

The type used shall be that which closely conforms to the type which was removed and shall be approved in writing by the Engineer.

**441.08 Base and Subbase Replacement.** All granular or stabilized base and subbase which are removed shall be replaced with an equal compacted thickness of material which closely conforms to the original material removed and shall be compacted to the density requirements of the granular or stabilized base and subbase removed.

**441.09 Disposal of Surplus Material.** Surplus or waste material resulting from the removal and replacement operations shall be disposed of by and at the expense of the Contractor according to Article 202.03.

**441.10 Method of Measurement.** Pavement Replacement and Pavement Replacement - Surface Course, will be measured in place, and the area computed in square meters (square yards). Pavement or surface course damaged by reason of construction operations outside of the working limit of 600 mm (2 ft.) from the form line specified will not be measured for payment.

**441.11 Basis of Payment.** This work will be paid for at the contract unit price per square meter (square yard) for PAVEMENT REPLACEMENT or PAVEMENT REPLACEMENT - SURFACE COURSE, which prices shall include any required earth excavation or embankment.



## SECTION 442. PAVEMENT PATCHING

**442.01 Description.** This work shall consist of the removal of the existing pavement, the necessary excavation and the replacement with the class and type of patch specified at designated locations.

This work will be classified as follows:

Class A Patches:	Pavement Removal and Continuously Reinforced Portland Cement Concrete Replacement
Class B Patches:	Pavement Removal and Portland Cement Concrete Replacement Using Dowels or Tie Bars
Class C Patches:	Pavement Removal and Portland Cement Concrete Replacement
Class D Patches:	Pavement Removal and Bituminous Concrete Replacement
Pavement Patching:	Contractor's Option of Class C or Class D

For each of the above classifications, the work on a lane width or less shall be further quantified by size as follows:

Type I	Less than 5 m <sup>2</sup> (5 sq. yds.)
Type II	5 m <sup>2</sup> (5 sq. yds.) or more, but less than 15 m <sup>2</sup> (15 sq. yds.)
Type III	15 m <sup>2</sup> (15 sq. yds.) or more, but less than 20 m <sup>2</sup> (25 sq. yds.)
Type IV	20 m <sup>2</sup> (25 sq. yds.) or more

**442.02 Materials.** Materials shall meet the requirements of the following Articles of Section 1000 - Materials:

Item	Article/Section
(a) Portland Cement Concrete (Note 1) .....	1020
(b) Concrete Reinforcement Bars, Fabric and Strand .....	1006.10
(c) Dowel Bars, Expansion Joint Assembly and Contraction Joint Assembly (Note 2) .....	1006.11
(d) Prefomed Expansion Joint Filler .....	1051.08, 1051.09
(e) Prefomed Fiberboard .....	1051.04
(f) Bituminous Materials .....	1009.01 - 1009.05, 1009.07, 1009.08
(g) Non-shrink Grout .....	1024.01
(h) Poured Joint Sealer .....	1050.02
(i) Backer Rod (Note 3)	
(j) Material for Forming Joint Grooves (Note 4)	
(k) Chemical Adhesive .....	1027.01

Note 1. When patching ramp pavements and 2-lane pavements with 2-way traffic, the special patching mixture specified in Article 1020.05(g)(2) shall be used for Class A, Class B and Class C patching. For all other pavements, either the early strength patching mixture specified in Article 1020.05(g)(1) or the special patching mixture shall be used, at the Contractor's option, for Class A, Class B and Class C patching.

Note 2. For Class B patches, the dowel bars shall be painted round bars conforming to the requirements of AASHTO M 227M (M 227), grades 70 through 80. The dowel bars may be painted with red oxide or zinc chromate one-coat shop paint.

Note 3. The backer rod shall be a closed-cell, plastic foam rod compatible with the sealant and the elevated temperatures of joint sealant application.

Note 4. Material for joint forms shall be suitable for forming the sealant reservoir to the width and depth as shown on the plans and of sufficient strength to retain its shape during concrete placement.

**442.03 Equipment.** Equipment shall meet the requirements of the following Articles of Section 1100 - Equipment:

Item	Article/Section
(a) Self-Propelled Rollers .....	1101.01
(b) Vibratory Rollers (Note 1)	
(c) Side Forms (Note 2) .....	1103.05
(d) Mixer or Truck Agitator (Note 3) .....	1103.01
(e) Batching and Weighing Equipment (Note 4) .....	1103.02, 1103.03
(f) Hot-Mix Plant .....	1102.01
(g) Concrete Saw (Note 5)	
(h) Wheel Saw (Note 6)	
(i) Equipment and Devices for Removing Old Concrete Slabs (Note 7)	
(j) Drilling Machine (Note 8)	
(k) Miscellaneous Equipment .....	1103.17
(l) Membrane Curing Equipment .....	1101.09
(m) Heating Equipment for Joint Sealant (Note 9)	



Note 1. The vibratory rollers and tampers shall meet the approval of the Engineer.

