DIVISION 500

PCC PAVEMENT AND NON-STRUCTURAL CONCRETE CONSTRUCTION

SECTION 501 — JPC PAVEMENT, PCC BASE, AND JPC SHOULDERS

501.01 DESCRIPTION. Construct a single course of JPC pavement, PCC base, or JPC shoulders. Construct longitudinal and transverse joints when required. Construct pavement, base, and shoulders on a prepared subgrade or an aggregate base course.

501.02 MATERIALS AND EQUIPMENT.

501.02.01 Concrete. Conform to Subsection 601.02 and 601.03.

501.02.02 Joint Materials. Conform to Section 807.

A) Sealers. Use hot-poured elastic, preformed, or silicone.
B) Filler. Use preformed sponge rubber, , or preformed asphalt.

501.02.03 Tie Bars. Conform to Section 811 for steel reinforcement, No. 5 epoxy, Grade 60.

501.02.04 Reinforcing Bar Adhesive. Use Type IV epoxy or grout adhesive conforming to Section 826.

501.02.05 Miscellaneous Steel. Conform to Section 811 for chairs, hook tie-bolts, spacers, aligning bars, and upper tie bars used in joint assemblies.

501.02.06 Epoxy Coating Material. Conform to Section 811.

501.02.07 Dowel Bars and Sleeves. Conform to Section 811.

501.02.08 Curing Materials. Conform to Section 823.

501.02.09 Batching Plant Equipment. Conform to Subsection 601.02, except do not use continuous mixers.

501.02.10 Mixers. Conform to Subsection 601.02.

501.02.11 Slip Form Pavers. Provide slip form pavers of an approved self-propelled type designed to spread, consolidate, and finish the concrete in one complete pass of the paver, and in such a manner that minimizes hand finishing. Ensure that the paver consolidates the concrete without damaging or displacing the load transfer devices and finishes the concrete to produce a smooth, uniformly textured surface having the specified crown and slope ready for final finishing. Use an automatic sensing device in continuous contact with a sensing guide to control the alignment. Maintain pavers according to the manufacturer's specifications.

501.02.12 Auxiliary Equipment for Slip Form Paving. Provide auxiliary equipment used in placing and finishing slip formed concrete, that is self-propelled and designed to operate without unnecessary contact with the newly placed concrete.

501.02.13 Forms. Provide form sections 10 feet long or longer and with a base width sufficient to ensure form stability. Use steel forms with self-aligning joints, designed to withstand the lateral and vertical loads imposed by spreaders, finishing machines, or other types of form-riding equipment. Use form sections that have the base of one end of each form section cut on a diagonal so the forms can be assembled to negotiate the inside and outside curves of roadways.

Ensure that each 10-foot length of form has at least 3 stake pockets securely riveted or welded to the web and base to act as diagonal braces. Equip each stake pocket with at least

one steel wedge to securely key the form to the stake.

Provide each form section with one lock-joint plate made of metal of a thickness equal to the form and of sufficient length to ensure stability, located on one end of the form in such a manner as to connect to the adjoining form. Construct the joints so that there will be no difference in the elevation of the end of each form, providing a smooth level track surface. Use plates formed or reinforced to allow hammering or driving without distortion or breakage.

Use approved flexible forms for construction of circular pavement edges where the radius is 100 feet or less.

501.02.14 Fine Grading Machines. Provide fine grading machines that are capable of preparing the grade for the paving equipment to the specified base tolerance and to ensure that the finished pavement conforms to the specified surface tolerances.

501.02.15 Spreaders. Provide spreaders that distribute the concrete uniformly without segregation and strike off the concrete to a uniform depth. Use spreaders equipped with scraping devices designed to clean the top of the forms when traveling in either direction.

501.02.16 Finishing Machines and Floats. Provide transverse finishing machines, longitudinal floats, and combination float finishers that are power driven and designed to operate without slipping on the forms or displacing the forms. Use finishing machines and floats that screed and finish the pavement within the specified tolerances.

501.02.17 Vibrators. Use vibrators for full width vibration of concrete paving slabs of either the surface pan type or the internal type. When using the internal type, provide vibrators having immersed tube or multiple spuds. When only spuds are used, space the spuds no more than 2 feet apart. Either attach the spuds to the spreader or the finishing machine or mount the spuds on a separate carriage. Make the frequency of the vibrators such as to satisfactorily vibrate and consolidate the concrete throughout its full width and depth. Achieve consolidation using industry standards according to the guidelines in ACI 309R including frequency recommendations, performance, and application of internal vibrators. Do not use electrical, multiple speed, internal vibrators.

Operate all consolidating devices so that when the forward movement of their mount stops the consolidating devices immediately stop.

Ensure that all slip form pavers are equipped and using vibrator frequency recorders. The recorder must be able to continuously monitor each vibrator's operating frequency and provide an immediate visual or auditory warning when the frequency goes outside the acceptable range.

501.02.18 Miscellaneous Equipment.

A) Straightedges. Provide straightedges required for testing the surface of the plastic concrete that are accurate 10-foot square-edged straightedges with a handle that is at least 3 feet longer than half the width of the slab.

B) Bulkheads. Construct bulkheads for construction joints of lumber of at least 2-inch nominal thickness or use an approved metal type. Shape bulkheads to conform to the cross section of the pavement. Design bulkheads to provide for correct installation of tie bars.

C) Footbridges. Design and construct the bridges so they will not come in contact with the concrete.

D) Hand Screeds. Provide hand screeds that are a minimum of 2 feet longer than the maximum width of the pavement to be struck off, so shaped and sufficiently rigid to strike off the pavement true to the required cross section.

