ITEM 705 CONCRETE INCIDENTALS

705.01 Fiber Reinforced Polymer (FRP) Dowel Bars. Furnish round and straight fiber reinforced polymer (FRP) dowel bars. Ensure that the resin used to manufacture the FRP bars consists of an acrylic modified epoxy resin with a minimum of 5 percent and a maximum of 7 percent tensile elongation at break. Ensure a minimum glass fiber content of 70 percent by weight. Furnish dowels of a type meeting the dimensional requirements of the standard construction drawings. Provide certified test data according to 101.03 with each shipment.

705.03 Preformed Fillers. Furnish preformed fillers according to AASHTO M 153 or AASHTO M 213, with the following modification:

5.7 For materials manufactured as described in 4.1.1 and 4.1.2, ensure that the producer certifies to the Engineer that the asphalt content is at least 35 percent by weight of the filler.

Furnish materials according to the City's QPL.

705.04 Hot Applied Joint Sealer, Furnish hot applied joint sealer conforming to ASTM D 6690, Type II Use this material as the primer for Type 3 membrane.

705.05 Burlap Cloth. Furnish burlap cloth according to AASHTO M 182, Class 2.

705.06 Sheet Materials for Concrete Curing. Furnish sheet materials conforming to AASHTO M 171 for moisture loss and reflectance only.

705.07 Liquid Membrane-Forming Compounds for Curing Concrete. Furnish liquid membrane-forming compounds conforming to ASTM C 309, with the following modification:

5.3 In addition - provide liquid membrane-forming compounds with a minimum solids content of 25%.

6.1 Water Retention – Provide a liquid membrane-forming compound with a water loss of not more than: 0.15 kg/m^2 @ 24 hours and 0.40 kg/m^2 @ 72 hours, when tested in accordance with 10.1.

7.1 Reflectance – Provide a Type 2 curing compound with a minimum daylight reflectance of 65%.

10.4 In addition - Mix Type 2 curing compound until uniform in color and consistency, and then pour into a glass graduated cylinder (Kimax 150 ml) to the 150 ml mark. Provide the Type 2 curing compound should have with a rate of settling with such that it's a uniformly white portion, as visible to the eye, is not less than 145 ml at 2 hours and not less than 125 ml at 24 hours after filling the Kimax cylinder. Perform the test at 73.0 ± 3.5 ^{o}F (23 ± 2 ^{o}C). During this test, the glass cylinder should be stoppered and left undisturbed.

11.1 In addition, equip the containers for Type 2 white pigmented liquid membrane forming compounds with mechanical agitators. Assign each container, in any batch or lot, a number as the container is being filled.

Furnish materials according to the City's QPL.

705.10 Air-Entraining Admixtures. Provide air-entraining admixtures conforming to AASHTO M 154. Conform to City Supplement 1001 for approval.

Furnish materials according to the City's QPL.

705.11 Preformed Elastomeric Compression Joint Seal for Concrete.

A. General. Provide preformed elastomeric compression joint seal conforming to ASTM D 2628, with the following modifications:

5.1 Provide the size and design as shown on the plans.

7.2 The Engineer will perform inspection at the project site.

7.3 If sampled, provide a minimum of 3 feet (1.0 m), with all manufacturers' markings.

12.1 In addition, provide markings every 1 foot (305 mm). Use lubricants recommended by the seal manufacturer to install preformed compression seals.

B. Qualification. Obtain City approval of each design, shape, width, depth, web, and shell thickness before use. Submit drawings of the seals showing all dimensions and dimension tolerances and weight per foot (meter) with the request for approval.

Furnish materials according to the City's QPL.

705.12 Chemical Admixture for Concrete. Provide chemical admixtures conforming to ASTM C 494 with a minimum relative durability factor of 90.

Furnish materials according to the City's QPL.

