INDIANA

DEPARTMENT OF TRANSPORTATION

STANDARD SPECIFICATIONS

EFFECTIVE FOR LETTINGS
ON OR AFTER
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1999

For copies of these Standard Specifications contact:

Contract Engineer
Indiana Department of Transportation
Room N855, Indiana Government Center North
100 North Senate Avenue
Indianapolis, Indiana 46204-2218

Price $15.00

A supplemented version of these standard specifications and the supplemental specifications only are located on the internet at the following address:

http://www.in.gov/dot/cc/standards/book/

SECTION 305 -- RECONDITIONING

305.01 Description. This work shall consist of reconditioning an existing road or an existing surface, by rubblizing and compacting, repairing, patching, widening, placing retrofitted load transfer assemblies, sealing cracks and joints, cleaning and reconditioning the ditches, shaping the shoulders, or a combination of these, in accordance with 105.03.

MATERIALS

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305.02 Materials. Materials shall be in accordance with the following:

Aggregates	904
Asphalt Emulsion	902.01(b)
Asphalt for Undersealing	612.02
Calcium Chloride	913.02
Dowel Bars	910.01(b)10
Joint Materials	906
Portland Cement	901.01(b)

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Rapid setting patch materials shall be selected from the Department's list of approved Rapid Setting Patch Materials.

Earthwork, if specified in the contract, shall be in accordance with applicable requirements of 200.

CONSTRUCTION REQUIREMENTS

305.03 Repairing. Repairing shall consist of scarifying the existing roadway within the limits shown on the plans or as directed, leveling and shaping to section, incorporation of aggregate and additives if required; compacting; shaping the shoulders, and cleaning and reconditioning the ditches as shown on the typical section.

If specified, the roadway shall, within designated limits, be scarified to the depth shown. The scarified material shall be uniformly mixed and spread over the roadway or roadbed as directed. The nongranular scarified material shall be pulverized so that it will pass a 50 mm (2 in.) sieve. The granular scarified material, including asphalt courses, shall be pulverized so that no piece is larger than the depth of the scarified section. All objectionable material, including large stones, sod, roots, and clods, shall be removed from the roadway section and disposed of satisfactorily.

Calcium chloride, if required, shall be incorporated uniformly in the course prior to compaction. Water may be required during the mixing operations to provide the desired moisture content needed to facilitate compaction. If asphalt additive is specified, the type and amount shall be as directed and in accordance with the applicable requirements of 405. Where specified, an aggregate course shall be constructed in accordance with 303.

After the scarified material has been pulverized and treated with additives, if specified, it shall be spread uniformly to the required cross section and compacted in accordance with of 402.13 or as directed. Shoulders, if so specified or shown on the typical section, shall be constructed in accordance with the applicable requirements of 208.02.

Ditches, if shown on the plans, shall be constructed in accordance with applicable requirements of 208.03. The excavated material shall be used in construction on the road or wasted as directed.

305.04 Rubblizing Existing PCCP. The existing pavement shall be rubblized with a self-contained, self-propelled resonant frequency pavement breaking unit capable of producing low amplitude, 8900 N (2000 lbf) blows at a rate of not less than 44 per s or with a self-contained, self-propelled, multiple headed, impact hammer with the heads directly adjacent to each other and the lift height of each head independently adjustable. The sequence of impacts shall be on a random basis. The unit shall be equipped with a water system to suppress dust generated by the operation.

The operating speed of the unit shall be such that the existing pavement is reduced into particles ranging from sand sized to pieces not exceeding 150 mm (6 in.) in the largest dimension, the majority being a nominal 25 to 50 mm (1 to 2 in.) in size. The concrete from the surface to the top of the reinforcement shall be reduced to the 25 to 50 mm (1 to 2 in.) size to the fullest extent possible. Continuous coverage, overlapped if necessary, with the breaking shoe or impact hammers shall be used. Additional passes of the resonator or multiple headed impact hammer may be required if larger sizes remain above the reinforcement.

Rubblizing shall begin at the edge of pavement and proceed to the center of the pavement. The rubblization of the first lane shall extend 150 mm (6 in.) into the adjoining lane.

Subsurface drains shall be installed along the edges of the pavement prior to the rubblization.

Prior to placing the HMA mixtures, the complete width of the rubblized pavement shall be compacted by means of vibratory steel wheel and pneumatic-tired rollers in the following sequence; two initial passes with a vibratory roller, two passes with a pneumatic-tired roller, and then four final passes with a vibratory roller. The last two passes shall be on the same day as the paving operations. When the multiple headed impact hammer is used, a Z-pattern steel grid vibratory roller shall be used for additional particle break-down to the satisfaction of the Engineer. This roller shall be a self-contained, self-propelled vibratory steel wheel roller with a Z-pattern grid cladding bolted to the surface of the drum.

