

# ITEM 04502.8023 M - CONCRETE PLACEMENT FOR PARTIAL DEPTH PCC PAVEMENT REPAIRS

## DESCRIPTION

This work consists of providing and placing concrete for partial depth portland cement concrete pavement repairs at various locations as specified in the plans. The Contractor shall be responsible for providing a performance concrete, as outlined in this specification, that allows the pavement repairs to be completed within the Maintenance and Protection of Traffic requirements of the contract plans. The Contractor may use a concrete mix conforming to §501-3.01 of the Standard Specifications or a rapid setting concrete repair material. However, this option shall be treated as the Contractor's concrete mix design and all requirements of this specification shall be applied.

## MATERIALS

Materials shall conform to the following specifications:

Portland Cement Concrete - General	501
Portland Cement Concrete Pavement	502
Rapid Setting Concrete Repair Material	701-09
Pre-molded Resilient Joint Filler	705-07
Portland Cement Mortar Bonding Grout	705-22
Membrane Curing Compound	711-05
Non-Chloride Accelerator Admixture	Approved List
Sandblasting Sand	No. 2 Sandblasting Sand

The Contractor shall be solely responsible for designing a concrete mix for the pavement repairs. In addition, the contract documents will provide any additional job specific requirements that shall be adhered to along with this specification.

The concrete mix design has two development phases; a design batch phase and a field batch phase. The design batch phase represents the laboratory preparation of the material. The field batch phase is the use of the material on the project site for pavement repairs.

### **Design Batching.**

Concrete mix designs to be used to make pavement repairs shall be submitted to the Regional Materials Engineer through the Engineer for acceptance. The following information will be used to ascertain the acceptability of concrete mix designs:

1. All materials used in the mix are from a NYSDOT approved source.
2. The design mix proportioning meets the design strength and material requirements as outlined below.
3. All necessary testing results have been provided.

Failure on the part of the Contractor to submit sufficient data to permit the Regional Materials Engineer to render an informed evaluation will result in the nonacceptance of design batch. Submitted concrete design batches and test results are for informational purposes only. The submission and acceptance of the concrete design batch does not relieve the Contractor of the responsibility of achieving the above specified design criteria. A minimum of six (6) working days will be needed to evaluate the acceptability of a design batch. The Engineer will notify the Contractor when a design batch is accepted by the Regional Materials Engineer.

### **Field Batching.**

No partial depth concrete pavement repairs may begin until the Contractor has an accepted concrete mix design and an accepted Quality Control Plan. The Contractor shall only use an accepted concrete mix design to complete pavement repairs. If in the opinion of the Engineer, an accepted non-standard mix design continually fails to achieve the specified strength properties the mix design shall be disapproved and any pavement repairs made rejected. The Contractor shall then return to the design batching phase to provide an acceptable mix design.

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### **Concrete Strength Requirement.**

The Contractor's field batch (regardless of the material option chosen) shall achieve a minimum compressive strength of 14 MPa after curing that allows the pavement repairs to be completed and opened to traffic within the Maintenance and Protection of Traffic requirements of the contract plans. In addition, the field batch shall have a minimum 28 day compressive strength of 21 MPa when Type III cement is used.

**The requirements of §501, Portland Cement Concrete - General, shall apply, except as modified in this specification.**

### **§501-2.01 Composition of Mixtures.**

The Contractor has three options for his concrete mix design -

#### OPTION A - Material Requirements

##### **Standard Concrete Mix:**

The Contractor may use a Class D concrete mix conforming to §501-3.01 of the Standard Specifications. This option shall be treated as the Contractor's concrete mix design and all requirements of this specification and section 501-3.01 of the Standard Specifications shall apply. If the Contractor chooses this option, the Contractor will not be required to submit any information already provided in §501-3.01 of the Standard Specifications.

Testing results for air content and slump shall be within the ranges outlined in tables 501-4 and 501-5 respectively. The Contractor shall reject any concrete material when the test results are not within the specified table ranges. No substitution for Class C concrete shall be allowed under this specification (note that a substitution in this case is represented by a non-standard concrete mix). The concrete shall meet the strength requirement after curing the concrete according to table 502-2 of the standard specifications.

