

ITEM 01502.6030 M - PCC PAVEMENT PARTIAL DEPTH SPALL REPAIRS USING CLASS D CONCRETE

ITEM 01502.6031 M - PCC PAVEMENT PARTIAL DEPTH SPALL REPAIRS USING MODIFIED CLASS D CONCRETE

ITEM 01502.6032 M - PCC PAVEMENT PARTIAL DEPTH SPALL REPAIRS USING CONCRETE REPAIR MATERIAL

ITEM 01502.6033 M - PCC PAVEMENT PARTIAL DEPTH SPALL REPAIRS USING RAPID SETTING CONCRETE REPAIR MATERIAL

ITEM 01502.6034 M - PCC PAVEMENT PARTIAL DEPTH SPALL REPAIRS USING RAPID SETTING POLYMER CONCRETE

DESCRIPTION

Prepare and patch portland cement concrete (PCC) pavement spalls less than 100 mm deep. Use Class D concrete, Class D concrete as modified by this specification, Concrete Repair Material, Rapid Setting Concrete Repair Material, or Rapid Setting Polymer Concrete as required by the contract documents or as directed by the Engineer.

MATERIALS AND EQUIPMENT

Portland Cement Concrete, Class D	501
Concrete Repair Material	701-04
Rapid Setting Concrete Repair Material	701-09
Premoulded Resilient Joint Filler	705-07
Portland Cement Mortar Bonding Grout	705-22
Membrane Curing Compound	711-05
Admixtures	711-08
Water	712-01
Rapid Setting Polymer Concrete	721-20
Non-Chloride Accelerator Admixture	Approved List

Class D Concrete Production. Apply the requirements of §501, Portland Cement Concrete - General.

Modified Class D Concrete Production. Apply the requirements of §501, Portland Cement Concrete - General, except as modified herein. At the contractor's option, use any combination of Type III cement, non-chloride accelerators, and/or water reducers to meet the specified strength and slump. Use only a neutralized vinsol resin based air entraining agent. Water reducers, if used, may be either Type A (Normal) or Type F (High Range). Use only one manufacturer's brand of accelerator at any one time.

Modified Class D Mix Design and Trial Batch. If Modified Class D concrete is the required repair material, develop a mix design and prepare a trial batch using the same (1) materials and (2) mixing, transporting, and discharging methods as those to be used on the project. Demonstrate the mix's ability to achieve the specified properties to the Regional Materials Engineer. Changes other than minor fluctuations in admixture dosage rates will require a new mix design and trial batch as determined by the Regional Materials Engineer. The Engineer may halt material placement and order new trial batches whenever the specified properties are not achieved.

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The mix must meet the following requirements:

Property	Minimum	Desired	Maximum
18 Hour Compressive Strength (Trial Batch)	15 MPa	-	-
18 Hour Compressive Strength (Project)	14 MPa	-	-
28 Day Compressive Strength (Trial Batch)	30 MPa	-	-
Air Content	6.0%	7.5%	9.0%
Slump	65 mm	-	90 mm

Alternate mixes will be considered provided they meet the above requirements as determined by the Regional Materials Engineer.

Concrete Repair Material or Rapid Setting Concrete Repair Material. Use only cementitious repair materials appearing on the Materials Bureau Approved List. The Engineer will contact the Regional Materials Engineer to verify whether a repair material is cementitious. Provide the Engineer a complete set of manufacturer's instructions for mixing, bonding, placing, and curing the material. Follow the manufacturer's instructions. Do not exceed the prescribed water amount.

Extend concrete repair materials with Type CA1 coarse aggregate meeting the gradation requirements of Table 501-2. Use a maximum aggregate extension rate of 60% of the dry, pre-packaged weight of repair material. Determine the aggregate moisture content and adjust the mix water added accordingly.

Rapid Setting Polymer Concrete. Use rapid setting polymer concrete appearing on the Materials Bureau Approved List. Provide the Engineer a complete set of manufacturer's instructions for mixing, bonding, placing, and curing the material. Follow the manufacturer's instructions, including all aspects of the Manufacturer's Safety Data Sheets when handling rapid setting polymer concrete and their primers.

Extend rapid setting polymer concrete with Type CA1 coarse aggregate meeting the gradation requirements of Table 501-2. Use a maximum aggregate extension rate of 75% of the dry component weight of the repair material. Extension aggregates must contain no moisture at the time of mixing.

