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ENGINEERING INSTRUCTION

YORK STATE DEPARTMENT OF TRANSPORTATION

SUBJECT: Bridge Design Manual-Special Specifications for Bridges-Item 16584.13 - Rapid setting Concrete for Bridge and Approach Slab Repairs.

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Distribution: 30 Main Office 32 Regions 34 Special

APPROVED:

Deputy Chief Engineer (Structures) Acting

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Supersedes:

This Engineering Instruction issues Item 16584.13-Rapid Setting Concrete for Bridge and Approach Slab Repairs.

The item has been developed for use in those instances where a rapid return to full traffic accommodation is required in a particular instance. While rapid setting concrete (RSC) materials are uniquely suited to such situations, they are also very expensive. Consequently, RSC materials will be permitted for contract work only with the prior approval of this office. Prior approval is dependent upon adherence to the following guidelines:

Guidelines for the use of RSC materials:

1. Traffic conditions do not allow permanent lane closures to exceed 72 hours. There is no minimum AADT which will automatically trigger this constraint. The condition must be justified by the designer in each instance. The use of RSC materials will not be permitted under any circumstances if the need for open traffic lanes cannot be justified at the location in question.

2. The structure requiring repair is basically sound. That is, concrete repairs are necessary only for selected locations, with each location being a specific size. It is the responsibility of the designer to verify that a basically sound condition exists. Documentation verifying sound structural condition is required. Visual surveys are not acceptable.

3. No one repair location exceeds 250 s.f. of surface area when measured as a plane projection. This is an approximate, not an exact, guideline. Some repair locations will marginally exceed 250 s.f. Such areas are acceptable provided they do not exceed the square foot limitation by more than ten percent and there are no more than two such repair locations on any given structure.

4. RSC repairs are generally applicable only to structural slab, or overlay, surfaces. However there may be instances where curb, sidewalk, or substructure repairs are desired to be effected with these materials. In all such instances the previous guidelines will apply. It is the responsibility of the designer to justify the expense of incorporating these materials into such repairs.

The following prices and material quantities may be used to estimate repair costs:

Prices

Surface Preparation - $20.00 to $35.00 per s.f.
RSC Material - $100 to $150 per c.f., or $1.20 to $1.80 per lb.

Quantity

Each 0.60 c.f. to be repaired will require one 50 lb. bag of material assuming an aggregate extension of 60%. There are other possible quantity yields, however this one is the most conservative and should result in an estimate not likely to overrun.

The designer should also take note that it will be necessary to insert copies of the following material subsections when item 16584.13 is used:

701-09-RAPID SETTING CONCRETE REPAIR MATERIAL (Normal Weather)
701-10-RAPID SETTING CONCRETE REPAIR MATERIAL (Cold Weather)
701-20-RAPID SETTING POLYMER CONCRETE

The foregoing subsections were all distributed with E.I. 87-18.

To avoid delay, designers are advised to request approval for use of this item as soon as they become aware that the material may be needed. Approval requests unaccompanied by the required documentation needed for justification, will not be processed. No telephone requests will be honored. For further information contact the Special Design Unit at (518) 457-4539.

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Description: This work shall consist of excavating loose and deteriorated concrete, exposing and cleaning reinforcing bars, cleaning and preparing the cavity, furnishing and placing the concrete repair material and reopening the surface to traffic one hour after placement of repair material. The contractor shall have the option of using one of the types of repair material listed below.

Materials: The materials used shall meet the requirements of the following subsections:

Coarse Aggregate (703-0204 Crushed Slag shall not be used)	703-02
Rapid Setting Concrete Repair Material - Normal Weather	701-09
Rapid Setting Concrete Repair Material - Cold Weather	701-10
Rapid Setting Methylmethacrylate Polymer Concrete	721-20
Water	712-01

The aggregate shall be sized as follows, based upon the depth of repair material placement:

Depth of Placement	Gradation
Up to 4 inches	Type CA1 Table 501-2
4 inches or greater	Type CA2 Table 501-2

The following aggregate extension rates by weight of the dry component of the patching material shall be used:

Patch Material Type	Type CA1 or CA2 Crushed Aggregate	Type CA1 or CA2 Uncrushed Aggregate
701-09 and 701-10	60-65%	75-80%
721-20	75-80% (Type CA1) 100-105% (Type CA2)	85-90% (Type CA1) 100-105% (Type CA2)

The quantity of water (if required) added shall be no greater than that required by the patching material manufacturer's instructions. The moisture content of the aggregate shall be determined by the Contractor. The Contractor shall adjust the patching material manufacturer's water content allowing for the aggregate moisture content. This adjustment shall be approved by the Engineer before mixing.

Aggregate used in Methylmethacrylate (MMA) polymer concrete shall be completely dry at the time of mixing.

MMA polymer concrete is flammable. Safety precautions shall be taken to prevent fire and explosion. Protective equipment shall be worn to prevent skin contact.

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Construction Details: The locations to be repaired are indicated on the plans or will be designated by the Engineer. Repairs shall conform to the details shown on the plans or be in accordance with the directions of the Engineer. The area around the spall or other distress will be sounded with a 16 oz. hammer and the perimeter of the area to be patched will be designated by the Engineer. All asphalt concrete, foreign materials of any kind, and unsound concrete shall be removed from the repair area.

All wire mesh reinforcement encountered during concrete removal shall be cut out and disposed of by the contractor. The contractor will not be required to replace wire mesh reinforcement removed from a patch area.