The rolling equipment shall be in accordance with 408.03. The vibratory roller shall be operated in the vibration mode at a speed not to exceed 1.8 m (6 ft) per s. All depressions, 25 mm (1 in.) or greater in depth from that of the immediate surrounding area, that result from the rubblizing or compaction effort shall be filled with aggregate No. 73 and struck off level with the surrounding area. Filled depressions shall be compacted with the same roller and compactive effort previously described.

Reinforcement in the rubblized pavement shall be left in place. However, all reinforcement exposed at the surface as a result of rubblizing or compaction operations shall be cut off below the surface and removed from the site. All loose joint fillers, expansion material, or other similar materials shall also be removed from the rubblized surface.

Except at restricted crossover and ramp crossings, traffic will not be allowed on the rubblized pavement before the HMA base or intermediate courses are in place. Rubblized material dislodged by construction traffic shall be removed from the pavement. Not more than 48 h shall elapse between rubblizing and placement of the initial HMA course. However, in the event of rain, this time limitation may be waived to allow sufficient time for the rubblized pavement to dry to the satisfaction of the Engineer. Crossover and ramp crossings shall be maintained in the same compacted state as other areas until the initial HMA course is placed.

The preceding rubblizing operations shall be scheduled after widening or shoulder work has progressed up to the elevation of the existing pavement grade. These areas may then be utilized to support the breaking unit while the existing pavement is being rubblized. Shoulders may then be completed in conjunction with the placement of HMA pavement courses over the compacted rubblized pavement.

A joint shall be saw cut full depth or load transfer devices shall be severed at an existing joint on ramps or mainline where the rubblizing abuts concrete pavement which is to remain in place.

305.05 Patching Asphalt Pavement. Areas to be patched will be marked on the surface by the Engineer and all or part of the existing pavement shall be removed to the depth shown on the typical section or as directed. If it is determined that all of the existing pavement is to be removed, the patching depth shall be the greater of 225 mm (9 in.) or to the bottom of the existing asphalt material. At least a 50 mm (2 in.) vertical butt joint shall be constructed to connect the patch to the pavement that remains in place.

Existing shoulders shall be patched at the locations and to the depth shown on the plans or as otherwise directed.

Subgrade under patches shall be compacted. If the excavation for patches discloses unsuitable material at subgrade elevation, such material shall be removed. The removed area shall be backfilled with suitable material and compacted to the required elevation. An approved template shall be furnished for checking subgrade elevations in trenches. Unauthorized excavation beyond neat lines shall be replaced with suitable material and compacted. Excavation for patching will not be paid for separately but shall be included in the cost of the filling material.

The mixture shall be as set out in the Schedule of Pay Items and made in accordance with these specifications for the kind of mixture used. If the mixture is not specified, the mixture shall be in accordance with 402 for HMA Base 25.0 mm or HMA Intermediate 19.0 mm. Mixture adjustments in accordance with 904.02(a) will not apply. Mixtures will be sampled, tested, and accepted in accordance with 402.06(a) unless the mixtures are supplied in accordance with 401.08 as allowed in 402.03. When mixtures in accordance with 401.08 are supplied, all applicable requirements of 401.02 shall be met and acceptance will be in accordance with 402.06(b).

Each course shall be compacted by approved mechanical equipment such as rollers, rammers, or other acceptable means. In small inaccessible areas, hand tamping will be permitted. Rammers shall be capable of exerting a minimum compacting force equivalent to that exerted by the drive wheels of an approved three wheel roller.

A three wheel roller or a pneumatic tire roller in accordance with 408.03(d) shall be used for the final compaction of the top course. Choke aggregate size No. 23, No. 24, or No. 12 may be required on the surface of the patch to eliminate pickup.

A smooth riding surface shall be maintained on HMA patches at all times. Deformations due to traffic or other conditions shall be corrected immediately. HMA base, intermediate, or surface mixtures may be used to maintain patches. HMA mixture used for this purpose will be paid for at the contract unit price per megagram (ton) for HMA for patching. If possible, patches shall be completed during daylight hours and opened to traffic at the close of the work day. Patches that cannot be completed during the day shall be backfilled, compacted, and a temporary surface shall be placed to carry traffic during the night.

