1. SCOPE

This test method covers acceptance tests for Concrete Repair Material - Rapid Hardening (NY Standard Specification Item 701-09) and Concrete Repair Material - High Early Strength (NY Standard Specification Item 701-12). The method includes tests for setting time, expansion/contraction, compressive strength, resistance to freeze-thaw, bond strength, color, chloride content, and sulfate content.

2. REFERENCED DOCUMENTS

2.1 AASHTO Standards
   M 201 Mixing Rooms, Moist Cabinets, Moist Rooms, and Water Storage Tanks Used in Testing of Hydraulic Cements and Concretes
   R 39 Making and Curing Concrete Specimens in the Laboratory
   T 22 Compressive Strength of Cylindrical Concrete Specimens
   T 105 Chemical Analysis of Hydraulic Cement
   T 106 Compressive Strength of Hydraulic Cement Mortar (Using 50-mm or 2-in. Cube Specimens)
   T 131 Time of Setting of Hydraulic Cement by Vicat Needle
   T 162 Mechanical Mixing of Hydraulic Cement Pastes and Mortars of Plastic Consistency
   T 177 Flexural Strength of Concrete (Using Simple Beam with Center-Point Loading)
   T 231 Capping Cylindrical Concrete Specimens
   T 260 Sampling and Testing for Chloride Ion in Concrete and Concrete Raw Materials by Procedure B (Acid-Soluble Chloride Ion by Atomic Absorption)

2.2 ASTM Standards
   C 1090 Measuring Changes in Height of Cylindrical Specimens from Hydraulic-Cement Grout
   C 1107 Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
2.3 **NYSDOT Standards**
Test Method 502-3P Freezing and Thawing, Portland Cement Concrete Cores
Standard Specifications - Construction and Materials

3. **APPARATUS**

3.1 Apparatus is as specified in Referenced Documents with the following exceptions:

3.1.1 The 50mm (2") cube mold assembly may be fabricated of high density polyethylene or Teflon.

3.1.2 Mortar mixing apparatus is as specified in AASHTO T 162 except the bowl positioner is adjusted to allow for the largest size aggregate in the mixture being tested.

3.2 Fifty ton hydraulic press with splitter head.

3.3 Twenty quart mixer such as the Toledo Model TM-20.

3.4 Munsell Neutral Value Scale chart.

4. **PROCEDURE**

4.1 **Mixing of Concrete Repair Material**

4.1.1 *Neat Mix* - Premix dry components to ensure uniformity. Mix the concrete repair material in accordance with the manufacturer's mixing instructions using water/grout ratio specified in the Laboratory Request Memo. If no mixing instructions are specified, then add the specified amount of water to the mixing bowl of the apparatus described in AASHTO T 162, add grouting material and mix at slow speed for 3 minutes. Briefly stop mixer (not over 15s) during first minute of mixing to scrape into the batch any grout that may have collected on the side of the bowl.

4.1.2 *Extended Mix* - Mix the concrete repair material in accordance with the manufacturer's recommendations using water/grout ratio specified in the testing memo and a coarse aggregate(CA1) extension of 60% by weight. If no mixing instructions are specified, place aggregate in a twenty quart mixing apparatus and then add total water. Mix for 30 seconds then add dry repair material. Mix the batch until uniform consistency is reached.

4.2 *Setting Time* - Determine the setting time according to AASHTO T 131 except place the material in the mold immediately after mixing and store the specimen at ambient conditions instead of in the moist cabinet. Begin taking Vicat readings immediately. Obtain additional readings at 2 minute intervals for materials whose initial set is expected to be 15 minutes or less. Obtain readings at 5 minute intervals if the initial set is expected to be greater than 15 minutes.
4.3 Expansion/Contraction - Determine expansion or contraction according to ASTM C 1090 using moist cabinet storage conditions. Obtain measurements at 1, 3, and 7 days.

