

S U P P L E M E N T A L S P E C I F I C A T I O N

AMENDMENT TO SECTION 520 – PORTLAND CEMENT CONCRETE

The purpose of this Supplemental Specification is to adopt the Surface Resistivity Test as a replacement for the Rapid Chloride Penetration Test for indicating permeability of concrete.

Amend 1.2 Tables 1A and 1B to read:

Table 1A - Classes of Concrete

Concrete Class	Minimum Expected 28 Day Compressive Strength ¹	Maximum Water/Cement Ratio ²	Entrained Air Percent	Permeability Target Value ⁶
	PSI (MPa)			kΩ-cm
AAA ³	5,000 (35)	0.400	5 to 9	20
AAA	5,000 (35)	0.444	5 to 9	
AA ³	4,000 (30)	0.400	5 to 9	20
AA	4,000 (30)	0.444	5 to 9	20
A	3,000 (20)	0.464	4 to 7	10
B	3,000 (20)	0.488	3 to 6	
T	3,000 (20)	0.559	----	
F	30 ⁴ (0.2)	3.0 to 4.0 ⁵	15 to 25 ⁵	

Table 1B - Class of Concrete – Performance Requirements (QC/QA)

CONCRETE CLASS	MINIMUM 28 DAY COMPRESSIVE STRENGTH	PERMEABILITY	AIR CONTENT		WATER/CEMENT RATIO		CONCRETE COVER
	PSI (MPa)	kΩ	Percent		Percent		in. (mm)
		Minimum	LSL	USL	LSL	USL	TV ± T
AA	4,000 (30.00)	5	5.0	9.0	Mean - 0.030	Mean + 0.030	1/2 (T = ± 12)
A	3,000 (20.00)	5	4.0	----	----	----	----
B	3,000 (20.00)	----	3.0	----	----	----	----

LSL - lower specification limit

USL - upper specification limit

Mean - calculated mean of all test results for a lot.

TV - Target Value¹

T - Tolerance

¹ Target value is defined as the typical clearance as shown on the plans or as ordered by the Engineer, for each location to be evaluated.

Amend 2.11.2.1 to read:

2.11.2.1 The Contractor shall submit a mix design appropriate for the raw materials and blends of approved aggregates available for the specific project. The concrete mix design limits given in Table 4 or Table 5 indicate the master ranges of mixes permissible under this specification. The mix design shall be within the master ranges indicated for the particular class of concrete specified. The mix design for each mix shall establish a single percentage of aggregate passing each required sieve size in accordance with Table 4 and Table 5, a cement factor and a water cement ratio, target strength and target permeability as shown in Table 1A. Approval of the mix design will include a tolerance range **between 15 and 35 kilohm-centimeters (kΩ-cm)**. Consideration for values **above 35 kΩ-cm** will be made for mix designs utilizing ternary blends developed to mitigate for ASR. Gradings which range from the maximum of one sieve size to the minimum of the next will not be permitted. Mix design submittals shall include results of strength and permeability testing. Strength test results shall be comprised of two test cylinders tested for compressive strength at 28 days (a set of two averaged to comprise one strength test) in accordance with AASHTO T 22 & 23. **Surface Resistivity testing of one cylinder** shall be completed in accordance with AASHTO TP 95 at an age of 56 days. No concrete placement shall be started on a project until the Bureau of Materials and Research has approved the mix design for that placement. The mix design for each mix shall be in effect until modified in writing by the Bureau of Materials and Research.

Amend 3.1.6.3.1 Table 7 to read:**Table 7 -Acceptance Testing Schedule**

PROPERTY	SUBLOT SIZE	TEST METHOD
Strength	See 520.3.1.6.3.2.1	AASHTO T 22 & 23
Permeability	See 520.3.1. 6.3.2.1	AASHTO TP 95
Air Content	See 520.3.1. 6.3.2.1	AASHTO T 152
Water/Cement Ratio	See 520.3.1. 6.3.2.1	NHDOT Microwave
Concrete Cover	Each Data Point	Rebar Depth Measuring Unit See 520.3.1.7.3.3

Amend 3.1.6.3.4 to read:

3.1.6.3.4 Permeability Testing. One 4 in x 8 in. (100 x 200 mm) cylinder shall be fabricated from all placements for Class AA and for Class A concrete. Preliminary Surface Resistivity Testing will be conducted on **cylinders** and performed in accordance with AASHTO TP 95. **The Pay Factor for the subplot shall be based upon the testing of one cylinder** at an age of 56 days or later. One sample will be taken per subplot placed. When concrete is specified to contain a corrosion inhibitor containing calcium nitrite, permeability testing will not be done and the pay factor for this concrete will be 1.0.