305.06 Patching PCCP or PCCP Base. Areas to be patched will be marked on the surface. Unless otherwise directed or specified, the depth of the concrete shall be 200 mm (8 in.). The surface of the concrete patch shall be at the top of the existing concrete base or concrete pavement. The existing pavement shall be removed completely from the areas to be patched. In general, all sides of a patch shall be straight. The maximum deviation from a straight line on any side shall not exceed 150 mm (6 in.). The sides of a patch shall deviate no more than 30 degrees from a right angle with the centerline. The edges shall be such that the maximum variation from the vertical shall not exceed 40 mm (1 1/2 in.). In trimming and straightening these edges it may be necessary to use hand methods. Methods and equipment used in cutting, breaking, and removal shall not cause undue breakage, excessive shattering, or spalling of the concrete to be left in place and shall be such that will prevent excessive vibration and shock from being transmitted along reinforcing steel to the adjacent pavement.

Areas to be patched shall be outlined with full depth drilled holes spaced no more than 150 mm (6 in.) apart and sawed.

The subgrade on which the patching material is to be placed shall be compacted thoroughly prior to placing the patching material.

(a) Patching with PCC. Forms shall be set for the outside edges of the existing pavement. Forms and setting shall be in accordance with the applicable provisions of 507.04(c). If a patch extends from one traffic lane into an adjacent one, forms shall be placed with the face at the line separating the lanes and the new concrete on the face side placed and finished. After the newly poured side is opened to traffic, the forms and any remainder of the old pavement shall be removed and the remaining portion of the patch shall be placed and finished. Although a joint is formed, no load transfer steel will be required.

Concrete used for concrete patches shall be in accordance with 506.03. Materials and construction requirements shall be in accordance with the applicable requirements of 500.

(b) Patching with HMA Mixture. If a rigid pavement or base is to be patched with HMA mixture, the rigid pavement, including overlay, shall be removed in accordance with 305.06, except the size of the patch shall be full lane width and of sufficient length to accommodate the compaction equipment. The depth shall be as shown on the plans. If it is determined that the rigid pavement, including any overlays, requires removal, the patching depth shall be either 300 mm (12 in.) or to the bottom of the existing rigid pavement, whichever is greater. Pavement edges shall be given a tack coat as directed. Compaction shall be in accordance with 305.05.

If only the flexible portion of a composite pavement requires patching, the patching shall be in accordance with the applicable requirements of 305.05.

The mixture shall be as set out in the proposal and made under the provisions of these specifications for the kind of mixture used. If the mixture is not specified, the material shall be in accordance with 402 for HMA Base 25.0 mm or HMA Intermediate 19.0 mm. Mixture adjustments in accordance with 904.02(a) will not apply. Mixtures

will be sampled, tested, and accepted in accordance with 402.06(a) unless the mixtures are supplied in accordance with 401.08 as allowed in 402.03. When mixtures in accordance with 401.08 are supplied, all applicable requirements of 401.02 shall be met and acceptance will be in accordance with 402.06(b). Surface tolerances shall be in accordance with 402.16.

305.07 Retrofit Load Transfer for PCCP. Retrofit load transfer consists of cutting slots and the placement of retrofitted dowel bar assemblies in the PCCP, parallel to the centerline of the roadway without damaging adjacent PCCP. Burrs and bumps remaining in the base of the slots after cutting shall be removed with hand or mechanical chipping hammers. Mechanical chipping equipment shall not exceed a nominal 7 kg (15 lbs) in mass (weight) and shall be operated at a maximum angle of 45 degrees from the pavement surface.

All surfaces of the slots shall be thoroughly cleaned by sand blasting and all cracks in the slots shall be sealed with a silicone sealer. The slots shall be cleaned and blown dry with compressed air.

Dowel bar assemblies shall be as shown on the plans. Prior to placement, the assemblies shall be coated with a bond breaking material and placed on non-metallic supports in the slots. Dowel bars shall be parallel to the pavement surface.

Rapid setting patch material shall be placed in the slots, troweled to match existing adjoining PCCP and cured in accordance with the manufacturer's recommendations.

Transverse contraction joints with retrofitted load transfers shall be sawed for the full lane width and sealed in accordance with 503.03(a) except the joint shall be cut in one operation. Transverse random cracks with retrofitted load transfer slots shall be routed and sealed for the full lane width in accordance with 503.05.

PCCP damaged outside the area of the slots due to Contractor's operations shall be repaired or replaced.

