SECTION 506—REINFORCED OR PLAIN CEMENT CONCRETE PAVEMENTS, RPS

506.1 DESCRIPTION—This work is construction of normal strength or high early-strength (HES) cement concrete pavement, plain or reinforced, on a prepared surface, under restricted performance specifications (RPS).

506.2 MATERIAL—Section 501.2 with the following modification:

Once material control is established, as specified in Section 704.1(d)4.a, the frequency of testing may be reduced to a minimum of one test every 30 minutes.

506.3 CONSTRUCTION—Section 501.3, with the following modifications:

(p) Surface Tolerance. Test the surface of pavement as follows:

1. Mainline Paving. Test as specified in Section 507 and Section 501.3(o)1. These pavements include, but are not limited to any full width lane used for travel, passing, climbing, center turn, acceleration, deceleration, and ramps.

2. Other than Mainline Pavement. Test as specified in Section 501.3(o). These pavements include, but are not limited to approach slabs, bridge decks, tapers, shoulders, medians, or other pavement surfaces as directed.

(t) Tests for Depth. Replace with the following:

The Inspector will determine lots and sublots as specified in Section 506.3(v).

Complete any surface corrective work before testing for pavement depth. Test pavement depth by obtaining one core from each sublot. The Inspector will determine the location of each core using PTM No. 1.

Drill cores at each sublot location, as specified in AASHTO T 24, in presence of the Inspector. Thoroughly clean the vertical surface of the core hole of laitance and loose and foreign material. Fill the holes with the mixture used to construct the course and consolidate. As an alternative, use a premixed, nonshrink grout.

Provide a measuring apparatus conforming to the requirements of PTM No. 614.

The Inspector will:

- determine the core length as specified in PTM No. 614,
- determine the average lot pavement thickness by averaging the individual sublot core thicknesses,
- accept concrete as specified in Section 506.3(v)1, and
- determine price adjustments as specified in Section 506.4(a).

Submit every tenth core to the MTD for 28-day compressive strength testing according to AASHTO T 24. For a partial lot, the Inspector will randomly select one core, according to PTM No. 1, for testing. If the core strength is less than 26 Mpa (3750 pounds per square inch) immediately perform an investigation of the concrete operations to determine the cause of the low strength. Provide a written evaluation of the problem and the proposed solution to the Department.

(u) Defective Work. Replace with the following:

Unless otherwise directed in writing, as specified in Section 110.10(d)1.a, by the District Executive, remove and replace pavement determined defective as follows:

1. Depth. The lot will be defective if the average core depth of the lot is less than the design thickness (D) minus 12.5 mm (1/2 inch) or more than one individual sublot core depth is less than the design thickness minus 12.5 mm (1/2 inch).

2. Compressive Strength or Air Content. The lot is defective if PWL for compressive strength or the plastic air content is less then 55%, as specified in Section 506.3(v)2.

3. Other Conditions. The lot is defective if the pavement contains surface defects from rain, improper final finish, or honeycombing that cannot be satisfactorily repaired as determined by the Representative.

4. Other Than Mainline Pavement Surface Tolerance. The lot is defective if the pavement contains depressions or high points as specified in Section 506.3(p) that cannot be satisfactorily corrected as determined by the Representative.

5. Edge Slumping. The pavement is defective if the requirements specified in Section 501.3(g)5 are not met.

Remove and replace a minimum of 3 m (10 feet) of pavement between transverse joints of reinforced cement concrete pavements or an entire panel of plain cement concrete pavement. Longitudinal edge spall repairs are not considered satisfactory repairs for edge slumping or spalling between adjacent lanes or outside pavement edges.

Where replacement extends to an existing transverse joint, replace the joint in kind. Construct transverse joints at other locations resulting from removal of defective pavement using the methods for joining pavements shown on the Standard Drawings.

(v) Acceptance. Add this section as follows:

Lots and sublots for the combined pavement characteristics of depth, strength, and air content will be determined based on the full width of pavement placement. Lots and sublots will begin at the starting point of paving and continue until 4 680 m^2 (5,600 square yards) are placed. Lots and sublots will be calculated as the work progresses and will include any pavement designated as RPS pavement. Do not combine various depth pavement into any lot or sublot.