Note 2. Wood forms will be permitted. The depth of form shall be plank width, the commercial dimension which equals the pavement thickness shown on the plans or the next larger commercial dimension.

Note 3. Batch type mixer having a rated capacity of not less than 0.3 m<sup>3</sup> (10 cu. ft.) may be used. Chute delivery will be permitted.

Note 4. Where the nominal production does not exceed 40 m<sup>3</sup> (50 cu. yds.) per day, the requirement for overhead bins and weighing hoppers completely suspended and hanging freely from the scales may be waived. Any other method for loading and weighing the aggregates must be approved by the Engineer.

Note 5. The concrete saw shall be equipped with a diamond blade of sufficient size to saw pavements full-depth and be capable of accurately maintaining cutting depth.

Note 6. The wheel saw shall be equipped with carbide-tipped rotating cutters and be capable of accurately maintaining cutting depth.

Note 7. As approved by the Engineer.

Note 8. The machine used for drilling the holes in the face of the existing pavement shall be capable of drilling the size and depth of holes as shown on the plans. The machine shall be equipped with a positive stop to control the depth of hole. During use, the stop shall be calibrated at least once a day. A drill support system using the pavement surface as a reference shall be required to assure hole alignment at mid-depth of pcc pavement. Hand held tools will not be allowed.

Note 9. The heating equipment shall be an indirect heating type with positive temperature control, mechanical agitation and recirculating pumps.

## CONSTRUCTION REQUIREMENTS

**442.04 Keeping Road Open to Traffic.** The road shall be kept open to traffic according to Article 701.05(e).

**442.05 Pavement Removal.** The pavement shall not be scored with a concrete saw or jackhammers more than 3 days prior to when it will be broken except when the pavement is closed to traffic. The pavement shall not be scored with a wheel saw more than one day prior to when it will be broken except when the pavement is closed to traffic.

If a wheel saw is used to score the pavement or areas of the pavement have been removed for purposes of cutting marginal bars and the pavement will be open to traffic, the cuts shall be filled with either full-depth cold bituminous mix meeting the approval of the Engineer or compacted granular material with a 50-mm (2-inch) minimum cap of cold bituminous mix meeting the approval of the Engineer. The cuts shall be constantly maintained so that they will not be a hazard to traffic.

Any drainage mat or pipe underdrains damaged during patching operations shall be repaired or replaced by the Contractor at his/her own expense.

Materials resulting from the removal of the existing pavement and unsuitable and unstable materials shall be disposed of according to Article 202.03.

The scoring and removal of pavement for the various classes of patches shall be as follows:

- (a) Class A Patches. Two transverse saw cuts shall be made perpendicular to the centerline at each end of the patch except that the saw cuts may be skewed slightly if necessary to maintain a minimum distance of 450 mm (18 inches) from the end of the patch to the nearest transverse crack in the pavement to remain in place. When approved by the Engineer, this minimum distance may be reduced to 150 mm (6 inches) in areas of close crack spacing where the pavement otherwise appears to be sound. The interior saw cut shall be made at the location that will provide the proper length of exposed existing steel as shown on the plans and shall be either full-depth or to a depth which will completely sever the longitudinal reinforcement. The longitudinal edges of the patch shall be formed by full-depth saw cuts. Patches one-half lane width or full lane width will be permitted. Saw cut extensions into pavement which is to remain in place will not be permitted. All outlining and interior saw cuts shall be made with an approved concrete saw. After the interior saw cuts have been made, an approved wheel saw may be used to make pressure relief cuts or intermediate cuts to reduce the pavement length to a size that accommodates removal and hauling operations, at the Contractor's expense. The wheel saw cutting operations shall be controlled to limit subbase penetration to a maximum of 15 mm (1/2 inch).

The shoulder between the full-depth saw cut and the pavement edge shall be removed using a hand held hammer and hand tools prior to pavement removal. If available, the Contractor may use an approved wheel saw to make the shoulder cut and removal.

When the patch is adjacent to a pcc shoulder, a saw cut shall be made at the shoulder-pavement joint sufficiently deep to sever the tie bars. A second full-depth saw cut shall be made in the pavement a minimum of 100 mm (4 inches) from the edge of the shoulder. The pavement between the full-depth saw cut and the shoulder edge shall be removed using a hand held hammer and hand tools prior to removal of the remaining pavement.