305.08 Sealing Cracks and Joints in Asphalt Pavement. Reflection cracks and joints, both longitudinal and transverse, as well as cracked, and alligatored areas shall be sealed using from 0.5 to 0.7 L/m^2 (0.10 to 0.15 gal. per sq yd) of AE-90 or AE-150 asphalt material and covered with either No. 23 or No. 24 sand. The cracks, joints, and alligatored areas shall be cleaned by blowing with compressed air or by other suitable means prior to the placing of the asphalt sealing material. The asphalt material shall be allowed to penetrate the cracks and joints in the existing surface. All surplus shall be squeegeed back and forth over the area to refill them. All excess material shall be squeegeed off the pavement. The sealed surface shall be covered with sand at the rate of approximately 2.7 kg/m^2 (5 lb per sq yd).

305.09 Filling Cracks and Joints in Concrete Pavement. Locations for filling cracks and joints in concrete pavement will be as directed. The cracks and joints shall be cleaned of any loose asphalt pavement or foreign materials and then filled to the level of the existing surface. Any surplus asphalt material shall be removed from the

pavement surface. The filler may be RS-2, AE-60, AE-90, or AE-150 in accordance with 902.01(b). If undersealing is required, the material used for filling cracks and joints may be the same material used in undersealing. The pouring temperatures shall be those as required for the respective materials.

305.10 Widening. Widening shall be as shown on the plans or as specified. The subgrade in the widened area shall be compacted in accordance with 207 prior to the placing of the widening materials. The outside face of the excavated area shall be left as nearly vertical as the nature of the material will permit and not wider than the outside limits of the widening section when forms are not used.

(a) Widening with HMA Mixture. The widened section shall consist of courses of HMA mixture as shown on the typical section or as directed. The compacted depth of each course shall not exceed three times the maximum particle size as shown on the JMF. Except for surface mixtures, the course flush with the top of the existing surface shall be compacted with a three wheel roller and a pneumatic tire roller.

Widening with QC/QA – HMA mixtures shall be in accordance with 401 except density will be accepted in accordance with 401.16(c).

Widening with HMA mixtures shall be in accordance with 402. Mixtures will be sampled, tested, and accepted in accordance with 402.06(a) unless the mixtures are supplied in accordance with 401.08 as allowed in 402.03. When mixtures in accordance with 401.08 are supplied, all applicable requirements of 401.02 shall be met and acceptance will be in accordance with 402.06(b).

(b) Widening with PCC. If the existing concrete base is to be widened with PCC, the concrete shall be placed directly against the existing pavement edges, which shall be free from all foreign materials. Unless otherwise provided, the widening shall be 200 mm (8 in.) in depth. The surface of the concrete widening shall be at the same elevation as the top of the existing concrete base or concrete pavement. The edges of the widening adjacent to the existing pavement shall be edged to a 19 mm (3/4 in.) radius. If forms are set for the outside edge, it shall be edged in the same manner. All joints between edges of the adjacent pavement shall be filled with an approved joint filler or sealer. Reinforcing steel will not be required unless so specified. The concrete for widening may be placed with or without forms.

Materials and construction requirements shall be in accordance with the applicable requirements of 502.

If the surface texture is to be a drag finish, a drag shall be used which shall consist of a seamless strip of damp burlap or cotton fabric. It shall produce a uniform surface of gritty texture after being dragged longitudinally along the full width of pavement. For pavement of 4.8 m (16 ft) or more in width, the drag shall be mounted on a bridge which travels on the forms. The dimensions of the drag shall be such that a strip of burlap or fabric at least 0.9 m (3 ft) wide is in contact with the full width of pavement surface while the drag is used. The drag shall consist of no less than two layers of burlap with the bottom layer approximately 150 mm (6 in.) wider than the

upper layer. The drag shall be maintained in such condition that the resultant surface is of uniform appearance and reasonably free from grooves over 2 mm (1/16 in.) in depth. Drags shall be maintained clean and free from encrusted mortar. Drags that cannot be cleaned shall be discarded and new drags substituted.

Smoothness shall be in accordance with the applicable requirements of 502.20 from a line 1.0 m (3 ft) out from the edge of the existing pavement being widened to the outside edge of the new widening. The new concrete adjacent to the existing pavement shall be at the same elevation as the old pavement.

Curing shall be in accordance with the applicable requirements of 504. If resurfacing is a part of the contract, the surface of the newly placed concrete shall be finally finished by dragging with wet burlap or cotton fabric or by the use of a wooden float. In lieu of curing with earth, asphalt emulsion, AE-T in accordance with 406, may be used as curing material. No traffic shall be permitted on this application until the concrete has attained its required curing, which shall be no less than 48 h.

(c) Widening with Compacted Aggregate. All or a portion of the widened area shown on the plans or as specified, shall be filled with compacted aggregate of the type shown and placed in accordance with the specifications for the material used. The lifts shall be as shown or directed. Each course shall be compacted using the equipment in accordance with 305.10(a). The pneumatic tire roller shall be used on the top lift if the course is at pavement grade.