Saw Cutting Equipment. Use diamond blade saws with guides that are capable of making straight cuts to the dimensions depicted in the contract documents. Saws must be equipped with blade guards, water cooling systems, and

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cut depth control. Maintain an adequate supply of saws, new blades, and other parts at the site to ensure uninterrupted operation.

Chipping Hammers. Use chipping hammers weighing no more than 13.5 kg (including bit and muffler) equipped with sharp spade bits. Provide the Engineer with specifications from the hammer manufacturer. Use a maximum air pressure of 700 kPa (measured at the compressor) to power the hammer. Provide an air pressure gauge at the compressor that allows the Engineer to easily monitor air pressure. Maintain an adequate supply of hammers, new bits, and other parts at the site to ensure uninterrupted operation. The Engineer will halt operations if concrete to remain in place is damaged by the hammers.

Milling Machines. Use a milling machine with a 300 mm (minimum) wide milling head. The machine must be equipped with a mechanism that maintains the milling operation at a preset depth.

Vibrators. Use hand held spud vibrators having a maximum diameter of 25 mm and are capable of operating through a frequency range of 6000 - 9000 vibrations per minute.

CONSTRUCTION DETAILS. Repair areas as detailed in the contract documents or as directed by the Engineer. The Engineer will convene a pre-repair meeting seven to fourteen days before the planned start of repair preparation. Inspection personnel and the Contractor shall attend to coordinate all aspects of patch preparation; material mixing, discharge, transport, and placement; material requirements; and inspection.

Determine Repair Boundaries. Sound the nearby areas with a 1 - 1.5 kg hammer to identify delaminated areas and include them within the repair boundaries. Extend repair areas 75 - 150 mm beyond the visible deterioration or delaminations, whichever is larger. Combine repair areas within 150 mm of each other into one repair. Keep repair areas as square as possible. Avoid irregular or triangular repairs. Mark the repair boundary outlines with spray paint.

Saw Cut Repair Boundaries. Diamond blade saw cut the repair boundaries 50 - 75 mm deep. Cut at right angles to the pavement joints and vertical to the pavement surface. Over run the cuts such that the entire repair area is cut to the same depth. Additional saw cuts of the same depth as the boundary cuts may be made within the repair area to facilitate concrete removal.

Remove Concrete Within the Saw Cuts. Use (1) chipping hammers or (2) a combination of chipping hammers and milling machines to remove concrete within the saw cuts. Remove concrete to a minimum depth of 50 mm such that (1) the repair bottom is at a uniform depth, ± 25 mm and (2) sound concrete is exposed along the entire repair bottom. Do not operate milling machines within 25 mm of the saw cuts. Use chipping hammers in these locations to establish the proper repair depth. If load transfer devices are encountered, or the repair depth exceeds 125 mm, discontinue partial depth repair operations. The Engineer will inspect the repair bottom to ensure it is completely sound.

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Clean the Repair Bottom and Vertical Faces. Thoroughly sand blast all repair faces that will be in contact with the repair material such that uniformly abraded surfaces result, completely free of any dirt, loose particles, or oil. High pressure water blasting may be required where dust control is critical as determined by the Engineer.

After sand blasting, air blast the repair to remove sand blast and any moisture from the repair. The Engineer will check the air stream with a clean, white cloth to ensure no oil or contaminants are included in the air blast.

Place Joint or Crack Insert. Place premoulded resilient joint filler into a joint or crack that abuts or traverses the repair area. Use a filler of the same thickness as the joint or crack width, ± 3 mm, to re-establish the joint or crack through the repair. Place the insert such that it extends 10 mm below and beyond the repair area and (2) restricts repair material from entering the joint or crack. Additional saw cuts may be needed to achieve the required dimensions for placing the filler. Make necessary saw cuts before cleaning the repair bottom and vertical faces. Do not cut load transfer devices with the additional cuts. Leave the filler in place after the repair is complete.

Apply Bonding Agent. Immediately before the bonding agent is applied, the Engineer will check the cleanliness of the repair area receiving faces by wiping them with a dark brown or black cotton cloth or glove. If any residue is found, re-clean the repair bottom and vertical faces as described above.

Use portland cement mortar bonding grout if the repair material is Class D concrete or Modified Class D concrete. Mix the grout in small quantities to ensure freshly mixed grout is routinely placed. Mix the grout to consistency that can be applied to the prepared surfaces without running or puddling. 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.