Replace 5.9.3 as follows:

5.9.3 Concrete with surface resistivity represented by a test value for the subplot will be subject to a pay factor **determined** in accordance with the following schedule rounded to 2 decimal places:

Class AA PERMEABILITY INDEX RESISTIVITY (kΩ-cm)	PAY FACTOR
≥5 and ≤10	1.05 – 0.06 (10 – SRT)
>10 and ≤35	1.05
>35 and ≤150	1.0 + 0.0004347 (150 – SRT)
>150	1.0

SRT = surface resistivity test in kΩ-cm

5.9.3.1 When the **surface resistivity** for any subplot is **less** than the **lower** specification limit as shown in Table 1, the concrete for that subplot will be rejected and subject to the provisions of 106.03.2.2

Amend Appendix C Step 1 D) Permability table to read:

D) **Permeability.**

LOT	DAY'S PLACEMENT (CY)	SUBLOT NUMBER	SUBLOT SIZE (CY)	PERMEABILITY INDEX (kΩ-cm)
1	162	1-1	54	29
1		1-2	54	36.5
1		1-3	54	85
2	14	2-1	14	32
3	148	3-1	49.33	40
3		3-2	49.33	37
3		3-3	49.34	8.5
4	13	4-1	13	7

Amend Appendix C Step 2 B) Permeability Pay Adjustments table to read:

B) **Permeability Pay Adjustments:** See 5.9.3 for pay factor equations.

LOT	SUBLOT NUMBER	PERME- ABILITY INDEX (kΩ-cm)	PAY FACTOR	SUBLOT SIZE (CY)	UNIT PRICE (\$/CY)	SUBLOT PAY ADJUST (\$) (See 5.9.6)	CUMULA- TIVE ADJUST (\$)
1	1-1	29	1.05	54	373.89	\$403.80	\$403.80
1	1-2	36.5	1.05	54	373.89	\$403.80	\$807.60
1	1-3	85	1.03	54	373.89	\$242.28	\$1,049.88
2	2-1	32	1.05	14	373.89	\$104.69	\$1,154.57
3	3-1	40	1.05	49.33	373.89	\$368.88	\$1,523.45
3	3-2	37	1.05	49.33	373.89	\$368.88	\$1,892.33
3	3-3	8.5	0.96	49.34	373.89	\$-210.83	\$1,681.50
4	4-1	7	0.87	13	373.89	\$-180.54	\$1,500.96

Amend Appendix C Step 3 to read:

STEP 3 – TOTAL PAY ADJUSTMENT:

Strength Pay Adjustment	-\$2,321.86
Permeability Pay Adjustment	\$1,500.96
Air Content Pay Adjustment (Lots 1&2)	\$1,052.87
Air Content Pay Adjustment (Lots 3&4)	\$481.57
Water/Cement Ratio Pay Adjustment (Lots 1&2)	\$394.83
Water/Cement Ratio Pay Adjustment (Lots 3&4)	-\$240.79
Concrete Cover Pay Adjustment (Lots 1&2)	\$526.44
Concrete Cover Pay Adjustment (Lots 3&4)	-\$240.79
Total Class AA Pay Adjustment (Item 1010.4X) =	\$1,153.23

NOTE: Pay adjustments may be calculated for each estimate based on all test results to date.

ROUNDING NOTE: Target values and results are rounded to the same places as the specification.
Average (x) and standard deviation (s) are not rounded.
Pay factors, Q_U , and Q_L are rounded to 2 places in all cases.