705.15 High Molecular Weight Methacrylate (HMWM) Resin. Provide low viscosity, non-fuming high molecular weight methacrylate (HMWM) resin conforming to the following:

Viscosity	Less than 25 cps (Brookfield viscometer, Model RVT with UL adaptor or Model LVF, # spindle and UL adaptor C @ 77 ºF (25 ºC) (ASTM D 2849)
Density	Greater than 8.4 lb/gal Ca 77 ºF (25 ºC) (ASTM D 2849)
Flash Point	Greater than 200 ºF (93 ºC) (PenskyMartens CC) (ASTM D 93)
Vapor Pressure	Less than 1.0 mm Hg C @ 77 ºF (25 ºC) (ASTM D 323)
TG (DSC)	Greater than 135 ºF (58 ºC) (ASTM D3418)
Shelf Life	One (1) year minimum at manufacturers recommended environmental considerations
Gel Time	Greater than 40 min, 100 g mass (ASTM D 2471) (thin film)
Percent Solids	Greater than 90% by weight
Bond Strength	Greater than 1500 psi (10.5 MPa) (ASTM C 882)

Furnish materials according to the City's QPL.

705.20 Non Shrink, Non Metallic Materials. Provide non-shrink, 100% solids, two part (resin and hardener), fast setting, and moisture insensitive anchoring materials for installing anchor bolts, dowels and similar material in concrete.

A. Provide certified test data according to 101.03 showing compliance with the following requirements. Include manufacturer's installation and application requirements.

Test Description	Specification	Requirements	Notes
Bond Strength (dry)	ASTM C882	2 day, Min. 1800 psi	Average of three samples (1)
Bond Strength after subjected to 300 cycles freeze/thaw testing	ASTM C882 specimens subjected to ASTM C666 Method B testing and the tested conforming to C882	Min. 1600 psi	Average of three samples (1)
Heat Deflection	ASTM D648	7 day, Min. 130 ºF	
Linear Coefficient of Shrinkage	ASTM C531	% Max. 0.005	
Pullout Strength Test (dry)	See Procedure below	24 hours, Min. Load 22500 lbs	Average of three cylinders in dry condition
Pullout Strength Test (wet)	See Procedure below	24 hours, Min. Load 22500 lbs	Average of three cylinders in wet condition

(1) make a total of six samples under C882. The City will test three of the C882 samples under C666 Method B and those samples tested.

Pullout Strength Test Procedure. As directed by the Engineer, perform pullout strength tests under dry and wet conditions as follows:

1. Dry Condition (epoxy steel)

   Cast three concrete test blocks or cylinders, a minimum of 6 inches (150 mm) in width or diameter by 12 inch (300 mm) in depth. Use concrete with a compressive strength of 4000+/- 500 psi at 28-days Center a 6 3/4 inch (170 mm) deep hole, drilled the diameter required by the manufacturer's requirements for installing a No. 6 (20M) rebar, in the block or cylinder by drilling or forming. Dry the hole surfaces and clean the holes following manufacturer instructions. Fill the hole with adhesive materials according to manufacturer recommendations. Insert a No. 6 (20M) deformed reinforcing bar 30 inches (760 mm) long, cleaned and degreased, into the hole. Hold and center the bar perpendicular to the concrete surface in the grout-filled hole during the curing period.

2. Wet Condition (epoxy steel)

   Cast three concrete test blocks or cylinders, a minimum of 6 inches (150 mm) in width or diameter by 12 inch (300 mm) in depth. Use concrete with a compressive strength of 4000+/- 500 psi at 28-days. Center a 6-3/4 inch (170 mm) deep hole, drilled the diameter required by the manufacturer's requirements for installing a No. 6 (20M) rebar, in the blocks or cylinders by

drilling or forming. Wet the hole's surfaces prior to applying the anchoring material by filling the hole with water and letting stand for five minutes. Turn the samples over for two minutes to allow the excess water to drain from the hole, Turn all samples over to the upright positions and immediately fill hole with adhesive materials according to manufacturer recommendations. Insert a No. 6 (20M) deformed reinforcing bar 30 inches (760 mm) long, cleaned and degreased into the hole. Hold and center the bar perpendicular to the concrete surface in the adhesive-filled hole during the curing period.