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

Placement. Small construction mixers or paddle mixers may be used subject to the Engineer's approval provided the proper slump and air is obtained and all manufacturer's instructions are followed. Ready mix trucks may be used if quantities are sufficient in the Engineer's opinion. 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 Class D concrete or Modified Class D concrete before the bonding grout has dried. Slightly overfill the repair area. Vibrate the material with a spud vibrator having a diameter less than 25 mm.

Finishing. If the pavement will be diamond ground after spalls are repaired, leave the repair material slightly higher (3 mm) 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. Do not add any additional water to the repair surface.

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Curing. Thoroughly coat Class D and Modified Class D 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.

Opening Class D or Modified Class D to Traffic. The Engineer will cast two pairs (four total) of cylinders (in accordance with Materials Method 9.2, Field Inspection of Portland Cement Concrete) from each days placement. The Engineer will mark the cylinders and leave them adjacent to the pavement under similar curing conditions.

The Regional Materials Engineer will determine the concrete compressive strength at the desired opening time. Test one cylinder from each of the pairs cast. Open the placement to traffic if:

- the average compressive strength of the cylinder pair exceeds 14 MPa,
- the compressive strength of each cylinder is above 10.5 MPa, and
- the corresponding time frame has elapsed for the entire area to be opened.

If these conditions are not met, the Regional Materials Engineer will retest the remaining cylinder pair a minimum of 6 hours later. If these conditions are again not met, open the placement after 72 hours.

Project testing of 28 day strength is not required. If subsequent trial batches are required, the Engineer may waive the 28 day compressive strength testing.

Opening Other Materials to Traffic. Open other repair materials as follows:

Material	Time to Opening
Concrete Repair Material (701-04)	24 hours after placement
Rapid Setting Concrete Repair Material (701-09)	2 hours after placement
Rapid Setting Polymer Concrete (721-20)	2 hours after placement

METHOD OF MEASUREMENT

The Engineer will calculate the area of partial depth repairs completed in accordance with this specification to the nearest 0.01 m².

BASIS OF PAYMENT

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In the square meter bid price include the cost of all materials, equipment, and labor necessary to complete the work. No additional payments will be made for saw cuts performed to widen a joint or crack to receive the joint insert material or to facilitate concrete removal.

Payment will be made under:

<u>ITEM NO.</u>	<u>ITEM DESCRIPTION</u>	<u>PAY UNIT</u>
01502.6030M	PCC Pavement Partial Depth Spall Repairs Using Class D Concrete	Square Meter
01502.6031M	PCC Pavement Partial Depth Spall Repairs Using Modified Class D Concrete	Square Meter
01502.6032M	PCC Pavement Partial Depth Spall Repairs Using Concrete Repair Material	Square Meter
01502.6033M	PCC Pavement Partial Depth Spall Repairs Using Rapid Setting Concrete Repair Material	Square Meter
01502.6034M	PCC Pavement Partial Depth Spall Repairs Using Rapid Setting Polymer Concrete	Square Meter

**ITEM 04502.8021 M - CONCRETE REMOVAL FOR PARTIAL DEPTH PCC
PAVEMENT REPAIRS - CORING METHOD**
**ITEM 04502.8022 M - CONCRETE REMOVAL FOR PARTIAL DEPTH PCC
PAVEMENT REPAIRS - SAWING METHOD**

DESCRIPTION

This work shall consist of removing deteriorated concrete from portland cement concrete pavement at various locations as specified in the plans, in accordance with the specifications and as directed by the Engineer.

MATERIALS

Materials shall conform to the following specifications:

Anchoring Materials - Chemically Curing 701-07

CONSTRUCTION DETAILS.

General.

The pavement repair mark out shall be completed as indicted in the contract plans. The removal depth shall be a minimum of 50 mm to a maximum of 100 mm. The Contractor shall use the sounding technique to remove all deteriorated concrete to sound concrete. The Engineer will witness the removal procedure and accept the removal before any repair material can be placed into the repair. If a repair would exceed the maximum depth the Engineer will inform the Contractor how to complete the repair. It may become necessary for partial depth repairs to be completed as a full depth repair.

Coring Method.

The Contractor shall use a trailer or truck mounted core drilling rig with water cooling system, unless otherwise restricted in the contract plans, to remove deteriorated concrete from the concrete pavement. No hand held or platform coring equipment will be allowed for removing concrete. The Contractor shall provide drill bits within the size ranges for removal as follows:

Removal area of less than 150 mm in diameter -the Contractor shall use any drill bit having a diameter ranging from 170 to 210 millimeters.