E) Hand Vibrators. Use spud type internal vibrators for hand finishing.

F) Transverse Floats. Provide transverse floats for hand finishing that are of lightweight, rigid construction, free of warps, and with handles of sufficient length to allow operation from off the pavement. Use floats with finishing faces that are

at least 10 feet long and 3 inches in width. Use metal floats that are formed to a channel cross section so as to provide sides one inch high and perpendicular to the finishing face.

G) **Longitudinal Floats.** Provide longitudinal floats for hand finishing that are at least 10 feet long, 6 inches wide, rigidly constructed, and equipped with handles.

H) **Small Tools.** Provide straightedges and templates for testing hardened pavement and forms, and all other small tools necessary to completely and satisfactorily finish the work.

501.02.19 Water Supply Equipment. Provide approved truck tanks or pumps and pipe lines that are of such capacity and efficiency to ensure an ample supply and an adequate pressure of water simultaneously for all requirements of the work, including mixing, curing, sprinkling the subgrade, and cleaning hauling equipment as necessary.

501.02.20 Concrete Saws. Provide concrete saws for sawing joints that are power-driven, having diamond-edge or abrasive saw blades, capable of cutting to the alignment, depth, and width specified for the joints, and in sufficient numbers to ensure all joints are sawed within the specified time limits.

501.02.21 Equipment for Applying Membrane Curing Compound. Conform to Subsection 601.02.

501.02.22 Air Compressors. Furnish air compressors having separators and traps.

501.02.23 Profiler. The Department will measure the longitudinal profile of the surface with an ASTM E 950, Class 1 device.

501.03 CONSTRUCTION.

501.03.01 Care, Storage, and Handling of Aggregates, Cement, and Coal Ash. Furnish, store, and handle aggregates, cement, and coal ash according to Subsection 601.03.

501.03.02 Admixtures. Furnish admixtures according to Subsection 601.03, except the Department will not require a water-reducing admixture.

501.03.03 Concrete Producer Responsibilities. Design concrete mixtures and perform quality control and process control according to Subsection 601.03.

501.03.04 Proportioning and Requirements. Furnish Class P concrete according to Subsection 601.03.

501.03.05 Weather Limitations and Protection. Mix, place, and finish concrete when the lighting is sufficient.

Discontinue mixing and concreting operations when a falling air temperature in the shade and away from artificial heat reaches 40 °F. Do not resume mixing and concreting operations until rising air temperature in the shade and away from artificial heat reaches 35 °F.

In cold weather, when the Engineer authorizes concreting of small or irregular areas such as crossovers, temporary openings, turnouts, narrow or irregular widening, and other areas where hand finishing is allowed, the Engineer may require the water and aggregates to be heated to no more than 150 °F. Heat the aggregates prior to being placed in the mixer. Use an apparatus that heats the mass uniformly and is arranged to preclude the possible occurrence of overheated areas. Ensure that the temperature of the heated mixture is no less than 50 °F and no more than 90 °F at the time of placing.

Do not place concrete on a frozen base. Do not use frozen aggregates in the concrete.

When deemed necessary to place concrete during cold weather when temperatures may be expected to drop below 40 °F, the Engineer may require submittal of a written plan for

review detailing the methods to be used to protect the concrete. This may include installing and maintaining protective coverings and heating devices to protect the concrete in place and to prevent its temperature from falling below 45 °F until the concrete is 7 calendar days old or has attained the required strength according to Subsection 501.03.20. When performing cold weather concrete work, provide and install recording thermometers or other approved temperature recording devices when requested by the Engineer. Do not use admixtures to prevent freezing.

Maintain the temperature of the mixture at or below 90 °F during placement. Unless the Engineer determines that safety concerns or other considerations prohibit a shutdown, cease concrete production when the mixture exceeds 90 °F until adequate methods are in place to reduce or maintain the mixture temperature. Do not place concrete in areas where hand finishing will be used if the ambient temperature is above 100 °F.

Protect newly placed pavement that is threatened with damage by rain. If the texture is damaged so the specified groove dimensions are not met, restore acceptable texture to the damaged areas by sawing to conform to groove requirements.

501.03.06 Slump. Conform to Subsection 601.03.06.

501.03.07 Preparation of Aggregate Base Course. When placing the concrete by the slip form process, prepare the grade for the paving equipment to the accuracy necessary to ensure that the finished concrete conforms to all surface tolerance requirements.

When placing the concrete using fixed forms, prepare the aggregate base course to the required lines, grades, and cross section. Backfill low places and cavities in the base course detected during the final shaping with concrete placed in conjunction with the pavement, base, or shoulders.

Maintain the finished aggregate base course in a smooth, compacted condition. Ensure that the base course is moist when placing the concrete. When required, wet the base course prior to placing the concrete. Avoid creating mud or pools of water.

501.03.08 Forming. Stake and brace the forms to resist concrete pressure and the lateral thrust of form-riding equipment. Set the forms so that they uniformly bear on the base course throughout their entire length and width. Set the forms directly in contact with the finished aggregate base course.

When the aggregate base is disturbed or loosened, thoroughly tamp the material supporting the forms either mechanically or by hand at both the inside and outside edges of the base of the forms.

Join all forms neatly and tightly, and thoroughly clean and oil all forms before placing concrete against them.

After setting the forms in place, check their top surfaces for grade and alignment. Reset, or remove and replace, any forms showing a top surface variation greater than 1/8 inch in 10 feet.

501.03.09 Mixing. Produce concrete by mixing according to Subsection 601.03.08. The Department reserves the right to stop the use of the mixing method in the construction of concrete pavements, bases, and shoulders when the concrete fails to conform to the specified requirements for proportioning, consistency, slump, or expected strength.