The pavement between the interior saw cuts shall be removed by lifting. Sufficient care shall be taken to minimize subbase disturbance and prevent spalling of the pavement that is to remain in place. Any subbase material disturbed during pavement removal operations or determined unsuitable by the Engineer shall be removed and replaced with patch material.

If the Engineer determines that the concrete has deteriorated to the extent that it is not practical to lift, the pavement may be broken into small pieces and removed. The breaking equipment shall not transfer an impact energy greater than 4000 J (3000 foot-pounds) per blow to the pavement surface.



The concrete in the splicing area, between the interior and outer saw cuts,

shall be removed using hand held hammers and hand tools. Care shall be taken to prevent underbreaking of the concrete to remain in place. The face of the concrete below the partial-depth saw cut shall be inclined slightly into the patch. The reinforcing steel in the splicing area shall not be bent to aid in removal of the concrete. If more than 10 percent of the reinforcing steel in the splice area is damaged due to the Contractor's operations, the patch shall be lengthened at his/her own expense to provide the required steel exposure for splicing. If less than 10 percent of the existing lap steel is damaged, it may be repaired by welding in lieu of lengthening the patch. No welding will be permitted on the splices between the existing steel and the new steel.

Should the Contractor's operations cause a spall having a width or depth greater than 25 mm (1 inch) in the pavement to remain in place or cause excessive shattering or underbreaking of the existing slab to remain in place, a new saw cut shall be made, at the Contractor's expense, extending the patch to remove the spall or underbreaking. After pavement removal, the pavement structure will be inspected by the Engineer to determine if it is sufficiently sound. If determined unsound, the Contractor shall extend the patch as directed by the Engineer.

The existing reinforcement steel shall be observed during the removal process to determine if there is any excess rusting or evidence of steel distress. Deteriorated steel will not be permitted in the splice area. The Engineer may require lengthening of the patch.

- (b) Class B Patches. Two transverse saw cuts outlining the patch shall be straight and perpendicular to the centerline, with a tolerance of 50 mm (2 inches) in 3.6 m (12 ft.). Saw cut extensions into pavement which are to remain in place will not be permitted. All saw cuts shall be made with an approved concrete saw (except as outlined below). Concrete not sawed full-depth shall be removed with hand tools. Only full lane width patches will be permitted.



When the patch is adjacent to a bituminous shoulder, a full-depth saw cut shall be made in the shoulder a minimum of 100 mm (4 inches) from the edge of the pavement or at such width as to facilitate forming. The shoulder between the full-depth saw cut and the pavement edge shall be removed with a hand held hammer and hand tools prior to pavement liftout.

When the patch is adjacent to a pcc shoulder, a saw cut shall be made at the shoulder-pavement joint sufficiently deep to sever the tie bars. A second full-depth saw cut shall be made in the pavement a minimum of 100 mm (4 inches) from the edge of the shoulder. The pavement between the full-depth saw cut and the shoulder edge shall be removed using a hand held hammer and hand tools prior to removal of the remaining pavement.

The Contractor may use an approved wheel saw to make the shoulder cut and removal, and to make pressure relief cuts or intermediate cuts to reduce the pavement length to a size that accommodates removal and hauling operations, at the Contractor's expense. The wheel saw cutting operations shall be controlled to limit subbase penetration to a maximum of 13 mm (1/2 inch). Wheel saw cuts shall be made after concrete sawing

outlining patch boundaries unless the wheel saw cuts are at least 450 mm (18 inches) inside the transverse patch boundaries. Should the Contractor be unable to conform to the requirements specified herein, the Engineer will withdraw approval of this alternative.

The pavement shall be removed by lifting. If the Engineer determines that the concrete has deteriorated to the extent that it is not practical to lift, the pavement may be broken into small pieces and removed. Breaking operations shall start adjacent to the removed wedge or the alternate wheel saw cut. The breaking equipment shall not transfer an impact energy greater than 4000 J (3000 foot-pounds) per blow to the pavement surface.

Care shall be taken to prevent subbase disturbance and spalling of the pavement which is to remain in place. Should the Contractor's operations cause a spall having a width or depth greater than 25 mm (1 inch), a new saw cut shall be made extending the patch to remove the spall, at the Contractor's expense. After slab removal, the existing pavement structure will be inspected by the Engineer to determine if it is sufficiently sound. If determined unsound, the Contractor shall extend the patch as directed by the Engineer. Any subbase material that is disturbed during pavement removal operations or determined unsuitable by the Engineer shall be removed and replaced with patch material.

Resawing of patch boundaries to remove spalls that exceed a width or depth of 25 mm (1 inch) will not be required when the patching is being performed to prepare the existing pavement for bituminous resurfacing.