Removal area of 150 mm to 300 mm in diameter - the Contractor shall use any drill bit having a diameter ranging from 320 to 355 millimeters.

Removal area of 300 mm to 450 mm in diameter - the Contractor shall use any drill bit having a diameter ranging from 460 to 510 millimeters.

The Contractor shall have two templates for each removal area (150 mm, 300 mm and 450mm, six total) for marking out the removal areas. The Contractor shall position the coring rig to the satisfaction of the Engineer and remove the entire marked out area. At joint locations the Contractor shall remove any thin portions of concrete remaining to the satisfaction of the Engineer. The Contractor shall use care to avoid coring into or just over a joint. If in the opinion of the Engineer the coring produces a small wedge like repair on or over a joint, this over coring will be rejected by the Engineer and shall be repaired according to §502-3.15 Defective or Damaged Concrete.

The drill bits shall be a thin wall impregnated diamond bit. The Contractor shall have on the project site a supply of drill bits in order to complete the planned removal for that work day. The Contractor may elect to use one core bit diameter for the project. If the Contractor chooses this option any additional concrete removed and concrete material placed over that needed to complete the repairs as marked out shall be at the contractor expense.

Once the coring operation begins it shall proceed to the maximum depth, no reentry of the core bit to the hole shall be allowed after the extraction of the coring bit. The Contractor shall insert into the coring hole a steel sleeve of the same diameter of the coring bit that extends a minimum of 5 mm above the pavement surface. The Contractor shall then remove the concrete within the sleeve using chipping hammers as described below.

If concrete deterioration is still present after the coring removal, the Engineer will evaluate and remark the

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removal area as needed. The coring or sawing method as determined by the Engineer shall then be used to complete any additional removal. The Contractor will be compensated for each type of removal under this specification.

Sawing Method.

The saw cut shall be made using a diamond blade saw no more than (5) five days in advance of the removal. The saw shall be equipped with guides, capable of making straight cuts, cut depth controls, and water cooling systems.

The saw cut shall be made to a minimum depth of 50 to 75 mm deep, cut at right angles to the pavement joints and vertical to the pavement surface. The saw cuts shall be over run to ensure the entire removal is cut to the same depth. The Contractor shall keep all over sawing to a minimum. All over sawing shall be filled before a significant temperature change with an anchoring material (chemically curing) meeting the requirements of section 701-07 of the standard specification. The Contractor shall be responsible for filling over sawed areas. Any damage to the pavement, prior to filling, at these location shall be repaired according to §502-3.15 Defective or Damaged Concrete. The Contractor may make additional saw cuts of the same depth to facilitate concrete removal, these additional saw cuts shall not be over sawed.

The Contractor shall then remove the concrete using chipping hammers as described below to sound concrete. If removal needed exceeds the 100mm maximum, the Contractor shall discontinue removal operations and notify the Engineer. The Engineer will evaluate the removal and determine if full depth pavement repair is necessary.

Joints.

When removing concrete at a transverse joint by the coring method and a load transfer devices has been cut or damage the Contractor shall notify the Engineer. The Engineer will ascertain whether or not to install a dowel bar retro-fit. When using the sawing method at a transverse joint, the Contractor shall not remove any concrete that will expose load transferring devices. The removal shall be stopped and the Engineer notified. The Engineer will determine the manner in which the work will continue.

The Contractor shall place pre-molded resilient joint filler into any transverse or longitudinal joints that are in or abut the repair area. The filler shall be of the same thickness of the joint width, ± 3 mm, to re-establish the joint opening. Place the filler material such that it extends 25 mm below and beyond the ends of the repair area. The joint filler shall restrict the repair material from entering the joint.

Chipping Hammers.

Chipping Hammers weighing no more than 13.5 Kg (including bit and Muffler) equipped with sharp spade bits shall be used for concrete removal operations. The Contractor shall provide the Engineer with the specifications from the hammer manufacturer. The air pressure power (measured at the compressor) to the hammer shall be a maximum of 700 kPa. The compressor shall have a air pressure gauge that allows the Engineer to easily monitor the air pressure.

The Contractor shall supply adequate numbers of equipment, kept in working order to ensure uninterrupted operation of the work. The Contractor shall replace equipment that in the opinion of the Engineer is not working satisfactorily.

Concrete shall be removed to sound concrete, to the maximum depth (as outlined above), or as specified by the Engineer. The removal shall produce a uniform bottom along the entire area of the repair.