501.03.10 Delivery. Deliver according to Subsection 601.03.07 except when concrete produced by central mixing is delivered by approved truck mixers, the Engineer will allow maximum slump applicable to truck-mixed concrete.

501.03.11 Placing Concrete. Obtain the Engineer's approval of the condition of the base course before placing any concrete. Deposit the concrete on the grade to require as little rehandling as possible. Unless hauling equipment is equipped with means for discharge of concrete without segregation of the materials, unload the concrete into an approved spreading device and mechanically spread it on the grade in a manner to prevent segregation of the materials. The Department will not require a mechanical spreader for

PCC Base. Perform necessary hand spreading with shovels, not rakes.

During any temporary shutdown of less than 30 minutes, cover the concrete at the unfinished end of the slab with wet burlap. When an interruption of the work exceeds 30 minutes duration, the Engineer may require that a construction joint be installed.

Consolidate all concrete with mechanical vibratory equipment throughout its full width and depth. The Engineer will allow small manually operated vibrators for variable width areas such as tapers, transitions, blockouts, parking areas, and other similar construction where hand finishing may be necessary. On mainline construction, vibrate the concrete by equipment specifically used for that purpose, in addition to vibration resulting from the operation of other placing or finishing equipment.

Thoroughly consolidate concrete against and along the faces of all forms and headers and along the full length and on both sides of all joint assemblies. When vibrating, do not disturb load transfer devices, tie bars, hook bolts, side forms, or the aggregate base course.

When slip form pavers are used, spread or distribute the concrete in front of the paver in a manner that will allow the paver to proceed uniformly without bulldozing large piles of concrete. Maintain the head of concrete at a uniform height and not so great as to cause erratic movements of the paver.

If placing concrete adjacent to a previously constructed lane of pavement, base, or shoulder and mechanical equipment is to be operated upon the previously constructed lane, conform to the strength requirements of Subsection 501.03.20 for that lane and place temporary seals according to Subsection 501.03.18 before placing equipment in that lane.

When constructing the pavement using fixed forms, provide at least 2 movable bridges from which finishers may satisfactorily finish the pavement.

501.03.12 Final Strike-Off. Perform operations in the following sequence: consolidation, strike off, machine finishing, straight edging, minor hand finishing, and texturing.

Do not add water to the surface of the concrete to aid finishing operations unless hand finishing. When hand finishing, the Engineer may allow application of water or a finishing aid to the surface to aid finishing. When the Engineer allows water or a finishing aid, apply it as a fog spray by means of approved spray equipment.

501.03.13 Finishing.

A) Finishing for Slip Form Paver. Ensure that slip form pavers consolidate and finish the concrete, in one pass of the paver, in such a manner that a minimum of hand finishing is necessary, producing a smooth, uniformly textured surface with the specified cross section ready for final straight edging and texturing. The Department will not allow tube float finishing machines.

B) Machine Finishing. Finish all concrete, except that placed by the slip form process or in areas where hand finishing is allowed, by machine methods. Distribute or spread the concrete while placing it. Immediately after placing the concrete, consolidate it by vibration, strike it off, and screed it using approved finishing machines. Pass the machines over each area of pavement, base, or shoulder as many times and at such intervals to produce a surface of uniform texture. The Department will allow an approved manually operated strike-off screed in lieu of a finishing machine for PCC base. Avoid excessive operation over a given area. Keep the tops of the forms clean by an effective device attached to the machine. Maintain the travel of the machine on the forms true without lift, wobbling, or other variation tending to affect the precision finish.

During the first pass of the finishing machine, maintain a uniform ridge of concrete ahead of the front screed for its entire length.

C) Hand Finishing. The Engineer may allow hand finishing methods when the following occurs:

1) Mechanical equipment breaks down after concrete has already been deposited on the grade;

2) Narrow widths or other small, irregular dimensions where operation of mechanical equipment is impractical; and
3) Lengths less than 2 feet.

Consolidate the concrete using a vibrator immediately after placing, then strike-off and screed the pavement with a Department approved portable screed.

In operation, move the screed forward on the forms with a combined longitudinal and transverse shearing motion, moving always in the direction in which the work is progressing and manipulated so that neither end is raised from the side forms during the striking and screeding process. When necessary, repeat this until the surface is of uniform texture, true to grade and cross section, and free from porous areas.

D) Floating. Immediately after completing the transverse screeding operation, float the surface smooth using a longitudinal float or a pan float. The Department will not require floating on PCC base. Use transverse hand floats only when the Engineer allows. The Department will allow the use of straightedges in lieu of hand floats for minor hand finishing done in connection with machine finishing. Use a mechanical float behind slip form pavers.

Operate the longitudinal float transversely across the concrete with a sawing motion, always maintaining the float parallel to the centerline of the work. Remove all variations in the surface. Remove all surplus water, laitance, and inert material. Float until the concrete shows no variation from straightedge requirements.

Add additional concrete to fill depressions during the longitudinal floating operation. Do not move the longitudinal float ahead more than half its length at one time. Use care to preserve the cross section of the pavement, base, and shoulders including the crown.

When using the pan type float finisher, adjust the suspended screeds and float pans to conform to the required grade and cross section and operate it to produce a smooth, dense surface free of irregularities or porous areas. When the float finisher is attached to a finishing machine equipped with approved screeds, the Engineer may allow the float finishing at the same time as the last pass of the screeding operation.

