

**ITEM 01203.029988 M - PAVEMENT EXCAVATION USING THE LIFT-OUT METHOD**

**DESCRIPTION:**

The Contractor shall remove and dispose of existing concrete pavement as shown on the Contract Plans or as ordered by the Engineer using the lift-out method.

**MATERIALS:**

Not specified.

**CONSTRUCTION DETAILS:**

The Contractor shall remove and dispose of existing cement concrete pavement using the lift-out method in a manner which does not disturb the existing subbase material, curb or drainage structures. The removal shall be performed by saw cutting the existing concrete pavement full depth around the area to be removed, drilling and inserting lift pins, lifting out the pavement and disposing of the concrete pavement in a manner acceptable to the Engineer. Other equivalent non-destructive means of lifting-out pavement may be used if determined acceptable by the Engineer.

Any curb, drainage structure or other appurtenance, damaged during the course of this work shall be replaced in kind by the Contractor at his expense.

Any adjacent pavement spalled or damaged by the Contractor's operations shall be sawcut, removed and replaced at the Contractor's expense.

**METHOD OF MEASUREMENT:**

Pavement excavation using the lift-out method shall be measured by the number of square meters of pavement removed and disposed of as shown on the Plans or as ordered by the Engineer.

**BASIS OF PAYMENT:**

The unit price bid for this item shall include all labor, materials and equipment necessary to remove and dispose of the pavement, mesh reinforcement, transverse joints and longitudinal ties.

This price shall include the cost of sawcutting the pavement, drilling holes for lift pins and the cost of disposing of the pavement.

**ITEM 01502.6029 M - CEMENT CONCRETE WITH NON-CHLORIDE ACCELERATOR FOR RIGID PAVEMENT SLAB REPAIRS**

**DESCRIPTION**

Construct a high early strength portland cement concrete (PCC) pavement repair using non-chloride accelerator. Repair areas shall be indicated on the plans or as ordered by the Engineer.

**MATERIALS**

Portland Cement	Type III	701-01
Fine Aggregate		703-07
Coarse Aggregate	Type CA 2	501-2.02 B.2
Water		712-01
Air Entraining Agent	(Neutralized Vinsol Resin based only)	711-08
Membrane Curing Compound	White Pigmented	711-05
Polyethylene Film		ASTM C171
Non-Chloride Accelerator		Approved List

**Insulating Materials:** The insulating materials shall be 50 mm thick closed cell extruded polystyrene insulation board conforming to the requirements of ASTM C578 and having a certified total R-value of not less than ten, or insulating blankets found in Section 29a of the Approved List.

**Stockpiling Aggregates:** The requirements of Subsection 501-3.03A-Stockpiles will apply, with the following modifications for mobile mixer units and/or truck mixers.

- A. Unless otherwise approved by the Regional Director, the fine and coarse aggregates shall be stockpiled at the work site.
- B. The stockpiles shall be covered.
- C. The free moisture of each aggregate type, at the time of batching, shall not exceed 7% of the saturated surface dry weight of the fine or coarse aggregate or 8% total for both aggregates.

**Proportioning Concrete:**

**Mix Design and Trial Batch.** Develop a mix design and prepare a trial batch using those materials to be used on the project. Demonstrate the mix's ability to achieve the specified properties to the Regional Materials Engineer's satisfaction. Changes other than minor fluctuations in admixture dosage rates will require a new mix design. The Engineer may halt placement and order additional trial batches whenever the specified properties are not achieved.

The mix must meet the following requirements:

- A. Cement content 490 kg/m<sup>3</sup>
- B. The final water cement ratio, by weight, (including water in the accelerator solution and aggregate free surface moisture) shall be a maximum of 0.39 for mobile mixers or a maximum of 0.41 for truck mixers.

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C.