#### OPTION B - Material Requirements

##### **Non-Standard Concrete Mix:**

The Contractor shall design a concrete mix that meets the following requirements:

- A. The coarse aggregate shall meet the requirements of table 501-2, type CA1.
- B. The design air content (entrapped plus entrained) shall be 7.5%. The field air content shall be a maximum of 9.0% and a minimum of 6.0%.
- C. The concrete mix design shall have a maximum water/cement ratio (weight) of 0.46.
- D. The design batch slump shall be 75 mm. The field batch slump shall be a maximum of 100 mm and a minimum of 40 mm.
- E. The Contractor's mix design shall determine the minimum curing period necessary for the mix or mixes to achieve the required compressive strength prior to opening the repaired pavement to traffic.
- F. The design batch shall achieve a minimum compressive strength of 15 MPa at the end of the select curing period and a minimum 28 day compressive strength of 30 MPa.
- G. The field batch shall meet the strength requirement of this specification.

Non-Standard Mix Design Properties	Minimum	Desired	Maximum
Slump	40 mm	-	100 mm
Air Content	6.0%	7.5%	9.0%
Design Batch, 28 day Compressive Strength	30 MPa	-	-
Design Batch, Selected Curing Period Compressive Strength	15 MPa	-	-
Field Batch, Selected Curing Period Compressive Strength	14 MPa	-	-
Field Batch, 28 day Compressive Strength (when type III used)	21 MPa	-	-

#### OPTION C - Material Requirements

##### **Rapid Setting Concrete Repair Material:**

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For repair areas having a length to width ratio of 1 ½ to 1 or less the Contractor may use a rapid setting concrete repair material conforming to section 701-09 of the Standard Specifications. For repair areas having a length to width ratio of 2 to 1 or greater the Contractor may select from the following (3) three rapid setting concrete repair material conforming to section 701-09 of the Standard Specifications. The Contractor may use any of the following (3) three rapid setting concrete repair material conforming to §701-09 of the Standard Specifications:

1. HD-50
2. Patchroc 10-60
3. L & M Durapatch HiWay

This option shall be treated as the Contractors concrete mix design and all requirements of this specification shall apply. If the Contractor chooses this option, the Contractor will not be required to submit any information for the design batch phase other than the supplier and material to be used.

The Contractor shall include in the Quality Control Plan, the manufacturer's instructions for preparing and placing the material. Testing results for air content and slump shall not be required. The concrete shall meet the strength requirement after curing the concrete according to the manufacturers recommendations. The Contractor shall reject any material not in conformance with the manufacturer's instructions and the quality control plan.

### **§501-2.02 Materials.**

*A. Cement:* Type I, II, I/II or Type III Portland cement may be used. In Addition, if Type III cement is used the Contractor shall be required to perform 28 day compressive strengths on all field batches.

*C. Admixtures:* Use only neutralized vinsol resin based air entraining agents. Water reducers, if used, must be Type A (Normal). Only non-chloride accelerators shall be used. No more than one type of non-chloride accelerator may be used in any mix design.

### **§501-3.04 Concrete mixing, Transporting and Discharge.**

**Apply the following addition to sections 3.04C Central Mixed Concrete, 3.04D Transit Mixed Concrete 3.04E Truck Mixed Concrete.**

#### Accelerator Solution added using Air Pressurized Tanks.

The truck mixer shall be equipped with air pressurized tanks meeting the following requirements:

- Sufficient capacity to supply the required solution quantity,
- Discharges the required solution quantity into the truck mixer drum in less than one minute,
- A tank output hose, made of clear plastic, leading into the truck mixer drum, and
- A properly working relief valve.

The non-chloride accelerator shall be added to the mix at the project location. The addition of the non-chloride accelerator shall be added only in the presence of the Engineer. For Central Mixed and Transit Mixed Concretes, after the addition of the non-chloride accelerator, the concrete shall be mixed as specified in table 501-9.

#### Accelerator Solution added by Contractor Method.

An alternate method for adding the non-chloride accelerator may be proposed in writing by the Contractor. The Regional Materials Engineer will review and accept or reject the Contractors proposed method.