E) Surface Correction. While the concrete is still plastic, scrape the pavement and shoulder surface to remove all laitance, excess water, and inert material, and test the surface for trueness with a straightedge. Hold the straightedge in successive positions parallel to the road centerline in contact with the surface, and swing it across the entire area from one side of the slab to the other until the entire surface is free from visual departures. Advance along the road in successive stages of no more than half the length of the straightedge. Immediately fill any depressions found with freshly mixed concrete, strike-off, consolidate, and refinish them. Continue the straightedge testing and refloating until the entire surface is free from observable departures from the straightedge and the slab has the required grade and cross section. Ensure that at the time of testing, the surface is free from soft mortar or excess water.

F) Edging. Finish the outside edges of the slab when using fixed forms and the edges of all expansion joints with an edging tool to a radius of 1/8 inch.

G) Burlap Drag. Finish the pavement using a burlap drag having a double thickness of burlap at least 4 feet wide. Attach the burlap to a bridge and keep it saturated while in use. Lay the burlap on the pavement surface and drag it in the direction that the pavement is being placed with approximately 2 feet of width in contact with the pavement surface. The Engineer will allow hand finishing of the outer edges with smaller pieces of burlap when necessary to avoid rounding or slumping of the edges of slip formed pavement. In all other instances, use burlap of sufficient width such that the full width of the pavement receives the burlap finish. When allowing hand finishing on areas, the Engineer will allow manual means for the entire surface. Maintain drags clean and free from encrusted mortar. Discard

drags that cannot be cleaned, and replace them with new drags.

H) Texturing. Immediately after finishing the concrete with the burlap drag, texture the surface by forming transverse grooves. The Department will waive the requirement for transverse grooves when the pavement is to be diamond ground before opening to traffic.

Form the transverse grooves by mechanical equipment using a comb made with steel tines. When allowing hand finishing on areas, the Department will allow the use of manual tools such as rakes with spring steel tines.

Form transverse grooves in the concrete with a width between 0.09 inch and 0.13 inch and a depth between 0.12 inch and 0.19 inch. Space the grooves at random intervals between 0.4 inch to 1.5 inches with no more than 50 percent of the spacing being one inch or greater.

The Department will allow longitudinal grooving when specified by the Contract. Provide concrete pavement with longitudinal texturing. Depth, spacing, and any other details in regards to texturing will be completed as per the requirements for transverse grooving with the exception of the direction of texturing, and the spacing of longitudinal grooves. Spacing for the longitudinal groves will be 3/4 inch. Obtain the Engineer's approval as per the method of construction.

Regardless of the method used to form the grooves, ensure that the grooves are relatively smooth and uniform, and form the grooves without tearing the surface or bringing pieces of the coarse aggregate to the top of the surface.

Correct any individual areas of 50 square yards or larger of the hardened grooved concrete that do not conform to the above requirements. Correct by cutting acceptable grooves in the hardened surface with an approved cutting machine or by other methods approved by the Engineer.

The Department will not require texturing on PCC base.

I) Station Numbers. Stencil station numbers into the pavement before it takes its final set. Mark the complete station number every 500 feet. Mark equations in the alignment, when they occur, in the pavement in the same manner and at the same locations as specified in the Contract.

Size and place the stencils according to the Standard Drawings.

J) Rumble Strips In Shoulders. After finishing the shoulders, form rumble strips according to the Standard Drawings. When the shoulder is used to maintain traffic during construction, do not form rumble strips until the mainline is opened to traffic. When the mainline is open to traffic saw cut Type 3 rumble strips according to the Standard Drawings.

501.03.14 Removing Forms. Remove forms as soon as the concrete has hardened sufficiently to allow sawing the transverse joints. Immediately fill all honeycombed areas appearing in the edges of the pavement, base, or shoulders with mortar composed of one part cement and 2 parts fine aggregate by loose volume. Then, cure the edges of the pavement, base, or shoulders.

501.03.15 Curing. Immediately after completing finishing operations and the concrete has set sufficiently to prevent marring the surface, cover and cure the entire surface of the newly placed concrete, including the face of all construction joints. In all cases in which curing requires the use of water, ensure that water is available. The Department may suspend the placement of concrete when failure to provide sufficient cover or adequate water for curing occurs.

When it becomes necessary to uncover an area of the pavement before the end of the curing period, do not expose the pavement for more than 30 minutes.

Cure according to one of the following methods:

A) White Membrane Curing. After completely finishing the concrete and immediately after any free water has disappeared, completely and uniformly coat the entire pavement surface with Type 2 (white pigmented) liquid membrane-

forming curing compound. Apply the compound in one or 2 applications. When 2 applications are necessary to meet the required rate, apply the second application within 30 minutes of the first. If there is a delay in applying the first application of the curing compound, cover the pavement surface with wetted burlap.

Apply the curing compound through a pressure sprayer at the rate of one gallon to no more than 120 square feet total application, whether applied in one or 2 applications. When desired, decrease the application rate to one gallon to no more than 150 square feet when texturing is not required. During its application, ensure that the compound is in a thoroughly mixed condition with the pigment dispersed throughout the vehicle. Continuously stir the compound by effective mechanical means while applying it. The Engineer will allow hand sprayers for coating odd widths or shapes and for coating areas exposed by the removal of forms. Correct honeycomb areas, then coat the sides of the slab within 30 minutes following removal of the forms.

The Department will not require removal of curing compound overspray from tie bars when the deformations are still visible.

When the compound is too thick to satisfactorily apply during cold weather, warm it in a water bath at a temperature no greater than 100 °F. Do not thin the compound with solvents.

When rain falls on the newly coated pavement before the film has dried sufficiently to resist damage, or when the film is damaged or is noticeably faulty, apply a new coat of the compound to the affected areas.