Damage to Adjacent Pavement.

The Contractor shall be responsible for all damage that occurs as a result of the Contractor's operation. All damaged pavement shall be repaired according to §502-3.15 Defective or Damaged Concrete.

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PAVEMENT REPAIRS - SAWING METHOD**

Opening to Traffic.

The Contractor shall be responsible for completing the repairs according to the Maintenance and Protection of Traffic plan for the project or as ordered by the Engineer. No repair location shall have the concrete removed and opened to traffic with out the first placing the repair material called for in the contract plans.

METHOD OF MEASUREMENT.

Coring Method. This work shall be measured as the number of field measured square meters of concrete removed in accordance with this specification.

Sawing Method. This work shall be measured as the number of field measured square meters of concrete removed in accordance with this specification.

BASIS OF PAYMENT.

The unit price bid for the both methods shall include the cost of all labor, materials, tools and equipment necessary to satisfactorily complete the work, including drilling, sawing and removing concrete. The Contractor shall repair, at the Contractor's expense, any damage to the adjacent pavement or the material being installed that is caused by the Contractor's operations.

ITEM	DESCRIPTION	UNITS
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04502.8022 M	CONCRETE REMOVAL FOR PARTIAL DEPTH PCC PAVEMENT REPAIRS - SAWING METHOD	SM

**ITEM 05502.0702 M - PCC PAVEMENT PARTIAL DEPTH SPALL REPAIRS USING
MODIFIED CLASS D CONCRETE**

DESCRIPTION:

Prepare and patch portland cement concrete (PCC) pavement spalls less than 100 mm deep. Use Class D concrete as modified by this specification or as directed by the Engineer

MATERIALS AND EQUIPMENT:

Portland Cement Concrete, Class D	501
Portland Cement Mortar Bonding Grout.	705-22
Membrane Curing Compound.	711-05
Admixtures	711-08
Water.	712-01
Non-Chloride Accelerator Admixture.	Approved List

Modified Class D Concrete Production. Apply the requirements of §501, Portland Cement Concrete - General, except as modified herein. At the contractor’s option, use any combination of Type III cement, non-chloride accelerators, and/or water reducers to meet the specified strength and slump. Use only a neutralized vinsol resin-based air entraining agent if a non-chloride accelerator is used. Water reducers, if used, may be either Type A (Normal) or Type F (High Range). Use only one type of accelerator at any one time.

Modified Class D Mix Design and Trial Batch. Develop a mix design and prepare a trial batch using the same (1) materials and (2) mixing, transporting, and discharging methods as those to be used on the project. Demonstrate the ability of the mix to achieve the specified properties to the Regional Materials Engineer. Changes other than minor fluctuations in admixture dosage rates will require a new mix design and trial batch as determined by the Regional Materials Engineer. The Engineer may halt material placement and order new trial batches whenever the specified properties are not achieved.

The mix must meet the following requirements:

Property	Minimum	Desired	Maximum
18-Hour Compressive Strength (Trial Batch)	15 MPA	–	–
18-Hour Compressive Strength (Project)	14 MPA	–	–
28-Hour Compressive Strength (Trial Batch)	30 MPA	–	–
Air Content	6.0%	7.5%	9.0%
Slump	65 mm	–	90 mm

Alternate mixes will be considered, provided they meet the above requirements as determined by the

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MODIFIED CLASS D CONCRETE**

Regional Materials Engineer.

Saw Cutting Equipment. Use diamond blade saws with guides that are capable of making straight cuts to the dimensions depicted in the contract documents. Saws must be equipped with blade guards, water cooling systems, and cut depth control. Maintain an adequate supply of saws, new blades, and other parts at the site to ensure uninterrupted operation.

Chipping Hammers. Use lightweight (13.5 kg, maximum) chipping hammers with spade bits. Provide the Engineer with specifications from the hammer manufacturer. Use a maximum air pressure of 700 kPa (measured at the compressor) to power the hammer. Provide an air pressure gauge at the compressor that allows the Engineer to easily monitor air pressure. Use sharp bits. Maintain adequate supply of hammers, new bits, and other parts at the site to ensure uninterrupted operation. The Engineer will halt operations if concrete to remain in place is damaged by the hammers.

Milling Machines. Use a milling machine with a high kilowatt rating and a 300 mm (minimum) wide milling head. The machine must be equipped with a mechanism that maintains the milling operation at a preset depth.

