

APPROVED:

Division Administrator

By: _____

FEDERAL HIGHWAY ADMINISTRATION

Supplemental Technical Specification for

PCC Pavement Thickness Tolerance

SCDOT Designation: SC-M-503 (01/25)

1. SCOPE

- 1.1. This supplemental technical specification describes sampling, testing, and concrete pavement unit price adjustment for Portland cement concrete (PCC) pavement thickness. This specification applies to all PCC pavement, including mainline, shoulders, gore areas, and ramps unless otherwise stated in the Contract.
- 1.2. When diamond grinding and texturing is required on new pavement, requirements for pavement thickness tolerance apply after all grinding operations are complete and accepted. It is the Contractor's responsibility to consider potential loss of pavement thickness from the grinding operation and adjust initial pavement thickness accordingly to ensure that the finished product has the required thickness.

2. REFERENCED DOCUMENTS

- 2.1. SCDOT Standard Specifications Divisions 500 and 700
- 2.2. AASHTO T 148, Measuring Length of Drilled Concrete Cores
- 2.3. SC-T-100, Random Method of Sampling Highway Construction Materials

3. DETERMINATION OF LOTS FOR MEASUREMENT

- 3.1. Normal Width Through Lanes
 - 3.1.1. For pavements with uniform cross-sections, each 1000 linear feet, or fraction thereof, of each traffic lane is considered to be a single lot.
 - 3.1.2. For shoulder pavement four feet or less in plan width, each 3000 linear feet, or fraction thereof, is considered to be a single lot unless the shoulder is formed monolithically with the mainline. If the shoulder is four feet or less in plan width and formed monolithically with the mainline pavement, then the shoulder is included in the mainline lots. For shoulder pavement greater than four feet in plan width, the shoulder is treated as given in Subsection 3.1.1.
 - 3.1.3. If a bridge or other obstacle is encountered, the linear measurement of the lot will not include the bridge or obstacle length. If the lot adjacent to the bridge is 500 linear feet or more, the Resident Construction Engineer (RCE) may choose to either create a fractional lot and begin a new lot at the other end of the obstacle or continue measurement of a full 1000 linear foot lot beyond the obstacle. This selection is made at the RCE's sole discretion. If, at the end of the project, a fractional lot of 250 linear feet or less is remaining, that lot may be included in the adjacent full lot for payment calculation.

3.2. Varying Width Pavement

- 3.2.1. For intersections, entrances, crossovers, ramps, gore areas, and other pavements with varying cross-sections, each 1000 square yards of pavement, or fraction thereof, will be considered to be a single lot. If a final remaining fractional lot is less than 250 square yards, it may be included in the adjacent 1000 square yard lot. Small or irregular areas may be combined to create lots of 1000 square yards, or a fraction thereof, at the RCE's sole discretion.
- 3.2.2. For ramp pavement, any ramp of 500 square yards or greater, including shoulders, will be considered an individual lot. Ramp pavement areas of less than 500 square yards may be grouped with other ramp pavement in the same interchange to create lots no greater than 1250 square yards in area. Ramp pavement greater than 1000 square yards in area will be split to form lots of 500 to 1250 square yards at the discretion of the RCE.

4. CONCRETE THICKNESS VERIFICATION BY CORING – METHOD A

- 4.1. Use section 5 of this supplemental technical specification to determine sampling locations for Method A
- 4.2. Use Section 6 of this supplemental technical specification for Core Analysis requirements for Method A

5. SAMPLING OF LOTS USING METHOD A (CORING VERIFICATION)

- 5.1. The RCE or the RCE's authorized representative will designate at least one random location for coring within each lot using SC-T-100. If the random location is within 18 inches of a transverse joint or 24 inches of a longitudinal joint, adjust the location away from the joint to avoid interference with dowels or tie bars. The RCE may also designate other locations within the lot where insufficient thickness is suspected.
- 5.2. At least one core per ramp leg will be taken.
- 5.3. At no expense to the Department, take a 4 inch diameter core at the designated locations and provide the core(s) to the RCE.
- 5.4. The RCE, in cooperation with Office of Materials and Research personnel, will determine the length of the cores in accordance with AASHTO T 148.