	<b>Min.</b>	<b>Desired</b>	<b>Max.</b>
Slump, millimeters	51	77	103*
Air Content, percent	4.0	6.0	7.5
*113 mm for truck mixers			

D. Compressive strength, 21 MPa in a maximum of twenty four hours.

Alternate mix designs will be considered provided the contractor demonstrates the ability to meet the requirements of this specification to the Regional Materials Engineer’s satisfaction.

**Equipment** All equipment proposed for use shall have the Engineer’s approval prior to the start of the work. The specific method and equipment that the Contractor proposes to use for finishing will be subject to the approval of the Regional Construction Engineer. Specific equipment requirements follow:

**Placing and Finishing.** This shall meet the requirements of Subsection 502-3.06 except a finishing machine shall be required only for pour areas exceeding 46 m<sup>2</sup>.

**Surface Texturing Equipment.** The specific equipment to be used, if this is to be the finished surface shall be approved by the Engineer. Prior to approval the Contractor shall demonstrate to the Engineer’s satisfaction that the equipment is capable of providing the required surface texture, otherwise a float finish shall be provided.

**Concrete Mixing, Transporting and Discharge.** The Contractor shall have the option of using Central Mixed Concrete, Truck Mixed Concrete or Mobile Mixed Concrete. If Mobile Mixed Concrete is to be placed in an area exceeding 28 m<sup>2</sup> the Contractor shall request approval of the Regional Construction Engineer in writing. The Contractor shall be required to supply additional Mobile mixers to ensure continuous production by two Mobile Mixers operating simultaneously. The Contractor shall also supply sufficient equipment and personnel to ensure prompt placement of the concrete produced. The mixing method shall be selected by the Contractor, prior to concrete placement. No change in mixing method will be allowed once the Engineer has been informed of selection.

**Central Mixed Concrete.** Section 501 of the Standard Specifications shall apply, together with the following modifications:

**Quantity:** The maximum quantity of concrete to be delivered to the project shall not exceed 8.0 m<sup>3</sup>.

**Truck Mixed Concrete.** Section 501 of the Standard Specifications shall apply, together with the following modifications:

A. Physical Requirements:

1. Flow Meters. Truck mixers shall be equipped with in line water flow meters capable of being easily reset to “0”, of withstanding water temperatures of up to 93EC and have a manufacturer’s certified flow rate capacity of 265 liters per minute. The flow meters shall be

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mounted in such a manner as to allow the Engineer easy access for reading the meter.

The flow meters will be inspected and approved by the Regional Materials Engineer prior to their being approved for contract work. The batching delivery tolerance for the water flow meter shall be 1% by weight or volume. The actual flow rate as measured by the Regional Materials Engineer shall not be less than 190 liters per minute. The flow meters shall be equipped with air strainers capable of removing all trapped air in the system.

2. Air Pressurized Tanks for Accelerator Solution. Truck mixers shall be equipped with air pressurized tanks having a capacity sufficient to meet the accelerator solution design needs of the mix. The air pressurized tank shall be capable of discharging the design quantity of accelerator solution into the truck mixer drum in less than 1 minute. The tank's output hose leading into the truck mixer drum shall be made of clear plastic. The air pressurized tank shall be equipped with a properly working relief valve.

B. Quantity: The maximum quantity of concrete to be produced at any one time by truck mixer shall be 5.0 cubic meters.

C. Batching and Mixing: The Contractor shall batch and operate their truck mixers in accordance with Subsection 501-3.04E Truck Mixed Concrete. The prescribed amount of accelerator solution to be used shall be introduced into the air pressurized tank at the batch plant.

Immediately prior to the batching of each truck, the Contractor shall make a determination of the total moisture content of the coarse and fine aggregate and compute the quantity of water contained by both aggregates in liters per cubic meter of concrete. That quantity, as well as the quantity of water present in the accelerator solution, shall be subtracted from the design water. After completion of water content data, the Contractor shall submit the data and calculations to the State representative at the concrete plant for review and approval.