- (c) Class C Patches. Standard reinforced concrete pavement shall be scored with a concrete saw to a depth which severs the reinforcement. If the Contractor elects, he/she may saw full depth to alleviate spalling and replacement as specified in Article 442.05(a).

Non-reinforced concrete pavement shall be scored with jackhammers or other equipment approved by the Engineer. The scoring shall be at least 150 mm (6 inches) from the marked face of the patch. Marginal bars and tie bars shall be cut in a manner satisfactory to the Engineer.

As an alternate, the Contractor may use an approved wheel saw to score the pavement full-depth on either standard reinforced or non-reinforced pavement. Should the wheel saw damage the pavement and/or reinforcement which are to remain in place, the Engineer will withdraw approval of this alternate.

The existing pavement shall be removed as shown on the plans. Ends of the patch need not be squared but may follow the existing cracks, provided angles smaller than those shown on the plans do not result.

If the patch is not scored with a concrete saw or wheel saw, the ends of the patch shall be hand trimmed with hand held hammers or other tools or equipment approved by the Engineer. The general plane of the cut face shall not deviate more than 40 mm (1 1/2 inches) from vertical. Abrupt breaks or deviations from the plane of the cut face sufficient to induce spalling in either the top or the bottom surface of the pavement will not be

permitted.

Should the Contractor's operations cause a spall having a width or depth greater than 25 mm (1 inch), the patch shall be extended to remove the spall, at the Contractor's expense, except that this extension will not be required when the patching is being performed to prepare the existing pavement for bituminous resurfacing.

Equipment and methods used for removing old pavement shall be such as to prevent cracking, shattering or spalling of the pavement remaining in place. Breaking equipment shall not transfer an impact energy greater than 4000 J (3000 foot-pounds) per blow to the pavement surface.

After breaking and removal of the existing pavement, any areas of the subbase which are below the required elevation of the finished subbase, shall be built up to grade at the Contractor's expense, with satisfactory compacted granular material, concrete or compacted bituminous material.

Tie bars extending across the longitudinal joint, or such portion as may be exposed in the area of the patch, shall be cut approximately at the face of the pavement which is to remain in place, or they shall be removed. Marginal bars shall be cut close to the face of the pavement which is to remain in place.

- (d) Class D patching shall be according to Article 442.09.

**442.06 Pavement Replacement.** Class A, Class B and Class C patches shall conform to the standard details and cross section included in the plans, and the work shall conform to the applicable portions of Section 420, with the following exceptions:

- (a) Placing Reinforcement and Dowel Bars.

- (1) General. The reinforcement shall be as shown on the plans. Patches 6 m (20 ft.) or longer shall be tied to the adjacent lane of existing pavement, pcc shoulders, and curb and gutter with No. 20 (No. 6) transverse tie bars, 600 mm (24 inches) long, embedded 200 mm (8 inches) at 610 mm (24 inch) centers according to Article 420.10(b), except the cost of the anchors ties shall be considered as included in the contract unit price for patching and no additional compensation will be allowed.
- (2) Class A Patching. Half-lane patches 6 m (20 ft.) or longer shall be tied to the adjacent lane of existing pavement, PCC shoulders, and curb and gutter with No. 20 (No. 6) 600 mm (24 inches) long, embedded 200 mm (8 inches) at 610 mm (24 inch) centers according to Article 420.10(b), except the cost of the ties shall be considered as included in the contract unit price for patching and no additional compensation will be allowed. The Contractor shall tie the steel together, using at least 2 secure ties for each lap splice. The details shall be as shown on the plans.

Should an existing lap splice be encountered in the patch slice area, the Contractor shall construct the new splice by tying both of the exposed reinforcement bars to the new reinforcement bar.

Reinforcement steel shall be placed and supported on chairs according to Article 421.06 such that uniform unsupported lengths not exceeding 1.2 m (4 ft.) are provided. In such cases where an uneven subbase hinders maintenance of a placement tolerance of ± 25 mm (1 inch) vertically, portland cement concrete, sand-cement grout, or bituminous hot mixture shall be used to adjust the chair height to allow the reinforcement to be placed within the specified tolerances.

When the existing reinforcement is fabric, the longitudinal reinforcement bars shall be the same size and spacing as the existing longitudinal reinforcement.

- (3) Class B Patching. Dowel and tie bar holes shall be drilled as shown on the plans, and parallel to the grade and centerline of the pavement with a tolerance of 3 mm (1/8 inch) in 300 mm (12 inches). The drilling operation shall not crack or spall the pavement.

Immediately prior to grouting the dowel bars or tie bars, the holes shall be thoroughly cleaned of drilling debris. Dust and debris shall be blown from the joint or crack with a power brush/blower or with compressed air. If compressed air is used, the pneumatic tool lubricator must be bypassed and a filter installed on the discharge valve to keep water and oil out of the lines. The dowel bars shall be clean and free from rust.