305.11 Method of Measurement. Reconditioning will be measured as indicated below. Such measurements will include all blading of ditches and shoulders if required, the milling and pulverizing of the existing roadbed, the preparation and conservation of existing bituminous materials, excavation, the compacting of the roadbed, the finishing of the surface, and the maintenance of the complete surface if applicable.

Water will be measured by the kiloliter (1,000 gallons), by means of calibrated tanks or distributors, or by means of accurate water meters. Only that water which is used in mixing materials or ordered to keep the surface moist will be measured for payment.

Repairing will be measured by the kilometer (mile). Patching asphalt pavement will be measured by the megagram (ton) of HMA mixture used. Patching rigid pavement or base will be measured by the square meter (square yard), if cement concrete is used, or by the megagram (ton), if HMA mixture is used.

Sealing cracks and joints in asphalt pavements, filling joints and cracks in concrete pavement or base widening with HMA mixture, compacted aggregate, and HMA for patching will be measured by the megagram (ton) of material used. Cement concrete will be measured by the square meter (square yard) complete in place.

Retrofit load transfer will be measured by each dowel bar assembly installed, complete in place. Sawing and sealing of transverse joints will be measured by the meter (linear foot), complete in place.

Routing and sealing of transverse random cracks in the slots for retrofitted load transfer assemblies will not be measured.

Construction activities for the cutting, cleaning of the PCCP, dowel bars, dowel bar supports, dowel bar end caps, foam core board, patching material and all other incidentals will not be measured.

Rubblized PCCP will be measured by the square meter (square yard) of rubblized pavement. The quantity of filler aggregate No. 73 will be measured by the megagram (ton) of aggregate placed.

305.12 Basis of Payment. The accepted quantities of reconditioning work will be paid for as set out below for each pay item. Water will be paid for at the contract unit price per kiloliter (1,000 gallons) when specified as a pay item, complete in place.

The accepted quantities of retrofit load transfer will be paid for at the contract unit price per each assembly installed, complete in place. Sawing and sealing of transverse joints will be paid for at the contract unit price per meter (linear foot).

Rubblized PCCP will be paid for at the contract unit price per square meter (square yard) for rubblized pavement. Aggregate, No. 73 will be paid for at the contract unit price per megagram (ton) complete in place.

Payment will be made under:

Pay Item	Metric Pay Unit Symbol (English Pay Unit Symbol)
Aggregate, No. 73	Mg (TON)
Cement Concrete	m2 (SYS)
Compacted Aggregate for _____ (type), ____ (size), ____	Mg (TON)
Compacted Aggregate for Patching	Mg (TON)
Cracks and Joints in Asphalt Pavement, Seal	Mg (TON)
Cracks and Joints in Concrete Pavement or Base, Fill	Mg (TON)
HMA Patching for Asphalt Pavement	Mg (TON)
HMA Patching for Rigid Pavement or Base	Mg (TON)
HMA Patching, Temporary	Mg (TON)
Portland Cement Concrete for Patching _____ (pavement type)	m2 (SYS)
Repairing	km (MILE)
Retrofit Load Transfer	EACH
Rubblized PCCP	m2 (SYS)
Sawing and Sealing Transverse Joints	m (LFT)
Water for Reconditioning	kL (kGAL.)
Widening with Compacted Aggregate, _____ (type), _____ (size)	Mg (TON)
Widening with HMA	Mg (TON)
Widening with QC/QA-HMA	Mg (TON)

The costs of furnishing, necessary storage, hauling, and placing of all materials; pavement removal as required; temporary pavement required to carry traffic at night; HMA overlay of a concrete patch in the pavement removal area as required; choke aggregate required to eliminate pickup; disposal; excavation; preparation of subgrade; compacting; finishing; curing; and filling cracks and joints except as otherwise provided shall be included in the costs of the patching materials.

The costs of all materials, covering aggregate, milling and cleaning, and all necessary incidentals shall be included in the cost of sealing cracks and joints in asphalt pavement.

The cost of excavation and disposal of existing materials required for the widening material shall be included in the cost of the widening material.

The cost of cutting of slots, cleaning, dowel bars, dowel bar supports, dowel bar end caps, foam board, mortar, and curing materials shall be included in the cost of the pay item retrofit load transfer.

The cost of sawing, cleaning, sealant materials, and all incidentals shall be included in the cost of the pay item sawing and sealing transverse joints.

The cost of routing and sealing of transverse random cracks shall be included in the cost of the other pay items.