Upon approval, the Contractor shall indicate in writing on the delivery ticket the exact number of liters of water to be added to the mix at the job site. Upon arrival at the job site, the driver shall give the delivery ticket to the Engineer. Before the addition of water into the truck mixer, the Contractor shall execute 20 dry revolutions and reset the flow meter to zero.

The water shall be added in one complete uninterrupted operation. No water is to be removed from the truck mixer for any purpose whatsoever, while water is being added to the drum. The accelerator solution shall be discharged into the truck mixer drum after the water quantity designated on the delivery ticket has been added to the concrete.

The mixing cycle shall be executed at the rate of twelve to eighteen rpm.

**Mobile Mixer Units**. A sufficient number of mobile mixers shall be supplied to provide for placement of concrete without formation of cold joints. Delays during placement greater than ten minutes shall be considered that time in which a cold joint will form. Concrete with cold joints shall be replaced or repaired as determined by the Engineer, at the Contractor's expense.

Mobile mixing units shall appear on the Department's Approved List and be subject to the following requirements:

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- A. Each unit shall be self-propelled. Each unit shall be capable of carrying sufficient unmixed material to produce on site, no less than 4.5 cubic meters of specialized concrete.
- B. Each unit will be inspected by the Engineer. Units not functioning in a manner the Engineer considers acceptable shall be repaired. If repair is impractical, the unit shall be replaced. All costs associated with delays attributable to mobile mixer replacement shall be borne by the Contractor. No extensions of time, for the purpose of replacing unacceptable mixers, will be granted. Conditions which will automatically designate a unit unacceptable are: hydrated cement deposits; broken, bent, loose or scalloped mixing paddles; mixing paddles worn 20 percent in any dimension; mixing paddles heavily caked with mortar; and admixture or water delivery system out of tolerance.

- C. Proportioning devices shall deliver the materials within the following tolerances (by weight):

Coarse Aggregate	+/- 2%
Fine Aggregate	+/- 2%
Cement	0% to +4%
Other Admixtures	+/- 3%
Water	+/- 1%

The quantity of cement introduced into the mix shall be measured by a meter which is clearly visible and kept clean at all times. The quantity of cement shall be recorded by a ticket printer. The recordation may consist of a print of the number of revolution counts of the cement feeder.

- D. There shall be positive control of the flow of water into the mixing chamber. Water flow shall be indicated by a flowmeter and readily adjustable to provide for minor variations in aggregate moisture. The system shall be equipped with a bypass valve, or hose, for determining proportioning accuracy.

The mixers shall provide positive control of the flow of the air entraining admixture and the accelerator solution admixture into the mixing chamber. Flow meters shall be used to control the quantity of admixture added to the mix.

The system shall introduce the accelerator solution and the air entraining agent at two separate points in the mixing auger. The accelerator solution shall be introduced at the same point as the mixing water. The air entraining agent shall be separated from this point by a distance of 300 mm. This separation shall be accomplished by the extension of the tube carrying the air entraining agent in a manner satisfactory to the Regional Materials Engineer. The system shall be capable of adding admixture in the amounts necessary to achieve the required air content, and accelerator solution percentage. The system shall be equipped with a bypass valve suitable for obtaining a calibrated sample of admixture to determine batching accuracy.

- E. The units shall be capable of combining aggregates, cement, admixtures and water into a thoroughly mixed and uniform mass. Discharging the mixture shall be accomplished without segregation.

- F. The units shall be made available to the Regional Materials Engineer for calibration tests in accordance with Department written instructions. The Materials Engineer shall have at least two working days for the calibration of each unit the Contractor proposes to use. The Contractor shall notify the Engineer and Materials Engineer, in writing, at least one week in advance of the dates each unit will be available for calibration. No calibration shall be performed while it is raining.