Cure Period. Cure the specimen at 77 ± 5 °F (25 ± 3 °C) for 24 hours.

Pullout Strength Test. Apply an axial load to the bar at a rate of 1/2 inch (13 mm) per minute until the bar pulls out of the specimen, or the concrete block or cylinder cracks or spalls. Record the failure mode and applied load.

B. Provide epoxy materials that conform to ASTM C881, Type IV, Grade 3, Class A, B or C.

Supply the anchoring material in non-reactive containers and with their MSDS. Label containers with the name of the product, the manufacturer, the shelf life expiration date, the batch number, quantity, and provide application instructions.

Maintain storage areas between 40 and 100 °F (5 and 38 °C).

Only use materials on the City's QPL.

705.21 Quick Setting Concrete Mortar. Provide prepackaged mortar material that requires the addition of water only.

Only use materials meeting the following criteria:

A. Capable extending 50 percent by dry mortar weight with aggregate meeting the following requirements:

(a) Gradation requirements of Table 703.01-1 for No. 8, 89, 9, or a combination thereof.

(b) AASHTO M 43, Maximum Passing No. 200 (75 μm) sieve - Not to exceed 0.2 percent.

(c) AASHTO T 84 and T 85, Absorption - Not more than 2 percent.

(d) AASHTO T 104, Soundness Loss - Not more than 2 percent.

1. Ensure that the material meets the following requirements:

Test		Type 1	Type 2
Compressive Strength ASTM C 109[2]			
psi (MPa)	@ 1 Hour	100 (0.7)	2000 (14)
	@ 3 Hour	250 (1.7)	---
	@ 24 Hours	2000 (14)	5000 (34)
	@ 7 Days	---	7000 (48)
Compressive Strength ASTM C 39[1],[2]			
psi (MPa)	@ 1 Hour	100 (0.7)	(2000) (14)
	@ 3 Hour	150 (1.0)	---
	@ 24 Hours	1000 (10)	3500 (24)
	@ 7 Days	---	6000 (41)
Initial Set Time (min) ASTM C 266[2]		5 Minutes	10 Minutes
Bond Strength, ASTM C 882[1]			
psi (MPa)	@ 24 Hours	1000 (7)	1000 (7)
	@ 7 Days	1500 (11)	1500 (11)
Flexural Strength ASTM C 78[1]			
psi (MPa)	@ 4 Hour	---	200 (1.4)
	@ 3 Day	650 (4.5)	500 (3.4)
Freeze and Thaw ASTM C 666 (use either Procedure B or A) [1]			
Procedure B (350 Cycles) Durability Factor		80%	80%
Procedure A (300 Cycles) Durability Factor		79%	79%

[1] Extend test specimens 50 percent by dry mortar weight with aggregate.

[2] Test the mortar as received with the addition of water. Designate the amount of water on the packing container by the manufacturer.

B. To prequalify the material, put the material in place and obtain a three year material evaluation conforming to ODOT Supplement 1070. The City will prequalify the material if it meets the following criteria at the end of the 3 year rating:

1. Percentage debonding/delamination ≤ 5%

2. Percentage spalling ≤ 5%

3. Mid panel average crack width ≤ 1/16 inch (1.6 mm) and total length of mid panel cracks ≤ 20 feet (6.1 m) total length

4. Edge Cracking/debonding average crack width ≤ 1/16 inch (1.6 mm) and total length of cracks ≤ 12 feet (3.6 m)

Furnish the Laboratory with a certified copy of test results from a recognized laboratory showing compliance with the requirements of this specification for item A. Furnish the laboratory written documentation of the method of surface preparation and any primers, adhesives, or activators used in the field test. The City will require the method of surface preparation and any primers, adhesives, or activators used in the field test for subsequent approval or use. To qualify as a recognized laboratory, the facility must show a record of regular inspections by the Cement and Concrete Reference Laboratory of the National Institute of Standards and Technology.