An approved chemical adhesive shall be used as the anchoring material for dowel bars. At the Contractor's option, either an approved non-shrink grout or chemical adhesive shall be used as the anchoring material for tie bars.

The grout or chemical adhesive shall be of a consistency such that the dowel or tie bar may be easily inserted into the hole with flow completely surrounding the bar, and without appreciable runout of grout or chemical adhesive after the bar is fully inserted. (The consistency of the grout should be thicker than the consistency recommended by the manufacturer's directions). The grout or chemical adhesive shall be injected to the back of the hole to eliminate air pockets prior to inserting the bar. The quantity of material used shall be such that the grout or chemical adhesive is dispersed along the entire length of the bar and voids are completely filled. After the material has been positioned at the back of the hole, the bar shall be fully inserted, using a back-and-forth twisting motion, leaving the proper length exposed as shown on the plans. If it is necessary to use a hammer to aid in seating a dowel, the exposed end of the dowel shall be protected with a wood block.

Immediately prior to placing the concrete, the exposed ends of dowel bars shall be cleaned and lightly oiled.

Class B patches Type III or Type IV shall be reinforced with pavement fabric according to the details shown on the plans. The reinforcement shall be placed at 90 mm ±25 mm (3 1/2 inch ±1 inch) below the final finished patch surface elevation according to Article 420.09, except

that placement of reinforcement by mechanical or vibratory means will not be permitted.



Hinge jointed pavement shall be patched according to the details shown on the plans and as specified for Class B patches, except that if the area to be patched does not contain a contraction joint, only the leave end of the patch shall be dowelled and pavement fabric reinforcement shall not be used. The traffic approach end of patches in areas not containing a contraction joint shall be tied. Patches that are 14 m (45 ft.) or more in length shall have sawed contraction and hinge joints constructed according to the applicable requirements of Article 420.10 at 4.5 m (15-ft.) maximum intervals and shall be in prolongation with joints or cracks in the adjacent lane whenever possible. Patches 4.5 m (15 ft.) or longer shall be tied to the adjacent lane of existing pavement, pcc shoulders, and curb and gutter with No. 20 (No. 6) transverse tie bars, 600 mm (24 inches) long embedded 200 mm (8 inches) at 610 mm (24 inch) centers according to Article 420.10(b), except the cost of the ties shall be considered as included in the contract unit price for patching and no additional compensation will be allowed.

- (4) Class C Patching. When the patched pavement is not to be resurfaced, transverse contraction joints shall be formed on 4.5 m (15 ft.) to 6 m (20 ft.) centers by sawing in all Class C patches that are 6 m (20 ft.) or more in length. They shall be placed in prolongation with joints or cracks in the existing slab whenever possible.
- (b) Replacing Full Width Pavement. Unless through traffic is detoured, full width pavement shall be replaced in 2 or more operations. When replacing adjacent lanes in one operation, the longitudinal joint down the lane line shall be a sawed longitudinal joint as specified in Article 420.10, except that tie bars shall be included only for Type A, Type B, and Type C patches that are 6 m (20 ft.) or more in length. When full-width pavement is replaced in 2 or more operations, a form shall be installed along the laneline by one of the following methods:
- (1) Method 1. Whenever practicable, an approved form, not less than 6 mm (1/4 inch) in thickness, shall be set along the longitudinal joint when placing the patching in the first half width. The depth of this form shall be equal to the thickness of the new pavement being placed, or as close thereto as standard lumber measurements will allow. No pavement in the lane open to traffic shall be removed to permit setting the form, and the form shall remain in place until the existing pavement in the opposite half width is removed.
  - (2) Method 2. When the existing pavement in the opposite half width is so broken or disintegrated that it is not feasible to use Method 1, a wood form shall be set along the longitudinal joint when placing the patch in the first half width, except that a metal form may be used for Type III patches when mechanical finishing is employed. Only sufficient concrete shall be removed from the lane open to traffic to permit setting the form. As soon as permissible after the concrete is poured, the form shall be removed, and the trench occupied by the form shall be filled immediately with compacted granular material,

which shall be constantly maintained in such a manner that it will not be a hazard to traffic.

(c) Forms.

(1) Side forms will be required.

(2) For Class B Patches, a bond breaker of 6 mm (1/4 inch) fiber board, or other material approved by the Engineer, shall be placed flush with the surface at the pavement centerline for the full length and depth of the patch. If the centerline sealant reservoir is to be formed, that part of the bondbreaker may be replaced by the joint reservoir form.

— (d) Ready Mix Concrete. Non-agitating trucks will not be permitted for transporting the mixed concrete, except in specific cases, and then only upon written permission of the Engineer.