A full lot is defined as 4 680 m^2 (5,600 square yards) of pavement, of the same constant depth, and consists of four equal sublots of 1 170 m^2 (1,400 square yards) each.

Combine partial lots with the last full lot or make a separate lot according to the following procedure:

- If less than 3 510 m^2 (4,200 square yards) remain, combine the remaining pavement with the last full lot.
- If the remaining pavement is equal to or greater than 3 510 m^2 (4,200 square yards), consider the remaining pavement as a separate lot.
- Determine sublots for the last pavement lot by establishing a number of equal size sublots.
- Determine the number of sublots by dividing the area of the combined lot or partial lot by 1 170 m^2 (1,400 square yards) and then rounding to the nearest whole number.
- Determine the equal size of each sublot by dividing the combined lot or partial lot quantity by the number of whole sublots calculated.
- Determine lots and sublots based on the full width of pavement placement.

1. Depth. The Representative will accept each lot for compliance with the specifications, for depth if the average core depth of the lot is more than the design thickness (D) minus 12.5 mm (0.5 inch) and not more than one individual sublot core depth is less than the design thickness minus 12.5 mm (0.5 inch).

2. Compressive Strength and Air Content. The Representative will accept concrete for compliance with the specification requirements, for compressive strength and air content, on a lot-by-lot basis, as specified in Section 105 and Section 106. The Representative will determine locations where samples of plastic concrete will be lifted, using PTM No. 1. Make one compressive strength test and one test for percentage of plastic air content on samples from each sublot.

Sublot plastic air content acceptance test results that are outside specification limits will be included in the determination of the PWL.

Mold acceptance cylinders at the determined sublot location. The average of the test results from two cylinders, made from the same sample, tested as specified in PTM No. 604, will constitute the 28-day compressive strength. Cure test specimens according to Subsection 11.1 of PTM No. 611. The result of one sample of concrete obtained and tested according to AASHTO T 152 for stone and gravel, or AASHTO T 196 for slag coarse aggregate, will constitute the percentage of air content. The Representative will accept concrete based on the adequacy and uniformity of compressive strength at the age of 28 days, and, with respect to the air content, when the PWL is 55% or greater.

Calculate the value of Q by one of the following equations, where $\overline{X}_4$ is the average of the sublot test results. Q_L is the lower quality index and Q_U is the upper quality index. "s" is the Standard Deviation as specified in Section 106.03(a)3.a.4.

2.a For Class AA 28-day concrete compressive strength,

$$METRIC: \quad Q_L = \frac{\overline{X}_4 - 23\ MPa}{s}$$

$$ENGLISH: \quad Q_L = \frac{\overline{X}_4 - 3{,}300\ psi}{s}$$

2.b For percentage of air content of Class AA concrete,

$$Q_L = \frac{\overline{X}_4 - 4.5\%}{s} \quad and \quad Q_U = \frac{7.5\% - \overline{X}_4}{s}$$

Determine the percentage of material within specification limits as specified in Section 106.03(a)3.

506.4 MEASUREMENT AND PAYMENT—Square Meter (Square Yard)

The Department will pay on a lot-by-lot basis at the contract price, adjusted for pavement characteristics relative to depth, compressive strength, and air content. The lot payment will be determined according to the multiple characteristic formula specified in Section 506.4(a)3.

(a) Adjustment for Pavement Characteristics.

1. Depth. The lot average core depth will be determined as specified in Section 506.3(t). The characteristic percentage for depth will be determined using Table A. The characteristic percentage for depth will be placed in the multiple characteristic formula as Pd specified in Section 506.4(a)3 to determine the lot payment.

2. Compressive Strength and Air Content. The Percent Within Limits will be determined for the lot as specified in Section 506.3(v)2. The characteristic percentages for compressive strength and air content will be determined by using Table B. The characteristic percentage for compressive strength and the characteristic percentage for air content will be used as Ps and Pa respectively in the multiple characteristic formula specified in Section 506.4(a)3 to determine the lot payment.