Vibrators. Use hand held spud vibrators have a maximum diameter of 25 mm and are capable of operating through a frequency range of 6000-9000 vibrations per minute.

CONSTRUCTION DETAILS:

Repair areas as detailed in the contract documents or as directed by the Engineer. The Engineer will convene a pre-repair meeting seven to fourteen days before the planned start of repair preparation. Inspection personnel and the Contractor shall attend to coordinate all aspects of patch preparation; material mixing, discharge, transport, and placement; material requirements; and inspection.

Determine Repair Boundaries. Sound the nearby areas with a 1 - 1.5 kg hammer to identify delaminated areas and include them within the repair boundaries. Extend repair areas 75 - 150 mm beyond the visible deterioration or delaminations, whichever is larger. Combine spalls within 600 mm of each other into one repair. Keep repair areas as square as possible. Avoid irregular or triangular repairs. Mark the repair boundary outlines with spray paint.

Saw Cut Repair Boundaries. Diamond blade saw cut the repair boundaries 50 - 75 mm deep. Cut at right angles to the pavement joints and vertical to the pavement surface. Overrun the cuts such that the entire repair area is cut to the same depth. Additional saw cuts of the same depth as the boundary cuts may be made within the repair area to facilitate concrete removal.

Remove Concrete Within the Saw Cuts. Use (1) chipping hammers or (2) a combination of chipping hammers and milling machines to remove concrete within the saw cuts. Remove concrete to a minimum depth of 50 mm such that (1) the repair bottom is at a uniform depth, ± 25 mm and (2) sound concrete is exposed along the entire repair bottom. Do not operate milling machine within 25 mm of the saw cuts. Use chipping hammers in these locations to establish the proper repair depth. If load transfer devices are encountered or the repair depth exceeds 125 mm, discontinue partial depth repair operations. The Engineer will inspect the repair bottom to ensure it is completely sound.

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Clean the Repair Bottom and Vertical Faces. Thoroughly sand blast all repair faces that will be in contact with the repair material such that uniformly abraded surfaces result completely free of any dirt, loose particles, or oil. High pressure water blasting may be required where dust control is critical as determined by the Engineer.

After sand blasting, air blast the repair to remove sand blast and any moisture from the repair. The Engineer will check the air stream with a clean, white cloth to ensure no oil or contaminants are included in the air blast.

Place Joint or Crack Insert. Place a compressible styrofoam or asphalt impregnated fiberboard insert along an abutting joint or crack. Ensure that the material selected is compatible with the repair material. Alternate material use is subject to the Engineer's approval. Use an insert of the same thickness as the joint or crack width, ± 3 mm, to reestablish the joint or crack through the repair. Place the insert such that it (1) extends 25 mm below and 75 mm beyond the repair area and (2) restricts repair material from entering the joint or crack. Additional saw cuts may be needed to achieve the required dimensions for placing the insert. Do not cut load transfer devices with the additional cuts. The insert may be left in place after the repair is complete.

Apply Bonding Agent. Immediately before the bonding agent is applied, the Engineer will check the cleanliness of the repair area receiving faces by wiping them with a dark brown or black cotton cloth or glove. If any residue is found, re-clean the repair bottom and vertical faces as described above.

Use portland cement mortar bonding grout. Mix the grout in small quantities to limit waste and ensure recently 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. Overlap the surrounding pavement surfaces.

Placement. Small construction mixers, mobile drums, or paddle mixers may be used subject to the Engineer's approval, provided the proper slump and air is obtained and all manufacturer's instructions are followed. Ready mix trucks may be used if quantities are sufficient in the Engineer's opinion. Use wheelbarrows, buggies, or other mobile batch 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.

Finishing. 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. Do not add any additional water to the repair surface.

Curing. Thoroughly coat with a curing compound meeting the requirements of §711-05, Membrane Curing Compound, at a minimum rate of 3.5 m²/1.

Opening to Traffic. The Engineer will cast two pairs (four total) of cylinders (in accordance with Materials Method 9.2, Field Inspection of Portland Cement Concrete) from each day's placement. The Engineer will mark the cylinders and leave them adjacent to the pavement under similar curing conditions.

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The Regional Materials Engineer will determine the concrete compressive strength at the desired time. Test one cylinder from each of the pairs cast. Open the placement to traffic if:

- the average compressive strength of the cylinder pair exceeds 14 MPA,
- the compressive strength of each cylinder is above 10.5 MPA, and
- the corresponding time frame has elapsed for the entire area to be opened.