4.4 Compressive Strength

4.4.1 Neat Mix - The compressive strength at a specified curing time is the average compressive strength of three 50mm (2") compression cubes. Cast the cubes in cube molds following the procedures of AASHTO T 106 for compressive strength except omit the use of a cover plate. Remove from the molds after 24 hours and cure in lime water inside the moisture cabinet until they are to be broken. Follow manufacturer’s curing instructions if material is not portland cement based. Break the cubes in compression as described in AASHTO T 106.

4.4.2 Extended Mix - The compressive strength at a specified curing time is the average compressive strength of two 75mm (3") x 150mm (6") cylinders. Cast the cylinders in cylinder molds following the procedures of AASHTO R 39. Strip cylinders from their molds after 24 hours and cure in lime water inside the moisture cabinet until they are to be broken. Follow manufacturer’s curing instructions if material is not portland cement based. Prior to testing cap cylinders following procedure outlined in AASHTO T 231. Break cylinders in compression as described in AASHTO T 22.

4.5 Freeze-Thaw

4.5.1 Neat Mix - Cast one set of three 50mm (2") cubes in cube molds following procedures of AASHTO T 106 for compressive strength except omit the use of a cover plate. Remove from the molds after 24 hours and cure in lime water inside the moisture cabinet for six additional days. Test the set of cubes according to NYSDOT Test Method 502-3P except as a container use a 300mm (12") x 150mm (6") plastic cylinder mold cut to a height of 100mm (4"). The three cubes are then placed in one container and soaked in solution for 24 hours before beginning the first cycle.

4.5.2 Extended Mix - Cast two 75mm (3") x 150mm (6") cylinders in molds following procedures of AASHTO R 39. Strip from the molds after 24 hours and cure in lime water inside the moisture cabinet for six additional days. Test cylinders according to NYSDOT Test Method 502-3P.

4.6 Bond Test - Break a 75mm x 100mm x 200mm (3" x 4" x 8") prism of NYSDOT Class D concrete approximately at the center of its 200mm (8") length using the fifty ton hydraulic press with splitter head. Dampen the broken ends of the prism by immersing the prism halves in a room temperature bath for a minimum of 30 minutes. Remove prisms and towel dry to a saturated surface dry condition. Brush on repair material mortar to completely coat the broken ends. Place the two halves in a 75mm x 100mm x 400 mm (3" x 4" x 16") mold with the unbroken ends butted in the center of the mold. Fill the remainder of the mold with the repair material and tamp with rubber tamper to consolidate. Finish by troweling and cover with plastic sheeting. Cure at laboratory conditions. Remove the prisms from the mold after curing for the specified length of time. Within 30 minutes of removing the
prisms from the mold subject the prisms to center point flexure as per AASHTO T 177. Set the lower blocks beneath the 75mm x 200mm (3" x 8") surface 150mm (6") apart centered about the concrete/repair material interface. Apply the load to the 75mm x 200mm (3" x 8") surface at the concrete/repair material interface at a rate of 3560 N/min (800 lb/min). In addition to determining the bond strength, observe whether the break occurred at the interface, in the concrete or in the repair material. If the break occurred in more than one region, estimate the percentage occurring in each region.

4.7 Color - Sample is compared to the Munsell Neutral Value Scale and the closest matching standard is recorded.

4.8 Chlorides - Determine Chloride content according to AASHTO T 260 Procedure B.

4.9 Sulfates - Determine Sulfate content according to AASHTO T 105 section 15.1.

5. REPORT

5.1 Batch weights with water amount (w/g ratio)
5.2 Initial Setting Time (minutes)
5.3 Expansion or Contraction (%)
5.4 Compressive Strength (MPa and/or psi)
5.5 Freeze-Thaw loss (%)
5.6 Bond Strength (MPa and/or psi) with description of failure
5.7 Color Value
5.8 Chloride (%)
5.9 Sulfate (%).