**Apply the following additions to 3.04E, Truck Mixed Concrete.**

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Flow Meters. The Regional Materials Engineer will measure the actual flow rate, inspect, and approve flow meters prior to use. Truck mixers shall be equipped with in line water flow meters meeting the following requirements:

- Resets easily to "0",
- Mounted to allow easy reading,
- Withstands water temperatures up to 90 °C (for hot water additions only),
- Equipped with air strainers capable of removing entrapped air within the system,
- A batching delivery tolerance of 1% by weight or volume,
- A manufacturers certified flow rate capacity of 265 liters per minute (lpm), and
- A minimum actual flow rate of 190 lpm.

Batching and Mixing. Produce maximum concrete batches of 5 m<sup>3</sup> per truck. Incremental batch size increases of 0.5 m<sup>3</sup> are allowable provided the contractor demonstrates the ability to place larger batches. Larger batches must also meet all time requirements of the specification as determined by the Engineer.

Introduce the required amount of non-chloride accelerator solution into the air pressurized tank at the batch plant. Drain wash water from the truck mixer drum before charging.

Twice daily, or more frequently as ordered by the Engineer, determine the fine and coarse aggregate moisture content. Compute the corresponding water added to the concrete mix from the aggregate moisture in liters per cubic meter (l/m<sup>3</sup>). Subtract that quantity, as well as the water portion of the non-calcium chloride solution (l/m<sup>3</sup>), from the design water. Submit these calculations to the NYSDOT plant inspector for approval. Upon approval, write on the delivery ticket, the exact volume of water to be added to the mix at the job site. Upon arrival at the job site, submit the delivery ticket to the Engineer.

Before adding water into the truck mixer, execute twenty dry revolutions at 12 to 18 revolutions per minute (rpm) and reset the flow meter to zero. Add water in one complete uninterrupted operation.

No water is to be removed from the truck mixer for any purpose while water is being added to the drum. Discharge the non-chloride accelerator solution into the truck mixer drum after the required water designated on the delivery ticket has been added. Add the entire non-chloride accelerator solution in one complete, uninterrupted operation in one minute or less. Apply a minimum of 100 revolutions at 12 to 18 rpm before discharging. The maximum mixing period is 10 minutes.

Section 3.04 G Mobile Concrete Mixing Units shall not be allowed for this specification.

Section 3.04 H Small Construction Mixers shall be allowed for only Option C of this specification.

Small construction mixers or paddle mixers may be used to mix the concrete repair material. All mixers shall be subject to the Engineer's approval and be replaced when in the opinion of the Engineer that it is not working satisfactorily. The Contractor shall be responsible for ensuring that the mixer can mix the concrete repair material according to the manufactures instructions. Any repair material that does not achieve the desired results as determined by testing or the Engineer shall not be used to make repairs. The Contractor shall have a minimum of 60 minutes to prepare and place the repair material after mixing has been started.

### **Concrete Testing Requirements.**

The Contractor shall be solely responsible for testing all concrete placed under this specification. All testing Equipment shall be properly calibrated as per the appropriate ASTM procedures. No vibrating will be allowed for any testing procedures. All testing shall be completed by an ACI Certified Testing Technician(s), using all ASTM Standard procedures for concrete testing as outlined below. All testing will be witnessed by the Engineer or his

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designee. Any testing not witnessed by the Engineer or his designee will result in the rejection of the concrete placement. The Contractor shall notify and provide the Engineer with any assistance needed so the testing procedures can be witnessed. If in the opinion of the Engineer, the concrete material being used is not achieving the design properties additional testing may be ordered.

The following ASTM Standard Testing Procedures shall be used to test the concrete material:

1. **C39 Compressive Strength of Molded Concrete Cylinders.**

The Contractor or the Testing Facility shall have the capability of testing the compressive strength of the cylinders. The compression testing machine may not be used on department projects without prior approval by the Regional Materials Group. The Engineer will verify that the testing machine has been calibrated within the last 12 months.