Provide quick setting concrete mortar packaged in strong moisture resistant paper bags or other suitable containers capable of withstanding shipping, normal handling, and storage without breakage. Provide packaging capable of protecting the material from deterioration when stored in a dry condition for a period of 1 year. Display information regarding the minimum nominal yield and instructions for mixing on each package. Calculate volumetric yield determinations using the manufacturers' recommended water content.

Furnish materials listed on the City's QPL.

705.22 Nonshrink Mortar. Provide nonshrink mortar conforming to ASTM C 1107, with the following modification:

9.1 In addition, provide grout with a fluidity at least equal to a flowable mixture as defined in ASTM C 827, Section 8.2.2 at the maximum water content. Provide grout with a minimum flow of 125 @ 5 drops of the flow table in 3 seconds.

Furnish materials according to the City's QPL.

705.23 Concrete Sealers

A. Provide an Epoxy-Urethane sealer incorporating a two component cross linked urethane and conforming to the following requirements:

1. Absorption - ASTM C642 (non-air entrained concrete). Proportion and mix concrete according to ASTM C672. Provide sealed concrete that does not exceed 1.0% absorption after 48 hours or 2.0% absorption after 50 days, under total immersion.

2. Scaling Resistance - ASTM C672 A rating of "No scaling" after 100 cycles on the sealed concrete (non-air entrained concrete) as compared to "Severe Scaling' on untreated concrete.

3. NCHRP 244, Series 11 - Cube Test

3.1 Weight gain - not to exceed 25% of untreated cube

3.2 Absorbed chloride - not to exceed 25% of untreated cube

4. NCHRP 244, Series IV - Southern Exposure

4.1 Absorbed chloride - not to exceed 10% of untreated concrete

5. Volatile Organic Compounds (VOC) maximum, ASTM D 3960, 3.33 lbs./gal(0.399 g/ml), as applied

Record and report the application rate (square footage/gallon) of sealer during the tests.

Provide test data from an approved independent testing facility. The sealer manufacturer funds the testing costs.

Furnish the test data, a one quart (one liter) sample, and the MSDS to the City. The City will determine material acceptance.

Furnish materials according to the City's QPL.

B. Provide a Non-Epoxy sealer conforming to the following requirements:

1. Absorption - ASTM C642 (non-air entrained concrete). Proportion and mix concrete according to ASTM C672. Provide sealed concrete that does not exceed 1.0% absorption after 48 hours or 2.0% absorption after 50 days under total immersion.

2. Scaling Resistance - ASTM C672 A rating of "No scaling" after 100 cycles on the sealed concrete (non-air entrained concrete) as compared to "Severe Scaling" on untreated concrete.

3. NCHRP 244, Series 11 - Cube Test

3.1 Weight gain - not to exceed 25% of untreated cube

3.2 Absorbed chloride - not to exceed 25% of untreated cube

4. NCHRP 244, Series IV - Southern Exposure

4.1 Absorbed chloride - not to exceed 10% of untreated concrete

5. Volatile Organic Compounds (VOC) maximum, ASTM D 3960, 3.33 lbs./gal(0.399 g/ml), as applied

Record and report the application rate (square footage/gallon) of sealer during the tests.

Provide test data from an approved independent testing facility.

The sealer manufacturer funds the testing costs.

Furnish the test data, a one quart (one liter) sample, and the MSDS to the Engineer. The Engineer will determine material acceptance.

Furnish materials according to the City's QPL.

705.24 Soluble Reactive Silicate. Provide a soluble reactive silicate (SRS) that consists of a blend of $Na/K/Fl_xSiO_x$ (sodium, potassium, fluoro or other silicate), surfactants, polymers, and stabilizers capable of thoroughly saturating and sealing concrete. Ensure that the treatment system meets the following performance requirements:

A. Scaling Resistance – Treated concrete that passes ASTM C 672, Scaling Resistance test with a rating of 'No Scaling' after 100 cycles (non-air entrained concrete) as compared to 'Severe Scaling' on untreated concrete.