6. ANALYSIS OF CORE LENGTH MEASUREMENTS USING METHOD A (CORING VERIFICATION)

- 6.1. Cores Greater Than Plan Thickness By 0.20 Inches Or More
 - 6.1.1. If the initial core thickness encountered in a lot is greater than the plan thickness by 0.20 inches or more, take at least two additional cores in the lot at locations designated by the RCE, for a total of at least three cores. If all the cores are greater than the plan thickness by at least 0.20 inches, but any single core is less than 0.40 inches greater, then designated thickness variance for the lot is 0.20 inches. If all the cores are greater than the

plan thickness by 0.40 inches or more, then designated thickness variance for the lot is 0.40 inches. However, if any core within the lot is found to be less than the plan thickness plus 0.20 inches, then the thickness variance is based on the average thickness calculated as given below and no additional pay will be made for that lot.

6.2. Cores Deficient By Not More Than 0.20 Inches:

6.2.1. If all the cores within a lot are deficient by 0.20 inches or less with regard to the plan thickness, full payment will be made for the lot and the thickness variance is considered to be zero. No additional payment will be made for cores greater than the plan thickness except as given in Subsection 5.1.

6.3. Cores Deficient By More Than 0.20 Inches, But Not More Than 0.60 Inches:

6.3.1. If any core within a lot is found to be more than 0.20 inches deficient but less than 0.60 inches deficient in thickness when compared to the plan thickness, take a total of at least three cores within the lot at locations specified by the RCE. Average the core thicknesses to determine the overall thickness for the lot. If any core length is found to be more than 0.20 inches greater than the plan thickness, assume the core length is the plan thickness plus 0.20 inches when calculating the average. The thickness variance for the lot is the plan thickness minus the overall lot thickness calculated as given herein.

6.4. Cores Deficient by More Than 0.60 Inches:

6.4.1. If any core within a lot is found to be deficient in length by more than 0.60 inches, take additional exploratory cores at 25-foot intervals along the centerline of the lane in each direction from the deficient core. If the deficient core is found in varying width pavement, then exploratory cores representing approximately each 35 square yards should be taken. Adjust the core locations as necessary to avoid coring within 18 inches of a transverse joint or 24 inches of a longitudinal joint. Continue taking cores until a core is encountered that is no more than 0.20 inches deficient in length. Remove areas of deficient thickness and replace with concrete pavement of the plan thickness.

6.4.2. Calculate the average thickness for the lot based on the average of the original cores plus additional cores taken in the repaired areas. Exploratory cores are not used in calculation of lot average thickness. For areas that were removed and replaced due to thickness deficiency, take at least one additional core in the repaired areas at locations selected by the RCE, but sample at a rate no less than one core per 500 linear feet of repaired area. If a core has a thickness more than 0.20 inches above the plan thickness, that core is assumed to be the plan thickness plus 0.20 inches when calculating the average. The thickness variance for the lot is the plan thickness minus the overall lot thickness calculated as given herein.

7. CONCRETE PAVEMENT THICKNESS VERIFICATION BY SCANNING (METHOD B)

7.1. The RCE will evaluate the concrete pavement through random measurements in accordance with the following:

- Contractor Quality Control Scan (QCS)
- Scan Verification Core (SVC), and
- Quality Acceptance Core (QAC)

7.2. Use section 8 of this supplemental technical specification to determine sampling locations for

Method B.

- 7.3. Use Section 9 of this supplemental technical specification for Scanning Analysis requirements for Method B.

8. SAMPLING OF LOTS USING METHOD B (SCANNING VERIFICATION)

8.1. Contractor Quality Control Scanning (QCS)

- 8.1.1. Measure the pavement thickness of the hardened concrete pavement at a rate of at least two (2) QCS measurement per lot as outlined in sections 3.1.1 and 3.1.3. Notify the RCE before performing the thickness measurements so they may observe the testing and record the test results. Provide daily summary reports listing the results of the day's QCS thickness measurements and additional QCS results to the RCE.