Protect the treated surface against damage for a period of at least 72 hours or until attaining the required strength. The Engineer will consider all traffic, pedestrian or otherwise, as injurious to the film of the applied compound. The Engineer will allow a minimum of traffic on the dried film as necessary to carry on the work, such as joint sawing and sealing equipment. When putting minimum traffic on the dried film, immediately repair any damage to the film by an additional application to the affected areas.

Take precautions to ensure proper curing at joints, and to prevent any of the curing compound from entering the joints. Protect sawed joints by closing the opening with a moistened rope of paper or other approved fiber, by covering the opening with a one-foot strip of curing paper or 4-mil white polyethylene film, or by other approved methods before repairing the damaged areas adjacent to the joints with an additional application of the compound.

Provide approved standby facilities or approved alternate methods for curing concrete pavements at a readily accessible location at the site of the work for use in the event of mechanical failure of the spraying equipment or other conditions which may prevent the proper application of the curing compound.

The Engineer may stop this method of curing when unsatisfactory results are obtained and may require the remainder of the concrete to be cured with wet burlap or curing blankets.

Do not use white membrane curing on PCC base that is to be surfaced with an asphalt mixture.

B) Wet Burlap. Thoroughly wet the burlap before placing. Carefully place the burlap over the finished surface to completely cover the surface and sides of the slab. Clean the burlap of all coating of earth or other deleterious substances before using it. Soak new burlap in water for 12 hours before use.

During the first 6 hours, the Engineer will require a single thickness of burlap. After the first 6 hours, use a double thickness. Overlap adjacent burlap strips at least 3 inches.

Keep the burlap thoroughly saturated and in place for at least 72 hours even when required strength is attained.

C) Curing Blankets. Cure according to Subsection 601.03.17 C). Place curing blankets to completely cover the surface and the sides of the slab for 72 hours or until attaining the required strength.

501.03.16 Diamond Grinding. When electing to or when the Contract specifies to diamond grind the pavement to achieve texture or ride quality, conform to Subsections 503.02 and 503.03 excluding 503.03.09. The Department will determine pavement thickness according to Subsection 501.03.21 after diamond grinding.

501.03.17 Joints. Construct all joints, longitudinal and transverse, according to the Plans and Standard Drawings. Use epoxy coated or other approved corrosion resistant tie bars and hook bolts. Construct all joints perpendicular to the surface of the pavement and to true alignment.

Ensure that sawed joints are of uniform width throughout. Use sawing equipment to cut the joint in strict conformity with the required alignment and depth. The Engineer will allow spraying of water on the saw blades during the cutting. Do not saw the joints until the concrete has hardened to the extent that tearing and raveling will not occur, but as soon as necessary to preclude random cracking. Do not allow any traffic on the pavement until the joints are sawed. The Engineer may require the construction of sawed joints at the time, day or night, and in the order or sequence that will most effectively hold random cracking to a minimum. Provide a standby machine and a sufficient supply of saw blades available at all times.

Cut transverse saw cuts for joints that are to be sealed with preformed compression joint seals in one continuous cut across the pavement.

When curbs or concrete medians are constructed integral with the pavement, construct all transverse joints continuous through the curb or median.

When constructing PCC Base, for adjacent slabs with approximately 50-foot joint spacing, match joints and construct additional joints at third points. For adjacent slabs with 25-foot joint spacing, match joint and construct additional joints at midpoints.

The Department will allow a transverse construction joint at a transverse joint, provided a dowel bar basket is used.

Thoroughly flush all sawed joints with clean water or clean with compressed air immediately after sawing so the vertical surfaces of the joint will be clean and will allow proper adherence of joint sealer to the surfaces.

Protect all joints from intrusion of injurious foreign material, including mortar or cuttings from adjacent sawing operations, until sealed.

A) Longitudinal Joints. Install longitudinal joints on the centerline, or parallel to the centerline within 1/2 inch from the true theoretical position. Construct longitudinal sawed joints with tie bars when the width of the pavement, base, or shoulder is more than 16 feet.

Cut longitudinal joints to true alignment within the tolerances specified in Appendix A, Table of Construction Tolerances, and to the depth specified in the Contract, and fill them with joint sealer according to Subsection 501.03.18.

Place deformed steel tie bars of the dimensions shown on the Standard Drawings transversely through the longitudinal joint. Space the tie bars as indicated, and rigidly secure them at both ends by Department approved supports. After the Contractor places and strikes off the concrete, the Department may allow him to install tie bars using a mechanical device designed to install the bars true to position and alignment.

Construct longitudinal saw construction joints between adjacent lanes or widths that are constructed separately according to the Standard Drawings.

Install the tie bars as required by the plans and standard drawings by inserting the bars in the plastic concrete, drilling and gluing the bars in place, using secured tie bar assemblies, or using a proposed alternative method approved by the Engineer. When installing by drilling and gluing in place, drill a dowel hole that is no more than 1/8 inch larger in diameter than the bar. Ensure the dowel hole is dry and free of all drill and coring dust. Place the adhesive in the dowel hole according to the manufacturer's instructions. Insert the bar to the bottom of the hole and twist 1/4 turn. An excess amount of adhesive must be clearly visible as an extruded ring of material surrounding the reinforcing bar at the surface of the

concrete.

The Department will allow bending tie bars back, when necessary, while constructing the initial width, and straighten them to the correct position before constructing the adjoining width. When desired, use approved epoxy coated hook tie bolts in lieu of tie bars. When used, install hook tie bolts so the length is equally divided between the 2 slabs.

The Engineer may stop the use of any method that fails to provide secure placement of the bars until satisfactory results can be achieved.