3. Multiple Characteristic Formula. The lot payment will be determined according to the following formula:

$$L_p = C_p\left[\frac{(2Ps + 2Pd + Pa)}{500}\right]$$

where:

L_p = Lot Payment
C_p = Contract price per lot (contract price times lot size)
Ps = Characteristic Percentage of Compressive Strength—(Table B)
Pd = Characteristic Percentage for Depth—(Table A)
Pa = Characteristic Percentage for Air Content—(Table B)

TABLE A (Metric)
Characteristic Percentages for Concrete Pavement Cores (Pd)
Relative to Specification Limits

380 mm Design Thickness

Average Core Thickness, mm	Characteristic Percentage Pd
380.00 or greater	100.0
377.50 - 379.99	97.1
375.00 - 377.49	94.4
372.50 - 374.99	91.4
370.00 - 372.99	88.0
367.50 - 369.99	86.4
Less than 367.50	*

360 mm Design Thickness

Average Core Thickness, mm	Characteristic Percentage Pd
360.00 or greater	100.0
357.50 - 359.99	96.7
355.00 - 357.49	93.6
352.50 - 355.99	90.3
350.00 - 352.49	86.5
347.50 - 350.99	84.6
Less than 347.50	*

330 mm Design Thickness

Average Core Thickness, mm	Characteristic Percentage Pd
330.00 or greater	100.0
327.50 - 329.99	96.3
325.00 - 327.49	92.8
322.50 - 324.99	89.2
320.00 - 322.49	85.0
317.50 - 319.99	82.8
Less than 317.50	*

300 mm Design Thickness

Average Core Thickness, mm	Characteristic Percentage Pd
300.00 or greater	100.0
297.50 - 299.00	95.9
295.00 - 297.49	92.0
292.50 - 294.99	88.1
290.00 - 292.49	84.5
287.50 - 289.99	81.0
Less than 287.50	*

280 mm Design Thickness

Average Core Thickness, mm	Characteristic Percentage Pd
280.00 or greater	100.0
277.50 - 279.99	95.5
275.00 - 277.49	91.2
272.50 - 274.99	87.0
270.00 - 272.49	83.0
267.50 - 269.99	79.2
Less than 267.50	*

250 mm Design Thickness

Average Core Thickness, mm	Characteristic Percentage Pd
250.00 or greater	100.0
247.50 - 249.99	95.1
245.00 - 247.49	90.4
242.50 - 244.99	85.9
240.00 - 242.49	81.5
237.50 - 239.99	77.4
Less than 237.50	*

230 mm Design Thickness		200 mm Design Thickness	
Average Core Thickness, mm	Characteristic Percentage Pd	Average Core Thickness, mm	Characteristic Percentage Pd
230.00 or greater	100.0	200.00 or greater	100.0
227.50 - 229.99	94.0	197.50 - 199.99	93.9
225.00 - 227.49	89.3	195.00 - 197.49	88.1
222.50 - 224.99	84.4	192.50 - 194.99	82.6
220.00 - 222.49	79.6	190.00 - 192.49	77.3
217.50 - 219.99	75.1	187.50 - 189.99	72.4
Less than 217.50	*	Less than 187.50	*

180 mm Design Thickness		150 mm Design Thickness	
Average Core Thickness, mm	Characteristic Percentage Pd	Average Core Thickness, mm	Characteristic Percentage Pd
180.00 or greater	100.0	150.00 or greater	100.0
177.50 - 179.99	93.7	147.50 - 149.99	93.4
175.00 - 177.49	87.7	145.00 - 147.49	86.8
172.50 - 174.99	80.8	142.50 - 144.99	78.7
170.00 - 172.49	75.1	140.00 - 142.49	72.6
167.50 - 169.99	69.7	137.50 - 139.99	66.8
Less than 167.50	*	Less than 137.50	*

* Defective work, as specified in Section 506.3(u).