If steel reinforcing bars are encountered during removal of deteriorated concrete, the terms and conditions of subsections 579-1.02 Exposure of Reinforcing Bars and 579-3.02 Reinforcing Bar Exposure shall apply. If reinforcement is encountered and exposed with the one inch clearance as called for in subsection 579-1.02B, only CA1 aggregate shall be used to extend the repair material regardless of the total patch depth.

The Contractor has the option of using chipping hammers, a milling machine approved by the Engineer, or high pressure water blast for concrete removal. If MMA polymer concrete is proposed for use, high pressure water blast is not permitted.

1. Chipping Hammers. The edges of the patch shall be chipped to produce a nearly vertical, intentionally rough sound edge. No undercutting shall be required or permitted. The floor of the patched area shall be chipped away to produce a minimum patch depth of one inch at all points within the patch if MMA polymer concrete is used. Patches that use other materials shall be a minimum of two inches deep.

   Chipping hammers that are used shall not damage the concrete that is to remain. Chipping hammers shall weigh not more than 45 pounds with the bit and muffler removed. The hammer shall deliver no more than 1600 blows per minute. The Contractor shall provide the Engineer with information from the hammer manufacturer that these requirements are not exceeded. The air pressure used to power the hammer shall not exceed 100 psi measured at the air compressor. An air pressure gauge in proper working condition shall be provided. Only sharp chisel point bits shall be used. All bits determined by the Engineer to be dull shall be sharpened or replaced. If the Engineer determines that the Contractor's operations are resulting in damage to concrete that is to remain, the Contractor shall make immediate corrections. These corrections shall include the use of a lighter chipping hammer if so ordered by the Engineer.

2. Milling Machine. Milling machines that are used for concrete removal shall result in the same surface preparation as in 1. Chipping Hammers. Their use shall be approved by the Engineer.

3. High Pressure Water Blast. The edges of the patch shall be blasted to produce a nearly vertical, intentionally rough sound edge. No undercutting shall be required or permitted. The floor of the patched area shall be blasted away to produce the minimum patch thickness required by the type of material, at all points within the patch.

   Water blasters shall have a minimum pressure of 10,000 psi when measured at the machine.

Sand blasting shall follow concrete removal to remove any remaining contaminants or loose chips of concrete.

Immediately prior to placing the patching material, the location to be patched shall be cleaned of all loose material by vacuum or air blasting. The air used for sand and air blasting shall be free of oil or any other foreign substances that would contaminate the cleaned surfaces. Air compressors shall be equipped with moisture traps. Air blasting shall have a pressure sufficient to remove all loose debris. The Contractor is required, at all times while sand, water or air blasting to provide protection by means of approved screening to prevent damage to, or interference with traffic in adjacent lanes.

If patching material is not placed during the same working day as when the patch area is prepared, the area shall be resandblasted, followed by vacuum or air blasting before patching material placement.

Patches being repaired with MMA polymer concrete shall be completely dry, and primed with a compatible primer before placement.

Patching material shall not be placed in wet weather. If, in the opinion of the Engineer, the patching material is damaged, it shall be removed and replaced.

Temperature limitations for placing the R.S.C. are as follows:

Ambient Temperature Range	Patching Material Type	
50°-90°F	701-09	R.S.C. (Normal Weather)
35°-50°F	701-10	R.S.C. (Cold Weather)
35°-90°F	721-20	Methylmethacrylate Polymer Concrete

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The materials shall be mixed in a mortar-type mixer or mixer of such capacity that one batch will completely fill the location(s) to be repaired. MMA polymer concrete may be mixed in manufacturer supplied plastic bags or a mortar type mixer. The mixer(s) shall be inspected and approved by the Engineer prior to use. If water is required it shall be the first material placed in the mixer. The moisture content of the aggregate used to extend the yield shall be determined and the quantity of water added shall be adjusted accordingly to compensate for the moisture content. The Contractor shall provide a device to accurately measure the quantity of water and aggregate. Aggregate used with MMA polymer concrete shall be completely dry. The materials shall be mixed following the manufacturer's directions.

If patching material is to be placed at a joint or slab edge, the necessary forms or joint forming material as indicated on the plans or ordered by the Engineer shall be provided. Any forms or joint spacers shall be coated with a material that will not react with the patching material and will not adhere to it.

The patching material, except MMA polymer concrete, shall be placed in one lift, starting at one edge of the repair area and working to the opposite edge. MMA polymer concrete may be placed in lifts. Lifts shall be a minimum of one inch. All patches equal to or greater than two inches in depth shall be consolidated by internal vibration following Standard Specifications 555-3.04 B "Vibrating" to minimize the possibility of voids in the patch. The patching material shall be hand screeded and finished to meet the adjacent elevation, cross slopes, and texture. Once placed, no curing procedure is required for any type of patching material; however it shall be allowed to air dry at least one hour prior to allowing traffic to travel over the patched area.

Method of Measurement:

The work will be measured as the number of pounds of R.S.C. material actually incorporated into the work. Measurement will be taken in accordance with the following:

R.S.C. Material	Measurement
Container empty	Weight shown on container
Container open; more than one-half the material used	Weight shown on container
Container open: one-half, or less than one-half, the material used.	One-half the weight shown on the container

No container shall be opened withour prior authorization from the Engineer. No unopened container will be measured. Containers opened without prior Engineer's authorization will be deemed to be unopened.

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Basis of Payment:

Rapid Setting Concrete for Bridge and Approach Slab Repairs.
The unit price per pound shall include the cost of all labor, equipment and materials necessary, including disposal of the removed material, to complete the work. This shall include, but not be limited to, surface preparation, sand blasting, air blasting, vacuuming, priming of the surface if necessary, and the mixing and placing of the repair material. Any forms necessary for the completion of this work shall be included in the cost for this item.