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**Mixer Unit Testing.** Calibration and yield tests shall be performed by the Regional Materials Engineer according to the Department's written instructions, with the cooperation of the Contractor as required:

- A. The Contractor shall supply sufficient quantities of cement, fine aggregate, coarse aggregate, water and admixture for the tests. Materials supplied shall be of the same type and size as well as from the same source as those materials which will be used to produce the concrete.

The Contractor shall supply 900 mm x 900 mm x 225 mm container to be used for a yield test.

The Contractor shall supply a portable scale of at least 25 kg capacity, and 2 containers of sufficient capacity to obtain cement samples of as much as 85 kg each. Two 25 kg weights for determining scale accuracy shall also be supplied.

- B. The Regional Materials Engineer will supervise proportioning and yield tests as part of the calibration tests. The proportioning test will consist of weighing each component to verify the proposed gate settings and the implementing of any necessary adjustments.

After this initial calibration additional full or partial calibrations may be required by the Engineer as follows: whenever major maintenance operations occur in the mobile mixing unit, whenever the unit leaves and returns to the job site, or whenever material proportioning becomes suspect.

**Test Equipment.** The Contractor shall furnish a recording thermometer to monitor batch temperature. No contract work under this item will be permitted until the Engineer possesses the thermometer, it shall be capable of recording temperatures in the -1E C to 77 EC range.

**CONSTRUCTION DETAILS**

**General.** All the requirements of Subsection 502-3 Construction Details shall apply except where modified in this specification.

The locations to be repaired shall be shown on the plans or will be designated by the Engineer. Repairs shall conform to the details shown on the drawings.

A 0.102 mm polyethylene film shall be installed to act as a bond breaker where required by this item, or where directed by the Engineer. On concrete repair areas greater than 5.0 meters in length, a 12.5 mm piece of bituminous expansion material shall be placed at one end of the repair area.

**Forms.** Forms shall meet the requirements of Subsection 502-3.04 or shall be approved as ordered by the Engineer.

**Concrete Placement.**

**General.** The temperature of the concrete at the point of discharge shall be between 35E C and 40E C. The Contractor shall heat the mixing water as necessary to achieve this discharge temperature.

The maximum time permitted from the end of mixing to the completion of concrete discharge shall be sixty minutes. All concrete remaining in the drum after that time interval shall be rejected and removed from the work site.

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If the initial measured slump is less than 51 mm, and in the opinion of the Engineer the concrete cannot be placed and finished in an acceptable manner, the Engineer may allow the Contractor to add water to the drum. The quantity of additional water will be between 4 and a maximum of 6 liters for every cubic meter of concrete remaining in the drum at the time of the addition. No more than one addition of water shall be permitted. After this addition, the concrete shall be mixed at least thirty revolutions at a mixing speed of 12 to 18 rpm.

Concrete shall be placed meeting the requirements of Subsection 502-3.06. Concrete may be placed directly from an approved mixer. Chutes used to place the concrete in final position shall be steel lined. The concrete shall be consolidated by internal vibration following Standard Specifications 502-3.06 Vibrating.

Concrete shall be finished with equipment meeting the requirements of Subsection 502-3.09. Finishing shall be done in accordance to Section 502-3.09.

The Contractor is advised that the design of this concrete will be such that initial set will take place within thirty to fifty minutes from the time of mix completion. To insure that the concrete is discharged and placed in the shortest possible time, the Contractor is advised to have a sufficient labor force available to insure the rapid and expeditious incorporation of the concrete into the project.

Under no circumstances shall the Contractor use more than one truck per repair area unless the second truck is standing by and has commenced its mixing cycle.

**Cylinder Testing.** During the first day of production, six 150 x 300 mm cylinders will be taken by the Engineer during placement of a representative repair area and immediately placed in autogenous (insulated) curing boxes furnished by the Engineer.