If these conditions are not met, the Regional Materials Engineer will retest the remaining cylinder pair a minimum of 6 hours later. If these conditions are again not met, open the placement after 72 hours.

Project testing of 28-day strength is not required. If subsequent trial batches are required, the Engineer may waive the 28-day compressive strength testing.

METHOD OF MEASUREMENT:

Cubic meters of each partial depth repair is obtained by multiplying the surface area of each repair by the average of three randomly selected depth measurements from each repair.

BASIS OF PAYMENT:

In the cubic meter bid price, include the cost of all materials, equipment, and labor necessary to determine the repair boundaries; saw cut the repair boundaries; remove PCC from within the repair boundaries; sand blast the repair faces; air blast the repair; place the joint or crack insert; apply the bonding agent; and mix, place, finish, and cure the repair material. No additional payments will be made for saw cuts performed to widen a joint or crack to receive the joint insert material or to facilitate concrete removal.

Payment will be made under:

Item Number

Item

05502.0702

PCC Pavement Partial Depth Spall Repairs Using Modified Class D Concrete

**ITEM 18502.0707 M - SURFACE PREPARATION FOR RAPID SETTING CONCRETE
PAVEMENT REPAIRS**

**ITEM 18502.0708 M - FURNISH AND PLACEMENT OF RAPID SETTING CONCRETE
PAVEMENT REPAIRS**

DESCRIPTION:

This work shall consist of patching spalls, potholes, corner breaks or other surface distress in portland cement concrete pavements and joints. The patch area shall be prepared by removal of all existing patching material, broken, damaged or disintegrated concrete and patched with one of the rapid setting concretes listed below where indicated on the plans or directed by the Engineer. The Contractor will have the option of using the types of repair material listed below.

MATERIALS:

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

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

The aggregate shall be sized as follows, based upon the depth of application of the mixture:

<u>Depth of Application</u>	<u>Gradation</u>
Up to 100 mm	Type CA1 Table 501-2
100 mm and greater	Type CA2 Table 501-2

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

Patch Material Type	Type CA1 or CA2 Aggregate Extension	Estimated Yield With Aggregate Extension (m³/22.7 kg bag)
701-09	60-65%	.0170 - .0175
721-20	75-80%	.0184 - .0190

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

Aggregate used in Rapid Setting Polymer Concrete (721-20) shall contain no moisture at the time of mixing.

Manufacturers' Material Safety Data Sheets should be consulted before storing, handling or using Rapid Setting

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Polymer Concrete and its primers. The dry and liquid components of polymer concrete are highly flammable and extremely explosion sensitive. Protective equipment should be worn to prevent skin and eye contact. Suitable MESA/NIOSH approved respirators are required where exposure limits are exceeded.

CONSTRUCTION DETAILS:

The areas to be repaired are indicated on the plans or will be designated by the Engineer. Repairs shall conform to the details shown on the plans or be in accordance with the directions of the Engineer. The area around the spall or other distress will be sounded with a 1 to 1.5 kg hammer and the perimeter of the area to be patched will be designated by the Engineer. To minimize possible shrinkage cracking and to maximize the service life of the pavement repair, patch areas should approach rectangular dimensions and preferably square dimensions when feasible. Patches should refrain from tapers or dimensions that result in narrow, pointed shapes. All asphalt concrete, foreign materials of any kind, and unsound concrete shall be removed from the repair area.

The Contractor has the option of using chipping hammers, a small milling machine, or high pressure water blast for concrete removal. When Rapid Setting Polymer Concrete is used, high pressure water blast is not permitted.

- 1. Chipping Hammers.** The edges of the patch shall be chipped to produce a nearly vertical, intentionally rough sound edge. No undercutting shall be required or permitted. The floor of the patched area shall be chipped away to produce a minimum patch depth of 25 mm at all points within the patch if Rapid Setting Polymer Concrete is used. Patches that use 701-09 material shall be a minimum 50 mm deep.

Chipping hammers that are used shall not damage the concrete that is to remain. Chipping hammers shall weigh not more than 20 kg with the bit and muffler removed. The Contractor shall provide the Engineer with information from the hammer manufacturer that these requirements are not exceeded. The air pressure used to power the hammer shall not exceed 700 kPa measured at the air compressor. An air pressure gauge in proper working condition shall be provided. Only sharp, 75 mm minimum width, chisel point bits shall be used. All bits determined by the Engineer to be dull shall be sharpened or replaced. If the Engineer determines that the Contractor's operations are resulting in damage to concrete that is to remain, the Contractor shall make immediate corrections. These corrections shall include the use of a lighter chipping hammer if so ordered by the Engineer. Damage caused by the Contractor's operations shall be repaired to the satisfaction of the Engineer at no additional cost to the State.