The testing of the concrete cylinders shall be done at the end of the curing period for the concrete mix being used. According to table 502-2 for Standard mixes, based on the chosen curing time for Non-Standard mixes, and the manufacturer's instructions for repaired setting concrete mixes. The curing time shall begin for a truck or mixer load of concrete after the application of the curing compound to the pavement placement in which the truck or mixer load was used. The cylinders shall have the curing compound applied at the same time as the last pavement repair made for that truck or mixer load. All concrete cylinders cast for testing shall be cured with the same treatments and at a location near to the concrete placement for the chosen time period.

The concrete cylinders shall be cast according to the testing frequency for the chosen mix just prior to the completion of the pavement repairs or a cessation of work. The cast concrete cylinders represent the material used to make the pavement repairs. If the average compressive strength of the cylinders fails to meet the minimum design requirements then the Contractor shall reject all repairs made with that concrete material.

The Engineer will provide form BR 300 Concrete Cylinder Report in sufficient quantity to the Contractor. The Contractor shall complete the form(s) and return them directly to the Engineer for evaluation prior to final acceptance of any pavement repairs that the cylinders represent.

The Contractor shall cast an additional set of cylinders per placement if requested by the Engineer. The State reserves the right to conduct any additional testing needed to verify the mix design requirements.

2. **C143 Slump of Portland Cement Concrete**

3. **C192 Making and Curing Concrete Test Specimens in the Laboratory**

4. **C231 Air Content of freshly Mixed Concrete by the Pressure Method.**

The Contractor shall calibrate the air pressure meter at least once per week. The Engineer may require the Contractor to calibrate more frequently if in the opinion of the Engineer the equipment is malfunctioning. The Engineer may witness the calibration at any time.

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### **Testing Frequency.**

The Contractor may do additional testing and cast more cylinders than required however all results shall be applied to the repair work that the testing or cylinders represent.

### Standard Concrete Mix.

The slump and air content tests shall be completed for each truck of concrete. The Contractor shall be required to cast a minimum of one set of cylinders for the days placement with the understanding that the cylinders represent that days placement. If the cylinders fail to meet the minimum strength requirements, the pavement repairs made for that day shall be rejected by the Contractor and replaced at no cost to the State.

### Non-Standard Concrete Mix.

The Contractor shall complete all required testing for each truck load of concrete.

### Rapid Setting Concrete Repair Material.

The slump and air content tests will not be required. The Contractor shall be required to cast a minimum of one set of cylinders for the days placement with the understanding that the cylinders represent that days placement. If the cylinders fail to meet the minimum strength requirements, the pavement repairs made for that day shall be rejected by the Contractor and replaced at no cost to the State. The Contractor shall not be allowed to mix material solely to cast cylinders. The Contractor shall prepare enough material to cast cylinders in conjunction with the pavement repairs being made.

The Contractor shall provide the following information to the Engineer prior to beginning pavement repairs for a given work day:

1. The pavement repair location and area to be represented by each truck load or the days placement of concrete.
2. The volume of concrete needed to complete the repairs.
3. The time expected for completing the placement of the truck or mixer load(s) of concrete.
4. The Contractor shall provide any changes to the above information if a work stoppage occurs during a placement.

The Contractor shall note that this information will be used to determine pavement repair acceptability and rejection. Accuracy of the information provided is the responsibility of the Contractor.

Minor changes or fluctuations in admixture dosage rates and the addition of water will be permitted. Any tested truck load of concrete that is modified for any reason shall be retested. The retesting shall consist of an air test, slump test and a casting of cylinders for compressive strength determination. No other changes to an accepted concrete mix design shall be allowed.

### **CONSTRUCTION REQUIREMENTS**

**The requirements of §502, Portland Cement Concrete Pavement shall apply, except as modified in this specification.**

#### **§502-3 Construction Requirements.**

*3.01 Weather limitations:* Since the Contractor is responsible for the performance of the concrete material and it's placement, these weather requirements shall be altered to weather recommendations. Any pavement repairs damaged by the weather shall be rejected and corrected by the Contractor according to §502-3.15 Defective or Damaged Concrete.