The cylinders will be tested by the Engineer for compressive strength, while simultaneously recording the temperature of the repair area. From these cylinders, the Engineer will determine at what corresponding repair temperature a cylinder compressive strength of 14 MPa has been achieved. The approximate strength of future repairs will be determined by this temperature. In addition to the initial set of six cylinders, the Engineer reserves the right to require additional cylinders to be taken for testing.

**Curing.** As soon as set has occurred, the repair shall be covered by a 0.102 mm thick polyethylene sheet and thermal insulating board conforming with the material section of this specification.

The polyethylene and insulated blankets and/or insulating boards shall extend a minimum of 300 mm beyond the edges of the placement. They shall be securely weighted down to prevent the uncovering of the concrete.

Particular care shall be taken to ensure that the edges of the insulating material are weighted sufficiently to ensure direct contact with the existing concrete surrounding the repair and to prevent wind intrusion beneath the polyethylene vapor barriers.

The insulation blankets and/or boards shall be weighted down with sand bags weighing a minimum of 7 kg each. The sand bags shall be placed 600 mm on center, beginning at the edges and proceeding inward in a grid pattern over the entire patch area.

The recording thermometer shall then be placed under the insulation boards at least 300 mm inward from the repaired edge to obtain an accurate concrete surface temperature.

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**Opening to Traffic.** When the repair area has achieved the temperature requirement established by the cylinder testing, approximately 60E C, the polyethylene vapor barrier and polystyrene insulation boards shall be removed.

Concrete placement operations shall be timed within the workday such that the required temperature and curing is achieved at the time specified on the plans for opening the repaired area to traffic.

**METHOD OF MEASUREMENT**

Measurement will be taken as the number of square meters of field measured plan area of concrete placed.

**BASIS OF PAYMENT**

The unit price bid per square meter shall include the cost of finishing all labor, materials, and equipment necessary to complete the work, including cleaning and blast cleaning. All saw cutting and concrete removal will be paid for under their appropriate items.

**ITEM 04502.8026 M - PAVEMENT REMOVAL FOR FULL DEPTH PCC PAVEMENT REPAIRS**  
**- LIFT OUT METHOD**

**ITEM 04502.8027 M - PAVEMENT REMOVAL FOR FULL DEPTH PCC PAVEMENT REPAIRS**  
**- EXCAVATION METHOD**

**DESCRIPTION**

This work shall consist of removing and disposing pavement for full depth pavement repairs at various locations or where directed by the Engineer.

**MATERIALS**

(None Specified)

**CONSTRUCTION DETAILS**

The Contractor shall use the lift out method to remove concrete pavement for full depth pavement repairs. The Contractor shall use the excavation method in place of the lift out method for the following types of removal:

1. When the concrete slab is asphalt covered and/or broken into small pieces.
2. The concrete pavement has been replaced with full depth asphalt.
3. When directed by the Engineer.

Areas where the excavation method may be used are indicated in the contract plans, however not all location may have been identified due to field conditions. Once the pavement has been evaluated and marked out, the removal method will have been determined as outlined above. The unit price bid for these items shall reflect any changes due to field conditions.

**Lift out Method** - The removal shall be accomplished by inserting lift pins into the pavement sections, lifting out the pavement sections and disposing of the concrete pavement sections. The Contractor shall make any intermediate full depth saw cuts needed to facilitate the removal of the concrete pavement. No over sawing shall be allowed for any intermediate cuts. If in the opinion of the Engineer the removal needs to be safer, the Contractor shall make the pavement removal sections smaller. Other equivalent non-destructive means of pavement removal may be used if acceptable to the Engineer.

**Excavation Method** - Pavement breakers or methods that break the pavement into smaller pieces shall not be permitted. The removal shall be accomplished by any other suitable means that does not damage the subbase materials. The Engineer shall be notified of the excavation method to be used. The Engineer will inform the Contractor if the method is acceptable. The Contractor shall not use a method unacceptable to the Engineer.

Some disturbance or removal of the subbase material is expected and shall be repaired as detailed in the contract plans. Any repair of the subbase material shall be in conformance with the standard specifications, section 203-3.12 "Compaction".