- 2. Milling Machines.** Milling machines that are used for concrete removal shall result in the same surface preparation as in 1. Chipping Hammers. Their use shall be approved by the Engineer.
- 3. High Pressure Water Blast.** The edges of the patch shall be blasted to produce a nearly vertical, intentionally rough sound edge. No undercutting shall be required or permitted. The minimum patch thickness shall be 50 mm in all areas of the repair. Water blasters shall have a minimum pressure of 69 MPa when measured at the machine.

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

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

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

Patches being filled with rapid setting polymer concrete shall be completely dry, and primed with a compatible primer recommended by the manufacturer before placing the polymer concrete.

Steel pavement mesh which is exposed in the area to be patched shall be removed and not replaced.

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

Temperature limitations for placing the patching materials are as follows:

Ambient Temperature Range	Patching Material Type
10 - 32E C	701-09 Rapid Setting Concrete Repair Material (Normal Weather)
2 - 32E C	721-20 Rapid Setting Polymer Concrete

The materials shall be mixed in a mortar-type mixer or mixer of such capacity that one batch will completely fill the area(s) to be patched. Polymer concrete may be mixed in manufacturer supplied plastic bags or a mortar type mixer. The mixer(s) shall be inspected and approved by the Engineer prior

to use. If water is required it shall be the first material added to the mixer. The moisture content of the aggregate used to extend the yield shall be determined and the amount of water added shall be adjusted accordingly to compensate for the moisture content. The Contractor shall provide a device to accurately measure the amount of water and aggregate. Aggregate used with polymer concrete shall contain no moisture. The materials shall be mixed following the manufacturer's directions.

Before placing the patching material at a pavement joint, forms shall be placed abutting the pavement edge and

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parallel to the joint. A straight edge shall be formed at the joint. Forms shall be flush with the vertical pavement edge. A joint space to be sealed under the appropriate item(s) shall also be provided. The forms shall be coated with a material that is compatible with the patching material but will not adhere to it. In no case shall the patching material bridge the joint opening and/or be sawed to create a joint reservoir.

The patching material, except polymer concrete, shall be placed in one lift, starting at one edge of the repair area and working to the opposite edge. Polymer concrete may be placed in lifts. All patches equal to or greater than 50 mm in depth shall be consolidated by internal vibration following Standard Specification 555-3.04 B. The patching material shall be hand screeded and finished to meet the adjacent elevation, cross slopes, and texture. Repairs formed with right angled edges (i.e. those at transverse, longitudinal and/or pavement shoulder joints) shall be edged with an edging tool that provides a 6 mm (± 3 mm) radius rounding of these corners. Once placed and finished, the patching material shall be cured in accordance with manufacturer's instructions. Patches shall be allowed to cure for at least one hour prior to allowing traffic to travel over the patched area.

METHOD OF MEASUREMENT:

Surface Preparation for Rapid Setting Concrete Pavement Repairs. The quantity to be measured will be the number of square meters of prepared area plane to the surface of the pavement.

Furnishing and Placement of Rapid Setting Concrete Pavement Repairs. The quantity to be measured shall be the number of kilograms of dry prepackaged component of the rapid setting repair material incorporated into the work.

BASIS OF PAYMENT:

Surface Preparation for Rapid Setting Concrete Pavement Repairs. The unit price bid per square meter shall include the cost of all labor and equipment necessary, including disposal of the removed material, to complete the surface preparation up to but not including sand blasting. Damage caused by the Contractor's operations shall be repaired at no additional cost to the State.

Furnishing and Placement of Rapid Setting Concrete Pavement Repairs. The unit price bid per kilogram of dry prepackaged material shall include the cost of all labor, material and equipment necessary to complete the work including sandblasting, air blasting, vacuuming, primer and forms.

Payment will be made under:

Item No.	Item	Pay Unit
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**ITEM 18502.0708 M - FURNISH AND PLACEMENT OF RAPID SETTING CONCRETE
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18502.0707	Surface Preparation for Rapid Setting Concrete Pavement Repairs	Square Meter
18502.0708	Furnish and Placement of Rapid Setting Concrete Pavement Repairs	Kilogram