Replacement of pavement damaged by the Contractor's operations shall be without additional payment.

The cost of removal of pavement for patches shall be included in the pay item for the material used to repair the patches.

The costs of furnishing all labor, materials, and equipment necessary to rubblize, suppress dust, cut and remove exposed reinforcement, cut and remove joint fillers or similar materials, saw cutting of the pavement, severing existing joints, compacting and maintaining the compacted condition of the rubblized pavement shall be included in the cost of rubblized PCCP.

The costs of furnishing, hauling, placing, leveling, and compacting the aggregate to fill the depressions in the rubblized PCCP shall be included in the cost of aggregate, No. 73.

SECTION 506 -- PCCP PATCHING

506.01 Description. This work shall consist of the removal and replacement of PCCP in accordance with 105.03.

MATERIALS

506.02 Materials. Materials shall be in accordance with the following:

10	Admixtures	912.03
	Calcium Chloride	913.02
	Coarse Aggregate, Class A or Higher, Size No. 11	904.02
	Coarse Aggregate, Class AP, Size No. 8	904.02
	Dowel Bars	910.01(b)10
	Fine Aggregate, Size No. 23	904.01
	Portland Cement	901.01(b)
	Water	913.01

The material for anchoring the dowel bars shall be a chemical anchor system selected from the Department's list of approved Chemical Anchors.

Coarse aggregate for partial depth patching shall be size No. 11. Coarse aggregate for full depth patching shall be size No. 8. Coarse aggregate for patching shall be stone or gravel.

A bonding agent shall be selected from the Department's list of approved Non-Vapor Barrier Type Bonding Agents.

506.03 Concrete Mix Design. The CMD shall be in accordance with 506.04, and shall be submitted, prior to placement, in a format acceptable to the Engineer and include the following.

(a) a list of all ingredients
(b) the source of all materials
(c) the fine to total aggregate ratio
(d) the absorption of the aggregates
(e) the SSD bulk specific gravity of the aggregates
(f) the batch mass (weights)
(g) the names of all admixtures
(h) the admixture dosage rates and the manufacturer’s recommended range

A change to any source of material or proportions of aggregate requires a new CMD. A change to the dosage amount of an admixture will be permitted; however, a new CMD will be required for the addition or deletion of an admixture.

506.04 Concrete Mix Criteria. The fine aggregate shall be at least 35% but not more than 45% of the total mass (weight) of the aggregate in each cubic meter (cubic yard). Proportions will be based upon SSD aggregates.

The CMD shall produce workable concrete mixtures, with the minimum amount of water, having the following properties:

Minimum portland cement content	390 kg/m^3 (658 lbs/yd^3)
Maximum water/cement ratio	0.40
Slump	50 mm (2 in.) to 125 mm (5 in.)
Air content	5.0% to 8.0%
Minimum flexural strength, third point loading	2100 kPa (300 psi) at 24 h
Minimum flexural strength, third point loading	3500 kPa (500 psi) at 3 days

A water reducing admixture shall be used.

Calcium chloride solution shall be added to the concrete. A maximum of 2%, by mass (weight) of cement, shall be used. The percentage shall be reduced to one if the ambient temperature is above 27°C (80°F).

506.05 Trial Batch. A trial batch shall be produced and tested to verify that the CMD is in accordance with the concrete mix criteria. The trial batch may be produced prior to construction in a laboratory, at the plant, or at the project site on the first day of concrete placement. The Engineer will verify the CMD, test the concrete's air content and determine the water/cement ratio, and prepare and test flexural beams. The flexural strength will be determined by averaging a minimum of two beam breaks. The Engineer will provide the Contractor the results of the tests.

The trial batch shall be of sufficient quantity to allow the Engineer to perform all required tests from the same batch. Trial batch concrete shall not be used for more than one test.

When the first day's production is used as a trial batch, production may continue until flexural strength tests are completed. If 24 h or three day flexural tests are not in accordance with the specified strengths, production shall stop and a new CMD shall be submitted.

506.06 Job Control. Control of PCCP for air content, slump, or flexural strength will be determined on the basis of tests performed by the Engineer in accordance with 505. Concrete and necessary labor for sampling shall be furnished as required by the Engineer. Testing will be in accordance with the Frequency Manual.

The Engineer will notify the Contractor when test results for air content, slump, or flexural strength are outside the requirements of 506.04. Rounding will be in accordance with ASTM E 29 using the rounding method.

CONSTRUCTION REQUIREMENTS

506.07 PCCP Removal. PCCP removal areas will be marked. Vertical saw cuts around the perimeter of the removal areas shall be made in the PCCP. Transverse cuts shall be perpendicular to the centerline of the PCCP.