— (e) Concrete Placement. For Class A, Class B and Class C Patches, concrete shall be placed according to Article 420.07 and governed by the limitations set forth in Article 420.08, except that the maximum temperature of the mixed concrete immediately before placing shall be 35 °C (96 °F.), the required use of an approved retarding admixture when the plastic concrete reaches 30 °C (85 °F.) shall not apply, and placing of the special patching mixture, when its use is required, shall be only when the air and ground temperatures in the shade are at or above 15 °C (55 °F.) and the temperature for the next 8 hours is expected to remain above 5 °C (40 °F.).



In the case of Class A Patches, if the subbase and subgrade material have been disturbed and/or removed in excess of plan pavement thickness plus subbase thickness or more from the surface of the pavement, the concrete shall be placed in lifts and separated by a bond breaker. The elevation of the bottom lift shall be level with the top of the subbase. A thin coating of rapid setting asphalt emulsion or thick coating of Type III curing compound shall be applied to the surface of the bottom lift. Care shall be taken to avoid coating the vertical faces of the existing pavement or any reinforcement. The remainder of the concrete shall be placed after the asphalt emulsion or curing compound has sufficiently cured but not before at least 1 day after placement of the bottom lift.

(f) Consolidating and Finishing. The concrete shall be consolidated by internal vibration. Special attention shall be given to consolidating the concrete around the corners, edges, dowel bars, tie bars and reinforcement.

For Class A and Class B, the surface of the patch shall be struck off with 2 passes of a vibratory or rolling screed as approved by the Engineer. For Class C Patches, finishing may be performed by either machine or hand methods. For repairs 4 m (12 ft.) or less in length, the screed shall be placed parallel to the edge of pavement. For repairs over 4 m (12 ft.) in length, the screed shall be placed perpendicular to the edge of pavement. In striking off, the template shall be moved forward with a combined longitudinal and transverse shearing motion, moving always in the direction in which the work is progressing and manipulated so that neither edge is raised during the striking off process. A slight excess of concrete shall be

kept in front of the cutting edge at all times during the striking off operation.

After strike off, but while the concrete is still plastic, the surface of the concrete shall be tested for trueness by means of a 3-m (10-ft.) straightedge according to Article 420.11(c).



For Class A and Class B patches which will not be overlaid, the surface shall be stamped with the current year approximately 300 mm (1 ft.) from the outer edge of the lane.

- (g) **Brooming and Edging.** When patching pavements which have not been overlaid, the final finish shall match the surrounding pavement. When patching pavements which have been overlaid, the surface of the concrete shall be textured with a broom finish applied transversely to the pavement centerline. The texturing operation shall be executed so that the surface is uniform in appearance and free from rough and porous spots, irregularities and depressions. If directed by the Engineer, concrete adjacent to a longitudinal joint shall be edged.
- (h) **Curing and Protection.** In addition to Article 1020.13, when the use of the special patching mixture is required and the ambient temperature is between 15 °C - 30 °C (55 °F.- 80 °F.), it may be necessary to cover the patch with polyethylene and insulation (R12 minimum) and maintain cover and insulation until opening strength is reached. Insulation shall not be placed when the ambient temperature at placement is greater than 32 °C (90 °F.).

When patching two or more lane widths of continuously reinforced concrete pavement in one operation and extreme daily temperature cycles are anticipated, the Engineer may require that 60 m (200 ft.) of pavement on each end of the patch be covered with wet straw and burlap or an approved insulation blanket, and that the patch be cured with wet burlap and covered in a similar manner. When covering is required, it shall be in place during the curing period. If wet straw and burlap is used, it shall be maintained in a wet condition throughout the curing period. When covering is required by the Engineer, it shall be paid for according to Article 109.04.

- (i) **Shoulder Replacement.** After the forms are removed but prior to opening to traffic, the disturbed shoulder area shall be replaced with like material, compacted and restored to the existing line and grade.
- (j) **Joint Sealing.**
  - (1) In Class A patches, all centerline joints, longitudinal joints adjacent to pcc shoulders shall be sealed according to Article 420.14(a).
  - (2) In Class B patches, all transverse joints, centerline joints, longitudinal joints adjacent to pcc shoulders, and saw-cut extensions in the shoulders shall be sealed according to Article 420.14(a) and manufacturer's recommendations. The sealant reservoir at patch boundaries shall be formed in the fresh concrete or sawed to the dimensions shown on the plans. If the reservoir is to be sawed, sawing shall not be performed until after the required curing period. The faces of the reservoir shall be thoroughly cleaned by sandblasting

and then blown clean with compressed air having a pressure of at least 620 kPa (90 psi) and a volume of 4 m<sup>3</sup> per min. (150 cfm) of air at the nozzle. The backer rod shall be uniformly placed at the depth shown on the plans or as directed by the Engineer.