**Shoulders** - The Contractor shall inform the Engineer of any work needed in the shoulder areas to facilitate the pavement removal. The Contractor shall restore the shoulder to the satisfaction of the Engineer. The Contractor shall have the approval of the Engineer prior to being any needed shoulder work.

**Damage** - Any adjacent pavement, subbase material, curb, drainage structure or other appurtenance that are to remain in place and are damaged by the removal operation shall be replaced in kind by the Contractor at his expense. Any disturbed subbase materials shall be compacted in conformance with the standard specifications, section 203-3.12 "Compaction".

**Disposal** - The Contractor shall be responsible for the disposal of all pavement and subbase materials removed to complete full depth pavement repairs. The disposal of all removed material shall be accomplished in a manner acceptable to the Engineer.

**ITEM 04502.8026 M - PAVEMENT REMOVAL FOR FULL DEPTH PCC PAVEMENT REPAIRS  
- LIFT OUT METHOD**

**ITEM 04502.8027 M - PAVEMENT REMOVAL FOR FULL DEPTH PCC PAVEMENT REPAIRS  
- EXCAVATION METHOD**

**METHOD OF MEASUREMENT**

This work shall be the number of square meters of pavement removed and disposed in accordance with the plans, this specification and as directed by the Engineer.

**BASIS OF PAYMENT**

The unit price bid shall include the cost of all labor, materials, and equipment necessary to complete the work in accordance with this specification. In addition, the work shall include the cost of all intermediate saw cuts and shoulder work needed to facilitate pavement removal. Any subbase repairs up to a maximum depth of 100 mm, unless otherwise ordered by the Engineer, will be made under the items provided in the contract plans.

<b>ITEM</b>	<b>DESCRIPTION</b>	<b>UNITS</b>
<b>04502.8026 M</b>	PAVEMENT REMOVAL FOR FULL DEPTH PCC PAVEMENT REPAIRS - LIFT OUT METHOD	<b>SM</b>
<b>04502.8027 M</b>	PAVEMENT REMOVAL FOR FULL DEPTH PCC PAVEMENT REPAIRS - EXCAVATION METHOD	<b>SM</b>

## **ITEM 04502.8030 M - LOAD TRANSFER DEVICES FOR FULL DEPTH PCC PAVEMENT REPAIRS**

### **DESCRIPTION**

Furnish and install load transfer devices (LTD's) and pre-molded resilient joint filler at locations shown on the plans or where directed by the Engineer.

### **MATERIALS**

Pre-molded Resilient Joint Filler. Use a one piece pre-molded resilient joint filler meeting the requirements of §705-07, with a thickness as specified in the contract plans.

Load Transfer Devices (LTDs). Each LTD consist of (1) a smooth, epoxy coated dowel bar coated with an approved bond breaker and (2) an expansion cap capable of providing 12 mm of expansion room. The LTDs must be supplied by a supplier appearing on the Approved List for §705-15, Transverse Joint Supports.

The dowels must conform to the configurations, dimensions, and spacings shown in the contract documents. The dowel, epoxy coating, and bond breaker must meet the requirements for dowel bars detailed in §705-15, Transverse Joint Supports. The "Tests" and "Basis of Acceptance" portions of §705-15 shall not apply. However, the Contractor must provide the Engineer (1) certification from the supplier that the dowel elements meet the "Tests" requirements of §705-15 and (2) certification from the rolling mill as to the type and grade of steel used.

Submit detailed shop drawings to the Director, Materials Bureau, for approval before work begins. The drawings must detail:

- the expansion cap,
- the name of the bond-breaker and the name and address of the manufacturer,
- the type of corrosion protection coating and the name and address of the manufacturer,
- the name and address of the corrosion protection coating applicator .