PCCP removal areas shall not remain open overnight. Shoulders or adjacent PCCP damaged during the removal shall be repaired as directed.

(a) Partial Depth Removal. The saw cut shall be a minimum of 25 mm (1 in.), to a maximum of 75 mm (3 in.). Removal of all unsound concrete to a minimum depth of 25 mm (1 in.) shall be by hand chipping tools or hand held mechanically driven equipment. Mechanical hammers shall not be heavier than a nominal 21 kg (45 lb) class. Mechanically driven tools shall be operated at a maximum angle of 45 degrees from the PCCP surface. If the saw cut face is damaged, a parallel saw cut 25 mm (1 in.) outside the initial saw cut shall be made and the concrete in this area shall be removed by hand chipping.

Reinforcing steel encountered during the removal operation shall be cause for a full depth patch in accordance with 506.07(b). Wire mesh reinforcement exposed during the removal operations shall be removed.

Exposure of unsound concrete below 75 mm (3 in.) shall be cause for a full depth patch in accordance with 506.07(b).

The partial depth cavities shall be thoroughly sandblasted and, just prior to placing new concrete, cleaned of all dust, chips, and water. The air lines for sandblasting and air cleaning shall be equipped with oil traps to prevent contamination of the surfaces.

(b) Full Depth Removal. The saw cut shall be the full lane width and thickness of the PCCP. After the full depth saw cut is completed, vehicle mounted removal equipment may be used to remove the concrete provided this equipment does not damage the adjacent sound concrete.

Removal areas in the same lane which are closer than 3.0 m (10 ft) shall require the PCCP between these areas to be removed and replaced. If a transverse joint is located within the removal area, the limits of removal shall be increased to a minimum of 0.3 m (1 ft) beyond the joint.

Full depth removal shall be extended until sound PCCP is encountered to allow dowel bars to be firmly anchored.

All subbase material disturbed during the removal operation shall be recompacted as directed.

506.08 Concrete Mixing and Transportation. Concrete mixing and transportation shall be completed by central mixed, shrink mixed, or transit mixed methods. Discharge from non-agitating equipment shall be completed within 30 min of mixing the water, cement, aggregates, and calcium chloride solution. Discharge from a truck agitator or a truck mixer shall be completed within 90 min of mixing the water, cement, and aggregates or within 30 min of the addition of calcium chloride solution. If the location of the plant is such that this time limit cannot be met, the calcium chloride solution shall be added to the concrete in a transit mixer at the site and the concrete shall then be mixed for an additional 40 revolutions prior to discharge.

Concrete shall be uniformly mixed when delivered to the job site. Batch tickets for each load of PCC shall indicate the mass (weight) of cement, pozzolan, and aggregates, volume of water, and the type and volume of admixtures. The mass (weight) of the cement shall be within 1% of the CMD and the saturated surface dry mass (weight) of the aggregates shall be within 2% of the CMD.

Wash water shall not be used as a portion of the mixing water.

When concrete is delivered in transit mixers, additional water to increase the workability of a load may be added within 45 min of initial mixing. Any addition of water shall be noted on the batch ticket and shall not occur as a continuing operation.

(a) Central Mixed Concrete. Central mixed concrete shall be completely mixed in a stationary mixer and transported in a truck agitator, truck mixer at agitating speed, or non-agitating equipment.

Mixing for central mixed concrete shall be no less than 60 s per batch. The mixing time shall be measured from the time all cement and aggregates are in the drum. The batch shall be so charged into the mixer that some of the water enters in advance of the cement and aggregates. All required water shall be in the drum by the end of the first quarter of the specified mixing time.

If a truck mixer or truck agitator is used for transportation, the concrete shall be agitated at the agitation speed designated by the manufacturer.

(b) Shrink Mixed Concrete. Shrink mixed concrete shall be partially mixed in a stationary mixer and the mixing completed at the plant in a truck mixer.

The time in a stationary mixer for shrink mixed concrete may be reduced to approximately 30 s. Mixing shall then be completed in a truck mixer at the plant by 50 to 100 revolutions of the drum at the mixing speed designated by the manufacture. Agitation during transportation shall be at the agitation speed designated by the manufacturer.

(c) Transit Mixed Concrete. Transit mixed concrete shall be completely mixed and transported in a truck mixer.

Mixing for a truck mixer loaded to rated capacity shall be 70 to 100 revolutions of the drum at the mixing speed, but not less than the number of revolutions recommended by the manufacturer. Discharge shall be completed prior to 300 revolutions of the drum.