8.1.2. Contractor Scanning Equipment and Scanning Method

Provide the following equipment as approved by the RCE to perform scanning:

- (1) MIT-SCAN-T2 or MIT-SCAN-T3 device, and
- (2) 30 cm \pm 0.1 mm diameter, 660 μ m \pm 10 μ m thick, steel (US ASTM Standard A653 Type 2 Commercial 1 Grade, G90) circular plate supplied by Kessler Soils Engineering Products, Inc. or approved equal.
- (3) Provide a valid calibration certificate for the MIT-SCAN-T2 or MITSCAN-T3 device for the specific reflector type and guaranteed measuring Range (depth). Include the deviation found and permissible deviation for each depth / reflector combination.

Perform scanning in accordance with the following:

- (1) Place the base plates at the randomly selected locations and anchor the plates to prevent movement during concrete placement. Mark the locations of the base plates to ensure ease of locating the plates after the paver has passed.
- (2) Base plates should be positioned such that metal objects (e.g. reinforcement, dowel bar baskets) should not be within 4 ft of the base plate. The base material should be level under the base plate.
- (3) Locate the base plate with the MIT-SCAN device by pressing the search button and moving the sensor head over the base plate.
- (4) For proper scan measurement, all the MIT-SCAN wheels must be in contact with the concrete during the test. Before starting the measurement, position the MIT-SCAN sensor head approximately 1 foot centrally in front of the base plate. A measurement is performed by pressing the measurement button and passing the sensor head over the middle of the base plate. The measurement run is approximately 4.5 ft.

(5) Take three (3) measurement runs in various directions across the base plate and average the three (3) measurements to determine the final individual scan thickness.

(6) The scan measurements must be taken and recorded in millimeters and converted to inches.

(7) Average the three readings and express the result in the nearest 1 mm or 0.05 in. If the difference between any of the results is larger than 3 mm [0.15in.] discard the results and take 3 more readings.

(8) When the first set of results is discarded, examine the second set of test results. If the difference between any results in the second set is larger than 3 mm [0.15in.], discard the set of results and note that the thickness at the location could not be determined by the QCS and take a SVC to replace scan readings.

8.1.3. Individual Deficient Scan (QCS)

If a final individual QCS measurement shows a thickness deficiency greater than 0.20 inch from plan thickness, take a core (QCS-Core) at the deficient location to determine if the pavement is defective.

The RCE will use the core results in lieu of the QCS results.

8.2. Quality Acceptance Testing - Coring

After concrete pavement placement, the RCE or the RCE's authorized representative will designate at least one random Quality Assurance Core (QAC) location for at a rate of 1 core every eight lots using SCT-100. If the random location is within 18 inches of a transverse joint or 24 inches of a longitudinal joint, adjust the location away from the joint to avoid interference with dowels or tie bars. The RCE may also designate other locations within the lots where insufficient thickness is suspected. Additionally, the RCE or RCE's authorized representative will identify at least one additional core location at a rate of 1 core for every eight lots that meets the requirements of Scan Verification Core (SVC) using SC-T-100. The Contractor will core the designated SVC, and QAC locations.

8.2.1. Scan Verification Core (SVC)

Take SVC at 100% of the QCS locations for the first three (3) lots of production. Following the initial three (3) lots of production, take SVC at the same location as the QCS measurement at a rate of one (1) core for every sixteen (16) QCS measurements. If the QCS measurements are not divided evenly by sixteen (16) for each plan thickness, take one (1) additional core in the remaining QCS locations.

Maintain a moving average of the percent difference between the SVC core thickness using the core length as the reference value. If the moving average reaches a percent difference greater than 1.5% of the core lengths or the device is not providing accurate and repeatable results then it should be returned to the manufacturer or their authorized representative for verification or re-calibration.

The RCE will use the verification core results in lieu of the QCS results.

8.2.2. Quality Assurance Cores (QAC)

Take at least one (1) random QAC core at a rate of 1 core for every eight lots as outlined in the Quality Acceptance Testing – Coring and Determination of Lots for Measurement Subsections. Add partial segments less than 50% of the defined lots lineal lane ft or square yardage to the previous lot. If partial segments are equal to or greater than 50% of the defined lot length or square yardage then consider it a single lot.