TABLE A (English)
Characteristic Percentages for Concrete Pavement Cores (Pd)
Relative to Specification Limits

15-inch Design Thickness		14-inch Design Thickness	
Average Core Thickness, inches	Characteristic Percentage Pd	Average Core Thickness, inches	Characteristic Percentage Pd
15.00 or greater	100.0	14.00 or greater	100.0
14.90 - 14.99	97.1	13.90 - 13.99	96.7
14.80 - 14.89	94.4	13.80 - 13.89	93.6
14.70 - 14.79	91.4	13.70 - 13.79	90.3
14.60 - 14.69	88.0	13.60 - 13.69	86.5
14.50 - 14.59	86.4	13.50 - 13.59	84.6
Less than 14.50	*	Less than 13.50	*

13-inch Design Thickness		12-inch Design Thickness	
Average Core Thickness, inches	Characteristic Percentage Pd	Average Core Thickness, inches	Characteristic Percentage Pd
13.00 or greater	100.0	12.00 or greater	100.0
12.90 - 12.99	96.3	11.90 - 11.99	95.9
12.80 - 12.89	92.8	11.80 - 11.89	92.0
12.70 - 12.79	89.2	11.70 - 11.79	88.1
12.60 - 12.69	85.0	11.60 - 11.69	84.5
12.50 - 12.59	82.8	11.50 - 11.59	81.0
Less than 12.50	*	Less than 11.50	*

11-inch Design Thickness	
Average Core Thickness, inches	Characteristic Percentage Pd
11.00 or greater	100.0
10.90 - 10.99	95.5
10.80 - 10.89	91.2
10.70 - 10.79	87.0
10.60 - 10.69	83.0
10.50 - 10.59	79.2
Less than 10.50	*

10-inch Design Thickness	
Average Core Thickness, inches	Characteristic Percentage Pd
10.00 or greater	100.0
9.90 - 9.99	95.1
9.80 - 9.89	90.4
9.70 - 9.79	85.9
9.60 - 9.69	81.5
9.50 - 9.59	77.4
Less than 9.50	*

9-inch Design Thickness	
Average Core Thickness, inches	Characteristic Percentage Pd
9.00 or greater	100.0
8.90 - 8.99	94.0
8.80 - 8.89	89.3
8.70 - 8.79	84.4
8.60 - 8.69	79.6
8.50 - 8.59	75.1
Less than 8.50	*

8-inch Design Thickness	
Average Core Thickness, inches	Characteristic Percentage Pd
8.00 or greater	100.0
7.90 - 7.99	93.9
7.80 - 7.89	88.1
7.70 - 7.79	82.6
7.60 - 7.69	77.3
7.50 - 7.59	72.4
Less than 7.50	*

7-inch Design Thickness	
Average Core Thickness, inches	Characteristic Percentage Pd
7.00 or greater	100.0
6.90 - 6.99	93.7
6.80 - 6.89	87.4
6.70 - 6.79	80.8
6.60 - 6.69	75.1
6.50 - 6.59	69.7
Less than 6.50	*

6-inch Design Thickness	
Average Core Thickness, inches	Characteristic Percentage Pd
6.00 or greater	100.0
5.90 - 5.99	93.4
5.80 - 5.89	86.8
5.70 - 5.79	78.7
5.60 - 5.69	72.6
5.50 - 5.59	66.8
Less than 5.50	*

* Defective work, as specified in Section 506.3(u).

TABLE B
Characteristic Percentages for Concrete Pavement
Compressive Strength (Ps) or Air Content (Pa)
Relative to Specification Limits

Percent Within Specification Limits	Characteristic Percentage
90 - 100	100
85 - 89	99
75 - 84	94
65 - 74	83
55 - 64	66
Below 55	*

* Defective work, as specified in Section 506.3(u).

(b) Defective Pavement Left in Place. The Department will not pay for defective pavement left in place, unless otherwise directed in writing by the District Executive.

(c) Concrete Pavement Cores. Each

The price includes measuring apparatus, which remains the Contractor's property upon completion of the project.

(d) Evaluation of Concrete Pavement Ride Quality and Payment of Incentive. As specified in Section 507.4.