B) Transverse Expansion Joints. Place transverse expansion joints at all bridge approaches according to the Standard Drawings.

Install the joints so the plane of the finished joint will be perpendicular to both the centerline and the surface of the pavement within 1/4 inch of true alignment in one lane width.

Provide a continuous joint through the full width of the pavement, with the length of individual pieces of joint filler no less than the width of one traffic lane. Securely connect adjoining sections to avoid an offset at their juncture. Install the joint filler for the full pavement width and from the bottom of the pavement to the bottom of the joint sealer, as shown on the Standard Drawings.

Place dowel bars, or other approved load transfer devices, when required, through transverse joints according to the Contract. When used, secure the dowels in position parallel to the surface and the centerline of the slab by a metal device that remains in the pavement.

Securely stake the load transfer device to the subgrade with anchor hooks according to the Standard Drawings. The Engineer may allow hooks less than 18 inches in length when used in conjunction with rock subgrade or cement stabilized base, however, the Engineer may require additional hooks to securely hold the assembly in place.

Place a removable finishing cap over the expansion joint material during construction operations to provide protection and support to the material.

After the Engineer checks the joint for proper installation, deposit the concrete on the base course as near the expansion joint as possible without touching it. Then, shovel it against both sides of the joint simultaneously, maintaining equal pressures. Deposit concrete to a height of approximately 2 inches more than the depth of the joint, and carefully work the concrete under the load-transfer devices. Do not dump concrete directly upon or against the load-transfer devices. Prevent displacement of the dowel bars during placing and finishing operations.

Work concrete around load-transfer devices and against the body of the joints at all points. Reset and realign any displaced dowels before passing the finishing machine over them. When necessary, remove concrete to reset and realign any displaced dowels.

Move the finishing machine forward during finishing operations and operate it in a manner that will avoid damage or misalignment of joints.

Immediately after completing all finishing operations and before the concrete has taken its initial set, finish the edge of the slab to the required radius adjacent to all expansion joints. Manipulate the edging tool to produce a well-defined continuous radius and a smooth, dense mortar finish. Do not tilt the edging tool while manipulating it. Remove the edging tool marks from the surface so the texture blends with the final finish.

Place 1/2-inch expansion joint material against all box inlets, manholes, concrete barriers, retaining walls, bridge abutments, concrete gutter, and similar structures that project through, into, or against the pavement.

C) Longitudinal Expansion Joints. Construct longitudinal expansion joints according to Subsection 501.03.17 B) at locations specified in the Contract.

D) Transverse Contraction Joints. Construct transverse contraction joints in ramp tapers, intersections, and similar areas at locations specified in the Plans and Standard Drawings. On uniform width roadway construction, install transverse

contraction joints at the spacing specified in the Plans and Standard Drawings.

Form transverse contraction joints by sawing, perpendicular to the surface of the pavement, within the tolerances specified in Appendix A, Tabulation of Construction Tolerances. Fill the joints with joint sealer as specified in Subsection 501.03.18.

Install load transfer assemblies, when specified in the Contract, according to Subsection 501.03.17 B) for transverse expansion joints. The Department will not require dowel bar sleeves, finishing caps, expansion joint fillers, or hand placement of concrete around the assemblies. The Department will not require load transfer assemblies for contraction joints in PCC base.

E) Transverse Construction Joints. Form the joints with a Department approved metal or wooden bulkhead, shaped to the cross section of the pavement, and designed to allow correct installation of tie bars according to the Standard Drawings. Rigidly secure the bulkhead to the subgrade so the finished joint will conform to all requirements for position and alignment. After removing the bulkhead and constructing the adjacent slab, saw the joint as specified in the Plans, and subsequently fill with joint sealer.

When using a construction joint, construct the joint no closer than 5 feet or one-half the spacing between adjacent joints, whichever is less, to any transverse contraction joint or transverse expansion joint. When the need for a construction joint occurs within the above distance from the preceding joint, remove the concrete to the specified distance behind the preceding joint and install the bulkhead at that location.

501.03.18 Sealing Joints.

A) Requirements for Sealing All Joints. Seal all joints as soon as practical and before opening the pavement, base, shoulders or any section of the pavement, base or shoulders to any traffic. Configure joint sealant according to the Standard Drawings.

Do not seal any joints until the Engineer inspects and approves them for sealing. Before applying the sealer, completely clean all joints of all loose scale, laitance, oils, greases, dirt, and other foreign substances, and remove all free water and loose particles by jetting with compressed air.

B) Uses of Sealant Types. Use any of the following sealant types for the indicated types of joints for JPC Pavement and Shoulders (For PCC base, use hot-poured elastic):

1) Silicone Rubber Seals.

   a) transverse and longitudinal sawed joints
   b) transverse and longitudinal expansion joints
   c) longitudinal and transverse construction joints
   d) joints between pavement and shoulders and fixed objects such as box inlets, manholes, retaining walls, and concrete barriers

2) Self-Leveling Silicone Rubber Sealant.

   a) resealing random cracks in JPC pavement, base, and shoulders
   b) sealing joints between JPC pavement, base, and shoulders and asphalt pavement or shoulders
   c) longitudinal and transverse construction joints
   d) joints between pavement and shoulders and fixed objects such as box inlets, manholes, retaining walls, and concrete barriers; and sealing joints cut in asphalt overlays of JPC pavement, base, and shoulders for control of reflective cracking

3) Hot-Poured Elastic.

a) longitudinal and transverse construction joints
b) joints between pavement, base, and shoulders and fixed objects such as box inlets, manholes, retaining walls, and concrete barriers
c) for applications where the Department allows self-leveling silicone joint sealant

C) Silicone Rubber Sealant. Seal joints according to the Contract and the written recommendations of the manufacturer. Place seals when the ambient temperature and the pavement temperature is 40 °F or higher.