8.2.3. Coring Method

At no expense to the Department, take a 4 inch diameter core at the designated locations in the presence of the RCE or the RCE's authorized representative. The RCE or authorized representative will field measure the core thickness to the nearest $\frac{1}{8}$ inch, verify (Field ID Number) the cores, and record the field measurement.

8.2.4. Analysis of Core Length Measurements

The RCE, in cooperation with SCDOT Office of Materials and Research personnel will determine the final pavement thickness by measuring the length of the cores (QCS-Core, SVC and QAC) in accordance with AASHTO T 148.

9. DETERMINATION OF ADJUSTED UNIT PRICE

9.1.1. The Department will use lab-measured cores (QCS-Core, SVC and QAC) and scans (QCS-that were not cored) to determine acceptance, need for additional exploratory cores and price adjustment based upon the following:

9.2. Cores or Scans Greater Than Plan Thickness By 0.20 Inches Or More

9.2.1. If all the cores and scans are greater than the plan thickness by 0.20 inches or more, but any single core or scan is less than 0.40 inches greater, then designated thickness variance for the lot is 0.20 inches. If all the cores and scans are greater than the plan thickness by 0.40 inches or more, then designated thickness variance for the lot is 0.40 inches. However, if any core or scan within the lot is found to be less than the plan thickness plus 0.20 inches, then the thickness variance is based on the average thickness calculated as given below and no additional pay will be made for that lot.

9.3. Cores or Scans Deficient By Not More Than 0.20 Inches:

9.3.1. If all the cores and scans within a lot are deficient by 0.20 inches or less with regard to the plan thickness, full payment will be made for the lot and the thickness variance is considered to be zero. No additional payment will be made for cores greater than the plan thickness except as given in Subsection 9.2.

9.4. Cores Deficient By More Than 0.20 Inches, But Not More Than 0.60 Inches:

9.4.1. If any core within a lot is found to be more than 0.20 inches deficient but less than 0.60 inches deficient in thickness when compared to the plan thickness, take a total of at least three cores within the lot at locations specified by the RCE. Average the core thicknesses to determine the overall thickness for the lot. If any core length is found to be more than 0.20 inches greater than the plan thickness, assume the core length is the plan thickness plus 0.20 inches when calculating the average. The thickness variance for the lot is the plan thickness minus the overall lot thickness calculated as given herein.

9.5. Cores Deficient by More Than 0.60 Inches:

9.5.1. If any core within a lot is found to be deficient in length by more than 0.60 inches, take additional exploratory cores at 25-foot intervals along the centerline of the lane in each

direction from the deficient core. If the deficient core is found in varying width pavement, then exploratory cores representing approximately each 35 square yards should be taken. Adjust the core locations as necessary to avoid coring within 18 inches of a transverse joint or 24 inches of a longitudinal joint. Continue taking cores until a core is encountered that is no more than 0.20 inches deficient in length. Remove areas of deficient thickness and replace with concrete pavement of the plan thickness.

- 9.5.2. Calculate the average thickness for the lot based on the average of all original cores (QCS-Core, SVC and QAC) and scans (QCS-that were not cored) plus additional cores taken in the repaired areas. Exploratory cores are not used in calculation of lot average thickness. For areas that were removed and replaced due to thickness deficiency, take at least one additional core in the repaired areas at locations selected by the RCE, but sample at a rate no less than one core per 500 linear feet of repaired area. If a core has a thickness more than 0.20 inches above the plan thickness, that core is assumed to be the plan thickness plus 0.20 inches when calculating the average. The thickness variance for the lot is the plan thickness minus the overall lot thickness calculated as given herein.

10. DETERMINATION OF ADJUSTED UNIT PRICE

- 10.1. Once the thickness variance for each lot has been determined, adjust the unit price for concrete pavement as shown in Table 1.

Table 1. – Schedule for Adjusted Payment Based on Lot Average Thickness	
Thickness Variance (Inches)	Adjusted Unit Price
0.40	105%
0.20	102%
0.19 to -0.20	100%
-0.21 to -0.30	95%
-0.31 to -0.40	90%
-0.41 to -0.50	85%
-0.51 to -0.60	80%
-0.61 or greater	Repairs Required