The sealing shall be done in one pour to fill the transverse joint and the centerline joint. Reheated or overheated material shall not be used.

At the Contractor's option, the centerline joint may be sawed/formed and sealed in a manner similar to the transverse joint.

- (3) In Class C patches, transverse contraction joints shall be sealed according to Article 420.14(a).
- (4) Sealing of joints as specified in (1), (2), and (3) will not be required when patching is being performed to prepare the existing pavement for bituminous resurfacing.

**442.07 Expansion Joints.** Where expansion joints exist in the portion of the pavement that is to remain in place, the adjacent new pavement shall be constructed when possible with a similar type joint. Where existing joints are obsolete or unobtainable, the expansion joint material may be any preformed expansion joint filler meeting the requirements of Section 1051.

In Class B patches, expansion joints shall be constructed as shown on the plans. The expansion joint materials shall conform to Article 1051.08 or 1051.09, and the joints shall be sealed as specified in Article 420.14(a).

**442.08 Opening Patches to Traffic.** The patches shall be opened to traffic according to Article 701.05(e).

**442.09 Class D Patching.** Class D patching shall conform to the standard details and cross sections shown on the plans. The materials and the methods of performing the work shall conform to Section 406 with the following exceptions:

- (a) **Barricading Patches.** Patches placed on roadways where the Traffic Control Plan permits an overnight lane closure, may remain closed until the following workday. On contracts on which overnight lane closure is not provided in the Traffic Control Plan, the removal and replacement of pavement shall be controlled by the Contractor so that all holes are filled and the compacted bituminous mixtures are cooled sufficiently to permit all barricades to be removed before dusk each day. The Contractor shall have the option of either stopping the patching early enough in the workday to permit the bituminous mixture to cool or use ice or water to induce early cooling.

Patches opened to traffic that are constructed high or become rough by rutting, shoving, or heaving shall be corrected within 48 hours by trimming off high areas and/or filling depressions. Filled areas shall be rolled to obtain the required density.

Continued opening of the roadway before the bituminous mixture has cooled sufficiently to prevent rutting or shoving will be reason for the

Engineer to establish a shut-off time when all patch holes must be filled. No additional compensation will be allowed the Contractor if it is necessary for the Engineer to restrict the shut-off time.

- (b) Pavement Removal. This work shall conform to Article 442.05(c).
- (c) Filling Holes. Each properly prepared hole shall be filled with at least two layers of bituminous concrete mixture conforming to the requirements of Section 406 for bituminous concrete binder course. The bituminous concrete mixture shall be placed only when the temperature in the shade is at least 5 °C (40 °F.) and the forecast is for rising temperature and when the subgrade is not frozen. Each layer shall be compacted with a mechanical tamper, a vibrating tamper, or a self-propelled roller. Trucks may be used to supplement the tampers or roller. If the required density is not obtained, the Contractor shall increase the number of layers and/or compactive efforts.


The top layer shall be not less than 50 mm (2 inches) compacted thickness. At the option of the Contractor, the 50 mm (2 inch) top layer may be constructed using bituminous concrete surface course. To facilitate possible extra compaction and consolidation by traffic, the surface of the completed patch may be finished up to 13 mm (1/2 inch) above the existing pavement.

- (d) Density. After final compaction, the finished patch shall have a density of not less than 93 percent of the theoretical density of the mixture. The density of the bituminous mixture placed in patches shall be measured by nuclear test methods or obtained from specimens furnished by the Contractor according to the requirements of Article 406.16(b) except as hereinafter specified.
  - (1) Coring. The diameter of a core specimen shall in no case be less than 90 mm (3 5/8 inches). Two specimens shall be taken from each type of patch placed during a day and these shall be furnished not later than the morning of the first work day following placement of the patches. When directed by the Engineer, additional specimens shall be taken but the total number per day from each type of patch shall not exceed 10. The Contractor shall remove the specimens at locations designated by the Engineer and transport them to the plant laboratory. Care shall be exercised to avoid damage to the specimens. The holes caused by the removal of the specimens shall be refilled immediately with a bituminous material meeting these Specifications, compacted and finished to the satisfaction of the Engineer. The cost of this work will not be paid for separately, but shall be included in the unit prices bid for the item(s) of patching involved.
- (e) Additional Compaction. Traffic shall be permitted on the patches for at least 3 days prior to resurfacing.
- (f) Maintenance of Patch. The surface of the completed patch shall be maintained in a smooth condition. High spots shall be trimmed level with the pavement surface. If depressions develop, they shall be filled with a Surface Course or a B Binder Mixture compacted with a tandem or three-wheel roller. No additional compensation will be permitted for

maintaining smooth patches.