Completely clean and dry joints, and ensure that they are frost free. Immediately after sawing, flush with a jet of water and use other tools as necessary to remove all cuttings. After flushing, blow the joint out with compressed air. When the surfaces are thoroughly dry and within 24 hours prior to sealing the joint, clean the joints by sandblasting followed by blowing out with compressed air. Sandblast in 2 passes, one for each joint face, with the nozzle held at an angle to the joint face and within one to 2 inches of the pavement. Direct the air blast following the sandblast in one direction to prevent recontamination of the joint. If cleaned joints are not sealed within 24 hours after sandblasting, reclean them by lightly sandblasting and blowing out again using compressed air.

Supply compressed air free of water, oil, or any other injurious substances.

Install foam back-up rods according to the Standard Drawings. When sealing 2 intersecting joints, first place a continuous foam back-up rod through the intersection. Either place this rod low at the intersection, and place the intersecting rod over it at the specified depth; or cut the intersecting rod, and place it against the first rod at the intersection.

When necessary, use additional air blasting to completely remove all moisture, dust, or debris that has accumulated in the joint after placing the back-up rod. Ensure that the joint is completely clean, dry, and frost-free immediately prior to placement of the sealant.

Install silicone rubber seals with an applicator having a built-in grooving tool. Install the seals by pushing, not pulling, the sealant ahead to form a uniform head. This pushing of the sealant will ensure that the joint is filled from the top of the backer rod to at least 3/8 inch below the pavement surface. Tool the sealant so that it is forced against the joint faces and recessed below the pavement surface. Use the same tool for both application and grooving. Demonstrate satisfactory results during production and the Engineer may allow separate tools for application and grooving.

Seal joints as soon as practical after sawing and before allowing traffic, except construction traffic, on the pavement. Do not allow any traffic over the sealed joints for the period of time recommended by the manufacturer for proper adhesion or curing or for a longer period if the seals have not completely adhered or cured.

For each working day, the Engineer will remove 5 sample plugs at locations determined by the Engineer. The Engineer will test each plug for conformity to the geometry specified for the joint seals. If the test plugs do not conform, the Engineer will remove additional plugs and will identify the location of the joint from which each plug was removed. The Engineer will test each plug to determine if any joints are deficient. When joints are determined to be deficient, remove and rework those joints. After deficient joints have been reworked, the Engineer will remove sample plugs at locations determined by the Engineer. The Engineer will repeat the sampling and testing. Repair holes from sample plugs no later than the next working day.

D) Self-Leveling Silicone Rubber Sealant. Install the self-leveling rubber sealant according to the manufacturer's instructions.

E) Resealing Joints. Saw cut, and clean all joints to minimum widths or greater according to the specifications for each joint type. The minimum width for joints

before resealing is 1/8 inch wider than the existing joint. If the saw cut of an existing joint is not of sufficient width to clean the joint faces, resaw the joint to a width that will expose clean vertical faces of the joint. Perform all additional resawing of an existing joint to clean the faces of the joint and install seals appropriate for the resawed width. Clean joints before resealing according to the requirements for new seals. Install additional silicone rubber sealant following additional resawing of joints to clean faces, or install wider preformed neoprene seals following additional resawing of an existing joint to clean faces. Remove all debris and old joint sealer resulting from the sawing operation from the pavement before opening to public traffic.

When necessary, saw the pavement to the required depth at the pavement edge, extend the saw cut into existing asphalt shoulders. When edge drain construction is included in the Contract and edge drains are to be placed in the asphalt shoulder adjacent to the JPC pavement being saw cut and resealed, perform edge drain construction after sawing and sealing of the pavement so that sealing of cuts in the asphalt shoulder will not be necessary. When edge drain construction is not included in the Contract or an alternate construction sequence is specified, seal all saw cuts in the asphalt shoulders that will remain in the finished work using hot-poured elastic joint sealer or self-leveling silicone rubber sealant. Perform sealing of cuts in the asphalt shoulder as soon as practical after completing pavement sealing in the adjacent lane.

F) Temporary Seals. When using temporary seals, firmly embed them in the joint. Place the material 1/4 inch below the pavement surface. Provide a material that is sufficiently strong and durable to resist intrusion of incompressible materials, and to allow complete removal after its usefulness has ended.

501.03.19 Surface Tolerances and Testing Surface.

A) Edge Slump. Prevent and correct the slumping of the pavement, base, or shoulder edges. Ensure that edge slump does not exceed 1/8 inch when the Plans indicate the edge of the pavement, base, or shoulder being constructed is to be abutted by subsequently constructed pavement, base, or shoulders, either by this Contract or future contracts. Ensure that edge slump does not exceed 1/4 inch where the edge is not to be abutted by subsequent pavement, base, or shoulder. Measure the edge slump with a straightedge laid on the pavement, base, or shoulder perpendicular to the edge.

Use a planing device or a device consisting of multiple saws to perform corrective work. Use rotary grinders only on isolated irregularities less than 50 square feet. Prohibit the use of bush hammers or other impact devices. Texture all areas of the concrete corrected by grinding in the same manner as the undisturbed pavement, base, or shoulder. When the specified texture is the transverse grooves, texture the ground areas by sawing the transverse grooves. Provide a final surface comparable to the adjacent pavement that does not require corrective work for texture, appearance, or skid resistance. Complete all corrective work within a section before the Department checks the thickness tolerance of that section. The Department will allow corrective work by diamond grinding according to Subsection 503.03.