B. Absorption – Provide treated concrete with an absorption under total immersion not exceeding 1.0 percent after 48 hours or 2.0 percent after 50 days (ASTM C 642, non-air entrained concrete). Proportion and mix concrete in accordance with ASTM C 672.

C. Skid resistance – Do not reduce the skid resistance of treated concrete pavement by more than 10 percent as compared to the same untreated pavement. ASTM E 274 using ASTM E 501 ribbed tire at 40 mph (64 kph), five test average.

D. AASHTO T 259 as modified. Modify the standard T 259 Resistance of Concrete to Chloride Ion Penetration as follows:

In addition to Section 3.1, intentionally break the specimens to produce a full depth crack through the middle of the slab.

Install Section 3.2 dams around the perimeter of the re-assembled, cracked, concrete specimens. Caulk around the perimeter of the dam to ensure water passage or absorption only through the crack and the concrete. After assembly, measure the crack width at three locations and report the crack width.

Perform the ponding of 3.4 until the 3% solution comes through the specimen's crack. Record and report the time required for the solution to appear through the specimen's crack. Remove the solution from the specimens and re-dry according to 3.3 (T 259).

After drying apply the SRS to the specimen's top surface at the manufacturer's recommended rate of application. Record and report the rate of application. Air dry the SRS coated dammed sample specimens for 7 days. After 7 days, reperform the ponding with 3% chloride solution until solution comes through the specimen's crack or 14 days. Record the time the till the ponded solution comes through the crack.

The City will accept SRS materials with a value of 2 or more when dividing the ponding time before SRS application into the ponding time after SRS application.

Sections 3.5, 3.6, 4.1, 4.2 and 5.1 (of T 259) do not apply.

Provide tests performed by an approved independent testing facility acceptable to the City.

Submit test data, a one quart (one liter), a technical data sheet, and the MSDS to the Engineer for approval.

Furnish materials according to the City's QPL.

705.25 Gravity-Fed Resin. Provide non shrink, non metallic resin conforming to ASTM C 881, Type 1, Grade 1, Class B or C and the following:

Provide resin with a maximum viscosity at the lowest allowable temperature of 250 cps. Obtain test data from the manufacturer to verify the viscosity at the lowest temperature for the class the Contractor seeks approval for.

A minimum average sand retention of 95.0% for three samples tested according to the Sand Penetration Test Method.

Show no signs of cracking, debonding or insufficient curing during the sand penetration test.

Material Approval. Obtain certified test data from the manufacturer verifying compliance with the above requirements; technical data sheet; current MSDS for the material; 1 gallon sample; and a letter certifying that the manufacturer will not alter product formulation without notification to the Engineer.

The Engineer will determine materials acceptance and include in the City's QPL.

Furnish materials according to the City's QPL.

705.26 Epoxy Injection Resin. Provide epoxy injection resin capable of application, positive adherence and strength development when applied to moist or wet surfaces at temperatures of 33 °F (1 °C) and above.

Use products that contain 100% solids material and no non-reactive diluents, solvents or other fillers. Provide materials that meet the following requirements:

A. Provide injection material that meets the requirements of ASTM C 881 Type IV, Grade 1 and Class B or C with a maximum viscosity of 600 cps at the lowest ambient material and substrate temperature the Contractor intends to use.

B. Provide paste materials that meet the requirements of ASTM C 881 Type I, Grade 3 and Class B or C.

Material Approval. Obtain material prequalification from the manufacturer of the materials and submit the following to the Engineer:

A. An Independent certified test data indicating that the materials, when mixed according to the manufacturer's recommendations, meet the requirements listed above.

B. Manufacturer's technical data sheet for the paste and injection materials.

C. MSDS for paste and injection materials.

D. 1 Gallon Sample or 2 kits of the injection materials.

Furnish materials according to the City's QPL.