*3.02 Equipment: A. Vibrators.* Hand held internal type vibrators having a maximum diameter of 25 mm and are capable of operating through a frequency range of 6000 - 9000 vibrations per minute shall be used to thoroughly consolidate the concrete, leaving the concrete free from honeycomb, for the full width and depth of the concrete placement.

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*3.03 Preparation of Subbase Course:* Replace with -

### **Preparation of Repair.**

The Contractor shall thoroughly sand or water blast all faces of the repair that will be in contact with the repair material such that uniformly abraded surfaces result, completely free of any dirt, loose particles, or oils. If sand blasting is to be used the Contractor shall provide a screen or other suitable devices to protect passing traffic. The Engineer will ascertain the suitability of the screen or device and accept or reject its use. The water blast Equipment shall be capable of producing a blast pressure of 20 to 40 MPa. To avoid damage to the remaining concrete, the equipment shall be capable of pressure adjustment to allow for the removal of only weakened concrete.

After sand or water blasting, the repair shall be air blasted to remove sand blast and any moisture from the repair area. The Engineer will check the air stream with a clean white cloth to ensure no oil or contaminants are in the air blast, prior to the air blasting of repair areas. This check will be conducted by the Engineer when the Engineer suspects the air blast may contain contaminants. If water blasting is used the Contractor shall provide a vacuum system to remove any residual water left after air blasting the repair area.

The Contractor shall re-prepare **any** location that the Engineer determines to be contaminated.

### **Apply Bonding Agent.**

Immediately before the bonding agent is applied, the Engineer or his designee will check the cleanliness of the receiving faces of the repair area by wiping them with a dark brown or black cotton cloth or glove. If any residue is found, the Contractor shall re-clean the repair bottom and vertical faces as described above. The Contractor may apply the bonding agent and place the repair material after receiving verbal approval on the cleanliness of the repair areas. The Contractor shall supply the Engineer with an adequate supply of dark brown or black cotton cloths or gloves for the duration of the contract to make this inspection of the repair areas.

The Contractor shall use portland cement mortar bonding grout for the repair material. Mix the grout in small quantities to limit waste and ensure freshly mixed grout is routinely placed. Evenly apply a thin coat of grout with a stiff bristle brush or broom to all surfaces receiving the repair material such that all cavities are coated. Slightly overlap the surrounding pavement surfaces. Do not apply bonding agent to the joint filler.

*3.06 Placing and Spreading Concrete:* In addition, No walking through vibrated concrete will be permitted. Concrete pavement repairs shall be one continuous placement at the repair location and no stopping of concrete placement will be permitted unless ordered by the Engineer. If a repair location can not be completed in one continuous placement, the concrete placed shall be removed and disposed of at the Contractors expense. The Contractor may deliver the repair material to the prepared area by wheelbarrows, buggies, or other transporting vehicles approved by the Engineer. Shovels can be used for very small patches. The Contractor shall place the repair material before the bonding agent has dried or the repair shall be re-cleaned. Slightly overfill the repair area and vibrate the material.

*3.08 Joints:* Joints that lie within the repair areas shall be reformed as specified in this specification or as directed by the Engineer. Make any additional saw cuts necessary to achieve the required dimensions for placing the filler. Make necessary saw cuts before cleaning the repair bottom and vertical faces. The Contractor shall not make saw cuts at or greater than half of the slab depth at transverse or longitudinal joints to prevent damage to load transfer and slab tying devices. Any difficulties in reforming joints shall be addressed as directed by the Engineer. The Contractor may leave the filler in place after the repair is complete, however the filler material shall not interfere with the sealing of the joint.

Place a pre-molded resilient joint filler material into the joint that abuts or traverses the repair area. Use a filler of the same thickness as the joint width,  $\pm 3$  mm, to re-establish the joint through the repair. Place the insert such that it extends 25 mm below and beyond the repair area and restricts repair material from

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entering the joint.