If the patched pavement is to be resurfaced on the same contract, minor depressions in the patch surface may be filled and compacted as a part of the resurfacing operation.

**442.10 Method of Measurement.** Pavement removal and replacement of the various classes and types will be measured for payment in place, and the area computed in square meters (square yards).


 To the extent possible, the contract documents contain information on the thickness of the existing pavement including subsequent resurfacing(s). In the event the average combined thickness of the existing pavement and overlays in an area to be patched differs from the thickness shown on the plans, the Engineer will adjust the patching quantity, for the specific patch type, of the individual paths meeting this requirement as indicated by the following chart. The quantities will be increased when the thickness is greater and decreased when the thickness is less.


<u>% change of thickness</u>	<u>% change of quantity</u>
0 to less than 15	0
15 to less than 20	10
20 to less than 30	15
30 and greater	20


No other compensation will be allowed for variations in patching thickness from that shown on the plans.

If additional pavement, subbase, or subgrade material is removed due to negligence on the part of the Contractor, the additional quantity of pavement removal and replacement or subgrade material will not be measured for payment. Shoulder removal and replacement resulting from edge forming will not be measured for payment.


When expansion joints are to be included in Class B patches, as shown on the plans or as directed by the Engineer, the expansion joint will be measured for payment in place in meters (feet).

 **442.11 Basis of Payment.** Where the Contractor has the option of using either Class C or Class D patches, this work will be paid for at the contract unit price per square meter (square yard) for PAVEMENT PATCHING, of the type and thickness specified.

 Where the Department requires a specific class of patch be used, this work will be paid for at the contract unit price per square meter (square yard) for CLASS A PATCHES, CLASS B PATCHES, CLASS B PATCHES (HINGE JOINTED), CLASS C PATCHES, OR CLASS D PATCHES of the type and thickness specified.

 When expansion joints are included in Class B patches, the expansion joint will be paid for at the contract unit price per meter (foot) for CLASS B PATCH - EXPANSION JOINT.

Where unsuitable material is encountered in the subgrade or subbase and its removal and replacement is required by the Engineer, such removal and replacement shall be performed by the Contractor and will be paid for according to Article 109.04.

 When additional pavement removal due to unsound concrete is directed by the Engineer, the additional saw-cuts required will be paid for according to Article 109.04. The additional quantity of pavement removal and replacement will be paid for at the contract unit price for the item(s) of patching involved.

The above prices shall include the cost of performing the work as specified herein, including sawing and removal and disposal of existing materials; furnishing and installing contraction joints, pavement reinforcement, dowel bars, tie bars, expansion anchor ties and contraction joints, as required; and shoulder replacement and joint sealing.

**SECTION 443. REFLECTIVE CRACK CONTROL TREATMENT**

**443.01 Description.** This work shall consist of constructing reflective crack control treatments of the type specified. Area reflective crack control treatment shall be either System A or C at the option of the Contractor. Strip reflective crack control treatment shall be either System A, B or C at the option of the Contractor.

**443.02 Materials.** Materials shall meet the requirements of the following Articles of Section 1000 - Materials:

Item	Article/Section
(a) Reflective Crack Control System .....	1062

**443.03 Equipment.** Equipment shall meet the requirements of the following Articles of Section 1100 - Equipment:

Item	Article/Section
(a) Pressure Distributor .....	1102.05
(b) Mechanical Sweeper (Note 1) .....	1101.03
(c) Asphalt-Rubber Equipment (Note 2)	
(d) Cover Aggregate Spreader (Note 3)	
(e) Rolling Equipment (Note 4) .....	1101.01
(f) Mechanical Laydown Equipment (Note 5)	

Note 1. For pavement cleaning and excess cover aggregate removal.

Note 2. All equipment utilized in processing and application of the asphalt-rubber material shall be a truck or trailer mounted self-powered distributor equipped with a heating unit, a mixing unit capable of producing a homogenous mixture of asphalt and rubber, pump(s) capable of spraying asphalt-rubber within  $\pm 0.22 \text{ L/m}^2$  ( $\pm 0.05 \text{ gal. per sq. yd.}$ ) of the specified rate, and a fully circulating spray bar capable of applying asphalt-rubber without a streaked or otherwise irregular pattern.

The distributor shall include a tachometer, pressure gages, volume measuring devices, an onboard weighing device to aid in proportioning materials and a thermometer. A "bootman" shall accompany the distributor and ride in a position so that all spray bar nozzles are in his/her full view and readily accessible for unplugging.

Note 3. The cover aggregate (chip) spreader shall be a self-propelled