506.09 Weather Limitations. Placement of PCCP patches between May 15 and September 15 shall be after 1:00 P.M. The 1:00 P.M. restriction will apply outside this calendar period when the expected ambient temperature is 21°C (70°F) or greater, unless otherwise directed.

PCCP patches shall not be placed on frozen subgrade, subbase, or PCCP.

506.10 Placing Concrete. The concrete shall be placed level to the adjacent PCCP and consolidated by internal vibration. The concrete shall be hand finished in accordance with 504. Texturing and tining are not required if the PCCP is to be resurfaced.

The PCCP patch shall be cured in accordance with 504.04(a). In addition, polyethylene film shall be placed over the patch and covered with a 100 mm (4 in.) layer of rigid or flexible insulation and firmly anchored. Small dimension lumber weighted with sandbags may be used, but large objects such as rocks or concrete blocks will not be permitted.

(a) Partial Depth. A non-vapor barrier type bonding agent shall be applied to the vertical and horizontal surfaces prior to placing concrete. Coated surfaces shall be protected from contaminants such as dust and dirt. Contaminated surfaces shall be recleaned and recoated. The bonding agent and concrete shall be placed in accordance with the bonding agent manufacturer's recommendations. The recommended time limits will be strictly enforced.

Existing joint openings within the patch shall be maintained for the full depth of the patch by preformed joint fillers or forms. After the patch has cured, these joints shall be sawed and sealed in accordance with 503.

(b) Full Depth. Patches shall be anchored with dowel bars to the adjacent PCCP as shown on the plans. Dowel bars shall be installed using an approved chemical anchoring system in accordance with the manufacturer's recommendations.

Patches constructed adjacent to transverse contraction joints that are to remain in place shall be constructed with type D-1 contraction joints. The joint shall be made continuous across the width of the PCCP to match the existing the joint. Patches greater than 5.5 m (18 ft) shall have type D-1 contraction joints in accordance with 503.03(a).

Concrete shall be placed around manholes or similar structures in accordance with 720.

Sawing and sealing of transverse joints may be omitted when the existing PCCP is to be overlaid as part of the contract.

506.11 Opening to Traffic. A patch may be opened to traffic in accordance with the following.

T	H	HT	T	H	HT
4 - 5°C (40 - 42°F)	30	26	16 - 17°C (61 - 63°F)	14	9
6 - 7°c (43 - 45°F)	27	23	18 - 19°C (64 - 66°F)	14	9
8 - 9°C (46 - 48°F)	24	21	20 - 21°C (67 - 69°F)	14	8
10 - 11°C (49 - 51°F)	21	19	22°C (70 - 72°F)	14	7
12°C (52 - 54°F)	19	16	23 - 24°C (73 - 75°F)	14	6
13 - 14°C (55 - 57°F)	16	14	Above 24°C (Above 75°F)	14	5
15°C (58 - 60°F)	16	11			

T = Lowest ambient temperature during placement, or the temperature of concrete at time of delivery, whichever is lower.
H = Time in hours to open to traffic.
HT = Time in hours to open to traffic when the average daily traffic is less than 10,000.

A patch may be opened to traffic sooner than permitted by the above table if test beams indicate a modulus of rupture of 2100 kPa (300 psi) or greater.

506.12 Method of Measurement. Partial depth patching and full depth patching will be measured by the square meter (square yard).

PCCP removal, subbase and subgrade excavation, when required, subbase and subgrade recompaction, non-vapor barrier bonding agent, dowel bars, reinforcing steel, chemical anchoring system, concrete, finishing and curing, and sawing and sealing of joints will not be measured for payment.

506.13 Basis of Payment. PCCP patching will be paid for at the contract unit price per square meter (square yard) for the type of patching required.

Partial depth patches which have been directed to be full depth will be paid for at the contract unit price per square meter (square yard) for PCCP patching, partial depth, plus 80% of the contract unit price per square meter (square yard) for PCCP patching, full depth.

Payment will be made under:

Pay Item	Metric Pay Unit Symbol (English Pay Unit Symbol)
PCCP Patching, Full Depth	m2 (SYS)
PCCP Patching, Partial Depth	m2 (SYS)

The cost of PCCP removal, subbase and subgrade excavation, when required, subbase and subgrade recompaction, non-vapor barrier bonding agent, dowel bars, reinforcing steel, chemical anchoring system, concrete, finishing and curing, and sawing and sealing of joints shall be included in the cost of PCCP patching.

The cost to repair or replace adjacent PCCP or shoulder damaged by the Contractor shall be included in the cost of PCCP patching.