The Contractor shall be responsible for making an initial saw cut (Stage I) along any joints that are filled with concrete repair material. An early entry or a green cut saw approved by the Director of Materials Bureau equipped with diamond saw blades, blade guards, depth of cut controls and guides that are capable of making straight cuts to the dimensions shown on the contract plans shall be used. The cost for the stage I saw cut shall be included in this concrete placement item. Damage to the Pavement resulting from improper saw cutting, as determined by the Engineer, shall be repaired according to §502-3.15 Defective or Damaged Concrete.

*3.09 Finishing and texturing:* The Contractor shall submit to the Engineer for approval a list of equipment, as part of the Quality Control Plan, to be used on the project. If the pavement will be diamond ground as part of the contract, leave the repair material at or slightly higher (3 mm maximum) than the surrounding pavement. If the pavement will not be diamond ground, finish the repair area to meet the surrounding pavement surface elevation. Keep hand finishing to a minimum. Hand trowel from the center of the patch outward toward the edges. No additional water shall be added to the repair surface.

*3.10 Curing:* The pavement shall be cured in accordance with § 502-3.10A. Use any atomizing mechanical sprayers capable of exerting consistent pressure without hand pumping. The applicators shall be equipped with tank agitators to continuously mix the curing compound. Use nozzles with spray shields to prevent drift. Flush nozzles daily before use and keep an adequate supply of spare nozzles on the project site.

*3.13 Surface test:* In addition, if the portland cement concrete pavement will be diamond ground as part of the contract, the contractor shall meet the requirement of this section prior to the diamond grinding treatment.

*3.16 Thickness Tolerance:* This section will not apply to this specification.

### **Quality Control Plan.**

The Contractor shall prepare a Quality Control Plan for the project. The Quality Control Plan must outline a detailed description of the Contractor's concrete quality control system. Guidelines for preparing a Quality Control Plan are provided in the special notes of the contract proposal. This system must provide reasonable assurance that the quality of the materials and the completed construction conforms to the contract specifications. The Contractor shall submit the Quality Control Plan to the Engineer in charge. A minimum of 10 days will be required by the Regional Materials Engineer for each review of the Quality Control Plan. The Contractor shall address or modify any testing procedures deemed necessary by the Regional Materials Engineer. The Engineer in charge will notify the Contractor in writing of the acceptance of the Quality Control Plan. The Contractor shall post a copy of the Quality Control Plan in the Engineer's field office for use by State personnel.

The Contractor shall appoint a Quality Control Plan Administrator to act as a point of contact for State personnel and to oversee the implementation of the Quality Control Plan.

The Contractor shall follow the Project Plans, Specifications and the accepted Quality Control Plan. Any work not in conformance with the above requirement shall be rejected by the Contractor's Quality Control Plan Administrator. Rejected work shall be corrected by the Contractor according to §502-3.15 Defective or Damaged Concrete at no cost to the State of New York. In addition the Engineer in Charge may reject any work not in conformance with the above requirements.

### **Opening Pavement Repairs To Traffic.**

The Contractor shall be responsible for completing and opening the pavement repairs within the maintenance and protection of traffic guidelines specified in the contract plans.

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Failure of the Contractor to meet the minimum strength requirement (14 MPa) and in addition when Type III cement is used the minimum 28 day strength requirement (21 Mpa) for the concrete pavement repairs shall not relieve the Contractor of his/her responsibility to re-open the roadway to traffic as outlined in the contract plans. Concrete pavement, represented by the cylinders cast, that has **not** achieved the minimum compressive strength and must be opened to traffic shall be deemed defective and repaired according to §502-3.15 Defective or Damaged Concrete.

Any concrete pavement repairs that crack, spalls or fails for any reason prior to the acceptance of the project shall be deemed defective and repaired according to §502-3.15 Defective or Damaged Concrete.

### **METHOD OF MEASUREMENT**

The Engineer will calculate the volume of concrete in cubic meters placed, based on the approved pavement repair plan and the field measured depth of the pavement repair.

### **BASIS OF PAYMENT**

The unit price bid per cubic meter for this item shall include the cost of all materials, equipment, and labor necessary to; design the concrete mixes, complete laboratory testing, prepare and implement a quality control plan, mix, place, test, finish, cure and make the stage I saw cut for the concrete pavement repairs.

This specification is  
DisApproved