Anchoring Material and Dispensing Equipment. Use a pourable anchoring material appearing on the Approved List for §701-07, Anchoring Materials - Chemically Curing. The anchoring material must also

- be a two component structural epoxy,
- contain 100 % solids epoxy,
- be dispensed from side-by-side cartridges using either manually or pneumatically powered injection guns, and
- be dispensed through a static mixing nozzle such that the material is thoroughly and homogeneously mixed without any hand mixing.

Drills. Use a hydraulic, boom mounted, gang drill with a minimum of three independently powered and driven drills capable of drilling the required holes in approximately 30 seconds. Use tungsten carbide drill bits. The forward and reverse travel of the drills must be controlled by mechanically applied pressure. Mount the drill on a suitable piece of equipment such that it is quickly transported and positioned at each repair. The drill rig frame must rest atop the pavement when holes are being drilled. The drill may not rest on pneumatic tires during drilling. Hand-held drills are not permitted.

Grout Retention Disk. Use plastic grout retention disks, 3 mm thick, of sufficient diameter to prevent grout from entering the joint. The hole in the center of the disk must have the same diameter as the dowel bar.

## **ITEM 04502.8030 M - LOAD TRANSFER DEVICES FOR FULL DEPTH PCC PAVEMENT REPAIRS**

### **CONSTRUCTION DETAILS**

**Drilling Holes.** Drill the existing pavement where depicted in the contract documents or where ordered by the Engineer. Drill holes such that

- the hole diameters are 3 mm ( $\pm$  1 mm) larger than the dowel diameter,
- the hole depth is one half the dowel length (+25 mm/- 0 mm),
- when the dowels are grouted in place, the longitudinal axes of the exposed portion of the dowels are parallel to the pavement centerline, the pavement surface, and the centerline(s) of adjacent dowel(s),  $\pm$  3 mm, as measured at the saw cut face and the dowel end, and
- when the dowels are grouted in place, the longitudinal mid-point of each dowel is within 25 mm of the saw cut face

Repair any damage to the existing concrete that results from drilling as directed by the Engineer at no cost to the State. Replace worn bits if the hole diameter is within 2 mm of the dowel diameter.

**Cleaning Holes.** Clean the drilled holes with oil-free and moisture-free compressed air. The Engineer will check the compressed air stream purity with a clean white cloth. The compressor must deliver air at a minimum pressure of 3.4 m<sup>3</sup> per minute and develop a minimum nozzle pressure of 0.63 MPA. Insert the nozzle to the back of the hole to force out all dust and debris.

**Dowel Installation.** Place the anchoring material in the back of the hole using a nozzle or wand of sufficient length. Push the dowel bar into the hole while twisting at least one full revolution. Insert the dowel such that the anchoring material is evenly distributed around the bar. Use sufficient amounts of anchoring material such that it slightly extrudes out the hole as the bar is inserted. Place a grout retention disk over the bar and tight against the exposed concrete face such that the anchoring material remains in place.

**Joint Filler Installation.** At joints requiring pre-molded resilient joint filler, install the filler such that it covers the entire exposed concrete face (full width and from subbase to pavement surface). Fit the filler over the protruding dowel bars such that it fits snugly against the exposed concrete face. Holes cut or punched into the filler (that allow it to fit over the protruding dowels) must be as approximately the same size as the dowel diameter, but no larger than the diameter of the grout retention disks. Holes must be neat such that no ragged edges of joint filler result. After the joint filler is placed against the exposed face, place a second grout retention disk over the dowel and tightly against the joint filler.

**Expansion Cap Installation.** Place an expansion cap over the end of each dowel bar. Push the cap onto the dowel until the stop hits the dowel end. Do not tap the cap in place.

### **METHOD OF MEASUREMENT**

This work shall be measured by the number of each dowel furnished and installed to the satisfaction of the Engineer.

