.4.2.1.

B.4.2.2.2 Width of 5 Feet or Less

- (1) If all subplot test results are no more than 3.0 percent below the minimum target density, calculate the daily lot density by averaging all individual test results for the day.
- (2) If a subplot test result is more than 3.0 percent below the target density, the engineer may require the unacceptable material to be removed and replaced with acceptable material or allow the nonconforming material to remain in place with a 50 percent pay reduction.
- (3) If a subplot has an unacceptable test result, determine limits of the unacceptable area by measuring density of the layer at 50-foot increments both ahead and behind the point of unacceptable density and at the same offset as the original test site. Continue testing at 25-foot increments until a point of acceptable density is found as specified in standard spec 460.5.2.2(1).
- (4) Tests indicating greater than 3.0 percent density below the specified minimum and further tests taken to determine the limits of the unacceptable area will be excluded from the computation of lot density. Do not include the quantity of unacceptable material when computing the lot density incentive pay.

B.4.2.3 Side Roads, Crossovers, Turn Lanes, and Ramps

- (1) Determine the pavement density as specified in B.4.2.1.

B.4.2.4 Documentation

- (1) Document QC density test data as specified in CMM 4-5-90. Provide the engineer with a copy of the data sheet for each lot within 24 hours of QC testing completion for that lot.

B.4.3 Corrective Action

- (1) Notify the engineer immediately when an individual test is more than 3.0 percent below the specified minimum in standard spec 460.3.3.1.
- (2) The engineer may require unacceptable material specified in B.4.3(1) to be removed and replaced with acceptable material or allow the nonconforming material to remain in place with a 50 percent pay reduction. Determine limits of the unacceptable area by measuring density of the layer at 50-foot increments both ahead and behind the point of unacceptable density and at the same offset as the original test site. Continue testing at 25-foot increments until a point of acceptable density is found as specified in standard spec 460.5.2.2(1). Removal and replacement of material may be required if extended testing is in a previously accepted subplot. Testing in a previously accepted subplot will not be used to recalculate a new lot density.
- (3) Compute unacceptable pavement area using the product of the longitudinal limits of the unacceptable density and the full subplot width, lying in the traffic lanes or shoulders.
- (4) Retesting and acceptance of replaced pavement will be as specified in standard spec 105.3.
- (5) Tests indicating greater than 3.0 percent density below the specified minimum, and further tests taken to determine the limits of unacceptable area to be removed, will be excluded from computation of the subplot and lot densities.
- (6) If 2 consecutive subplot averages within the same paving pass and same target density are more than one percent below the specified target density, notify the engineer and take necessary corrective action. Document the locations of such sublots and the corrective action that was taken.

B.5 Department Testing

B.5.1 Verification Testing

- (1) The department will have an HTCP certified technician perform verification testing. The department will test randomly at locations independent of the contractor's QC work. The department will perform verification testing at a minimum frequency of 10 percent of the sublots and a minimum of one subplot per mix design. The sublots selected will be within the active work zone. The contractor will supply the necessary traffic control for the department's testing activities.
- (2) The QV tester will test each selected subplot using the same testing requirements and frequencies as the QC tester.
- (3) Verification subplot average densities that are not more than one percent below the specified minimum target density will verify that the pavement density is acceptable.

- (4) If a verification subplot average is more than one percent below the minimum target density, the QC and QV subplot averages will be compared. Average QV subplot test results that are within 1.0 lb/ft³ of the QC average subplot test results will indicate the QC test results are acceptable.
- (5) If the first QV/QC subplot average comparison shows a difference of more than 1.0 lb/ft³, each tester will perform an additional set of tests within that subplot. The additional tests will be combined with the original set of tests to compute a new subplot average for each tester. If the new QV and QC subplot averages compare to within 1.0 lb/ft³, the original QC subplot average is acceptable.
- (6) If the QV and QC subplot averages differ by more than 1.0 lb/ft³ after a second set of tests, resolve the difference with dispute resolution specified in B.6. The engineer will notify the contractor immediately when density deficiencies or testing precision exceeding the allowable differences are observed.

B.5.2 Independent Assurance Testing

- (1) Independent assurance is unbiased testing the department performs to evaluate the department's verification and the contractor's QC sampling and testing including personnel qualifications, procedures, and equipment. The department will perform the independent assurance review according to the department's independent assurance program.

B.6 Dispute Resolution

- (1) Investigation of non-correlating QC and QV test results will be conducted to determine cause. Gauges will be checked on the project reference site and if one is found to be out of calibration, the gauge will be removed from the project and the other gauge's test results will be used for material acceptance.
- (2) Continue investigation in the work zone by analyzing testing, calculation, and documentation procedures if the gauges are both in calibration. If the testing discrepancy cannot be identified, the contractor may elect to accept the QV lot density test results or retesting of the lot in dispute within 48 hours of paving. Traffic control costs will be split between the department and the contractor.
- (3) If investigation finds that both gauges are in error, the contractor and engineer will reach a decision on resolution through mutual agreement.

B.7 Acceptance

- (1) The department will accept QMP HMA Pavement Nuclear Density based on the contractor QC tests, unless it is shown through the verification or the dispute resolution process that the contractor's test results are in error.
- (2) The department will not accept QMP HMA Pavement Nuclear Density if a non-correlated gauge is used for contractor QC tests.

C (Vacant)

D (Vacant)

E Payment

E.1 QMP Testing

- (1) Costs for all sampling, testing, and documentation required under this special provision are incidental to the work. If the contractor fails to perform the work required under this special provision, the department may reduce the contractor's pay. The department will administer pay reduction under the Non-performance of QMP administrative item.

E.2 Disincentive for HMA Pavement Density

- (1) The department will administer density disincentives as specified under standard spec 460.5.2.2.

E.3 Incentive for HMA Pavement Density

- (1) Delete standard spec 460.5.2.3.
- (2) If the lot density is greater than the minimum specified in standard spec table 460-3 and all individual air voids test results for that mixture are within +1.0 percent or -0.5 percent of the design target in standard spec table 460-2, the department will adjust pay for that lot as follows:

Percent Lot Density Above Minimum	Pay Adjustment Per Ton
From -0.4 to 1.0 inclusive	\$0
From 1.1 to 1.8 inclusive	\$0.40
More than 1.8	\$0.80

- (3) The department will adjust pay under the Incentive Density HMA Pavement bid item. Adjustment under this item is not limited, either up or down, to the bid amount shown on the schedule of items.
- (4) For shoulders paved integrally with the traffic lane, if the traffic lane does not meet incentive requirements, the department will not pay incentive on the integrally paved shoulder.