

ITEM 04502.8005 M - CONCRETE PLACEMENT FOR PCC PAVEMENT REPAIRS - PARTIAL DEPTH

DESCRIPTION

This work shall consist of concrete placement for partial depth portland cement concrete pavement repairs at various locations as specified in the plans. The Contractor shall use only his submitted and accepted concrete mix design or Rapid Setting Concrete Repair Material to make any partial depth pavement repairs, unless otherwise noted or restricted by the contract plans.

MATERIALS

Materials shall conform to the following specifications:

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

§501-2.02 Materials.

A. *Cement:* Type I, II, I/II or Type III Portland cement may be used. Type III cement, if used, shall have 10% minimum C3A content, a Blaine fineness greater than 500 m²/kg, and water soluble alkalies less than 0.4%.

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 and only one type of non-chloride accelerator at any one time.

§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.

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

Air Pressurized Tanks For Accelerator Solution.

- 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.

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

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 m³ per truck. Incremental batch size increases of 0.5 m³ are allowable provided the contractor demonstrates the ability to place larger batches in a trial as detailed in 'Trial Placement' below. 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/m³). Subtract that quantity, as well as the water portion of the non-calcium chloride solution (l/m³), 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 3.04G Mobile Concrete Mixing Units shall not be allowed for this specification.

Section 3.04H Small Construction Mixers.

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 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 to meet the design requirements of the mix. Any concrete 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 60 minutes to place a load of the repair material after mixing has been completed.

Design Requirements. The contractor shall design a mix that will achieve a minimum field compressive strength of 14MPa prior to opening the repaired pavement to traffic and must also meet the following requirements:

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- The course aggregate shall meet the requirements of table 501-2, type CA1.
- 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%.
- The concrete mix design shall have a maximum water/cement ratio (weight) of 0.46.
- The design slump shall be 75 mm. The field slump shall be a maximum of 100 mm and a minimum of 40 mm.
- The **design** and **trial** batch concrete mixes shall have a compressive strength of 15 MPa at the end of the curing period that the Contractor proposes to open the pavement to traffic and a minimum 28 day compressive strength of 30 Mpa.
- The Contractor's mix design shall determine the minimum curing period necessary for the mix to achieve the required compressive strength of 15 Mpa (design and trial) and 14 MPa (field) prior to opening the restored pavement to traffic.

Property	Minimum	Desired	Maximum
Slump	40 mm	-	100 mm
Air Content	6.0%	7.5%	9.0%
Compressive Strength (Design & Trial Batch)	15 MPa		
Compressive Strength (Field Batch)	14 MPa		
Compressive Strength (28 Day)	30 MPa		

Design Batch. The proposed concrete mix design shall be mixed and tested by an ACI Certified Technician. The test results shall be submitted to the Regional Materials Engineer for evaluation and acceptance. The testing shall use the following ASTM Standards for:

1. C39 Compressive Strength of Molded Concrete Cylinders.
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 test results submitted for evaluation shall provide the following information:

1. Concrete mix proportions
2. Source of all materials, eg. Cement, aggregates and admixtures.
3. Tested air content
4. Tested slump
5. Compressive strength of two sets of cylinders (one set consist of two cylinders), one set cured for the number of hours the mix is designed for (Based on the curing period used by the Contractor to achieve the 15 MPa compressive strength) and the other set cured for 28 days.

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 disapproval of the mix design. Submittal of the mix design and test results to the Regional Materials Engineer are for informational purposes only. The submittal and acceptance of the concrete mix design does not relieve the Contractor of the responsibility of achieving the above specified design criteria. If at any time the concrete mix does not achieve the specified design criteria the Regional Materials Engineer or the Engineer in Charge can terminate concrete placement operations and the Contractor shall follow the above procedures to provide an acceptable mix. The Contractor shall only use an accepted mix design at the locations indicated on the contract plans.

Trial Batch: A minimum of one week prior to the commencement of repair operations, The Contractor shall prepare a trial batch for each of the accepted mixes to be used on the project. The trial batch shall demonstrate

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the mixes ability to achieve the specified properties to the Regional Materials Engineer's satisfaction. The trial batch shall use the same (1) materials, (2) mixing, transporting, and discharging methods, (3) placement and finishing methods and (4) curing methods as those to be used on the project.

Field Batch: After receiving the Regional Material Engineer's acceptance of the trial batch the Contractor may begin concrete pavement repair work. Changes other than minor fluctuations in admixture dosage rates will require a new mix design. The Engineer may halt paving and order additional trial batches whenever the specified properties are not achieved. Failure of accepted mix designs to achieve the specified properties shall result in the disapproval of the mix and the contractor shall provide a new mix design following the above procedures.