### **BASIS OF PAYMENT**

In the unit bid price, include the cost of all labor, materials, and equipment necessary to complete the work. Saw cutting concrete, concrete removal, subbase preparation, new concrete, and joint sealing will be paid for under separate items.

**ITEM 04502.8031 M - CONCRETE PLACEMENT FOR FULL DEPTH PCC  
PAVEMENT REPAIRS**

**DESCRIPTION**

This work consists of providing and placing concrete for full 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.

**MATERIALS**

Materials shall conform to the following specifications:

Portland Cement Concrete - General .....	501
Portland Cement Concrete Pavement .....	502
Pre-molded Resilient Joint Filler .....	705-07
Membrane Curing Compound .....	711-05
Non-Chloride Accelerator Admixture .....	Approved List

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 full 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.

**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.

**ITEM 04502.8031 M - CONCRETE PLACEMENT FOR FULL DEPTH PCC  
PAVEMENT REPAIRS**

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 two options for his concrete mix design -

OPTION A - Material Requirements

**Standard Concrete Mix:**

The Contractor may use a Class C concrete mix conforming to §501-3.01 of the Standard Specifications. This option shall be treated as the Contractors 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 CA2.
- B. The design air content (entrapped plus entrained) shall be 6.5%. The field air content shall be a maximum of 8.0% and a minimum of 5.0%.
- 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	5.0%	6.5%	8.0%
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	-	-

**§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.

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*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.**

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

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moisture in liters per cubic meter ( $l/m^3$ ). Subtract that quantity, as well as the water portion of the non-calcium chloride solution ( $l/m^3$ ), 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 not be allowed for this specification.

### **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 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 and based on the chosen curing time for Non-Standard mixes. 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. The cylinders shall have the curing compound applied at the same time as the last pavement repair made for that truck 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 truck load of concrete.

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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.

### **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.

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 of concrete.
2. The volume of concrete needed to complete the repairs.
3. The time expected for completing the placement of the truck 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.**

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*3.01 Weather limitations:* Since the Contractor is responsible for the performance of the concrete material and its 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.

*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 for any reason the work is suspended the Contractor shall treat the stoppage as the ending of the placement. A new placement shall begin when commencing work again. 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.

*3.08 Joints:* It shall be the responsibility of the Contractor to make the initial saw cut (stage 1) for the concrete pavement repairs. The Contractor shall make Stage I saw cuts in the pavement at the following locations or as directed by the Engineer:

To Reestablish a Longitudinal Joint - when the longitudinal joint is removed and replaced by the pavement repair.

For a New Transverse Joint Location - when the pavement removal abuts existing concrete and load transfer devices are installed as shown in the contract plans or as directed by the Engineer.

Reconstruction of a Transverse Joint - For a full slab placement where transverse joint supports are installed as shown in the contract plans or as directed by the Engineer.

The Contractor may with the approval of the Engineer add a joint location to control cracking if the repair has an irregular shape. Any Contractor added joints shall be made at the Contractors expense.

The width and depth shall not be greater than the final stage II saw cut show in the contract documents. It is recommended that stage I saw cuts be completed as show on the concrete pavement standard sheets indicated in the contract plans.

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 Contractor may also use the soft cutting option to make the stage I saw cuts. 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:* In addition, the Contractor may use any air screed that meet the approval of the Regional Materials Engineer. The Contractor shall submit to the Engineer for approval a list of paving equipment as part of the Quality Control Plan to be used on the project.

*3.10 Curing:* Immediately after texturing, cure the pavement 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

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with spray shields to prevent drift. Flush nozzles daily before use and keep an adequate supply of spare nozzles on the project site. In a slip form paving operation, use self-propelled applicators guided by the same reference system as the slip form paver. In a fixed form operation, applicators need not be self-propelled.

*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.

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 from payment lines shown on the contract plans and the field measured longitudinal length of the pavement repaired.

### **BASIS OF PAYMENT**

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PAVEMENT REPAIRS**

In the cubic meter bid price 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.