Rapid Setting Concrete Repair Material

The Contractor shall only use cementitious repair products with a laboratory initial minimum set time of 10 minutes that appears on the Materials Bureau's Approved List. The Contractor shall provide to the Engineer a complete set of manufacturers instructions for mixing, bonding placing, and curing the material. The Contractor shall follow the manufacturers instructions and not exceed the prescribed water amount.

To extend the concrete repair material use a type CA1 course aggregate meeting the gradation requirements of table 501-2. Use a maximum aggregate extension rate of 60% of the dry pre-packaged weight of the repair material. Determine the aggregate moisture content and adjust the mix water added accordingly.

CONSTRUCTION REQUIREMENTS

Reforming Joints - Joints that lie within the repair areas shall be reformed as specified in this specification or as directed by the Engineer. 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, ± 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 entering the joint.

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 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.

Preparation of Repair - The Contractor shall thoroughly sand 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. High pressure water blasting may be required where dust control is critical as determined by the Engineer. After sand 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. The Contractor shall re-prep **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.

Use portland cement mortar bonding grout if the repair material is concrete mix designed by the Contractor. Mix the grout in small quantities to limit waste and ensure freshly mixed grout is routinely placed. Evenly apply a thin coat

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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.

Follow the manufacturer's instructions regarding the type and application of bonding agent for all other repair materials.

Placement - Use wheelbarrows, buggies, or other transporting vehicles approved by the Engineer to bring the repair material to the prepared area. Use shovels for very small patches. Place the repair material before the bonding agent has dried. Slightly overfill the repair area. Vibrate the material with a spud vibrator having a diameter less than 25 mm and capable of operating through a frequency range of 6000 - 9000 vibrations per minute.

Finishing - 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.

Curing - Thoroughly coat the surface of the concrete repair material with a curing compound meeting the requirements of §711-05, Membrane Curing Compound at a minimum rate of 3.5 m²/l Cure other materials in accordance with the manufacturer's instructions.

Concrete Testing Requirements. The Contractor shall be responsible for all testing. The Contractor shall submit a detailed outline of the testing procedure, to be used on the project, to the Engineer at the project pre-construction meeting for evaluation and acceptance by the Regional Materials Engineer. The plan submitted shall include a minimum of the following:

1. The ACI Certified Testing Technician(s) (including copies of certification).
2. Location of testing facilities.
3. How the Contractor intends to allow for state witnessing of the testing procedures.
4. General outline of how testing will be conducted during the project (ie. testing times).
5. The manner in which test results will be documented to the Engineer for final acceptance of repairs.

The Contractor shall provide any additional information to the Engineer at the pre-construction meeting to aid in the evaluation of the testing procedure by the Regional Materials Engineer. The Contractor shall address or modify any testing procedures deemed necessary by the Regional Materials Engineer.

All testing shall be completed by an ACI Certified Testing Technician(s), using all ASTM Standard procedures for concrete testing and as outlined above. The Contractor shall notify the Engineer and provide the Engineer with any assistance needed so that the testing procedure can be witnessed by the Engineer or his designee. All testing results shall be sent directly to the Engineer for evaluation and acceptance. Any concrete mix failing to meet the design requirements or not witnessed by the Engineer or his designee will result in that concrete placement being rejected and repaired according to §502-3.15 Defective or Damaged Concrete.

All the above testing shall be completed for each truck load of concrete. The testing of the concrete cylinders shall be governed by the curing time of the designed mix to reach the 14 MPa compressive strength. The curing time shall begin for a truck load of concrete after the application of the curing compound to the pavement placement in which the truck load was used.

When small construction mixers are allowed to be used, the slump and air content testing shall be completed for each mixer load. The Contractor shall complete one compressive strength test for all repair placements within that work day. The mixer load to be used for the compressive strength testing will be determined by the Engineer.

The cylinders shall have the curing compound applied at the same time as the pavement placement. All concrete cylinders cast for testing shall be cured with the same treatments and at a location near to the concrete placement for

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the chosen time period. 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.

Opening Pavement To Traffic. The Contractor shall be responsible for completing the pavement repairs within the maintenance and protection of traffic guidelines, specified in the contract plans. Incomplete repairs shall not relieve the contractor of his/her responsibility to re-open the roadway to traffic as outlined in the contract plans.

Failure of the Contractor to meet the minimum strength requirement (14 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 of the standard specifications.

Any concrete pavement repairs that crack, debond or spall 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

This work shall be field measured to compute the number of cubic meters placed at each pavement repair location as indicated in the plans or where specified by the Engineer.

BASIS OF PAYMENT

The unit price bid per cubic meter for the above work shall include the cost of all materials, equipment, and labor necessary to complete the work, including all design, trial and field batching of concrete mixes with all laboratory testing required, preparation of the repair location for the repair material and the placement, finishing, and curing of the concrete pavement repair material.