B) Ride Quality. When the Contract specifies that rideability applies, the Department will measure the ride quality in terms of the IRI and will use the IRI to determine acceptability and to calculate Ride Quality Adjustments. The Department will specify if the ride quality requirements are Category A or Category B when ride quality is specified in the Contract. Category B ride quality requirements shall apply when the Department fails to classify which ride quality requirement will apply to the Contract.

1) Acceptance Testing. The Department will test the ride quality of the

pavement for acceptance after the Contractor:

a) makes a request at least 2 weeks in advance;
b) partially completes the paving and the Department deems it necessary; or
c) completes all mainline paving.

The Department will determine the IRI by applying a linear transform, determined by correlation, to the values (average of 2 wheel paths) determined by ASTM E 1926. Thoroughly clean the surface of all dirt and other foreign matter immediately before the Department performs the testing.

The Department will divide and test each traffic lane using 0.1-mile test sections starting at the beginning of the lane and proceeding in the direction of traffic. The Department will exclude discontinuities, such as bridges, in the pavement. When a test section at the end of a lane is less than 0.1 mile long, the Department will include that section with the adjacent section. When deemed necessary, the Department will retest the pavement after any corrective work is completed.

2) Category A Requirements. Achieve an IRI of 80 or lower for each 0.1-mile section. When the IRI is greater than 90 for a 0.1-mile section, perform corrective work, or remove and replace the pavement to achieve the specified IRI. At the Department's discretion, a pay deduction of $1200 per 0.1-lane-mile section may be applied in lieu of corrective work.

The Department's testing generates a computer file containing the measured longitudinal profile in terms of elevation values of each wheel track at 3-inch intervals. The Department will create a strip chart from the file showing the elevation and distance traveled when the IRI is greater than 70 or upon request for lower IRI values.

3) Category B Requirements. Achieve an IRI of 85 or lower for each 0.1-mile section. When the IRI is greater than 95 for a 0.1-mile section, perform corrective work, or remove and replace the pavement to achieve the specified IRI. At the Department's discretion, a pay deduction of $750 per 0.1-lane-mile may be applied in lieu of corrective work.

The Department's testing generates a computer file containing the measured longitudinal profile in terms of elevation values of each wheel track at 3-inch intervals. The Department will create a strip chart from the file showing the elevation and distance traveled when the IRI is greater than 85 or upon request for lower IRI values.

When the Contract does not specify that ride quality requirements apply, straightedge the pavement or shoulder in the presence of the Engineer. Place a 10-foot straightedge parallel to the centerline to bridge all depressions and touch all high spots. Perform straight edging as soon as the concrete has hardened sufficiently to support walking, but not later than 10:00 AM of the day following the placing of the concrete. Plainly mark all high spots, indicated by a variation exceeding 1/8 inch from the straightedge, that are 6 inches or more from the pavement, base, or shoulder edge.

C) Corrective Work. Submit corrective work procedure plans to the Engineer for approval before performing the work. Provide a final surface comparable to adjacent pavement that does not require corrective work in respect to texture, appearance, and skid resistance.

501.03.20 Opening to Public Traffic. Open the pavement, base, or shoulders to traffic anytime 3,000-psi strength is attained, except when curing with wet burlap. When curing with wet burlap, wait at least 72 hours before opening the pavement to traffic.

Complete the construction of shoulders and thoroughly clean the pavement, base, or

shoulders and seal all joints, as required, before opening the pavement to traffic other than construction equipment.

Prior to opening the pavement to traffic, other than the construction equipment, complete the construction of shoulders in a satisfactory manner.

When operating any equipment entirely or partially on the pavement, provide means to protect the pavement from damage regardless of its age. Either provide the equipment with rubber-tired wheels or operate the equipment overprotective mats designed and constructed to prevent damage to the pavement surface and joints. Use mats consisting of wooden strips having a nominal thickness of 2 inches and a width of at least that of the treads. The Engineer may allow mats made of other suitable material. Sweep the pavement surface free of debris prior to placing the protective matting.

Construct a ramp of compacted earth, or other material of sufficient strength, to prevent undue stress in the pavement slab from equipment moving on and off the pavement.

Open residential entrances to traffic, on which only automobile traffic is expected, only at the end of the 72-hour curing period, or at an attained strength of 3,000 psi. Clean the pavement and seal all joints before opening the residential entrances to traffic.

501.03.21 Tolerance in Pavement Thickness. Core the pavement as the Engineer directs. The Engineer will determine the thickness of the pavement and concrete shoulders according to KM 64-309. The Engineer will evaluate areas of the pavement and shoulders found deficient in thickness by more than one inch. When the Engineer deems the areas warrant removal, remove and replace the areas with concrete of the thickness specified in the Plans.

501.04 MEASUREMENT.

501.04.01 JPC Pavement. The Department will measure the quantity in square yards according to the Plan dimensions as shown in the Record Plans. The Department will determine the final quantity based on the design quantity with increases or decreases by authorized adjustments. Authorized adjustments include changes in the Record Plan dimensions, additional areas not shown in the Record Plans, and errors and omissions in the design quantity in excess of one percent.

The Department will not measure reinforcing steel, load transfer assemblies, dowels, joint construction (including removal of concrete to accommodate a construction joint bulkhead), joint sealing, joint repair, form pins, texturing, additional work for drilling holes for form pins, texturing areas of the pavement that have been corrected by grinding, coal ash, Type IP cement, Type III cement, additional Type I cement for high early strength, formed rumbles strips, and all other items necessary to construct the pavement according to the Contract for payment and will consider them incidental to this item of work.

501.04.02 PCC Base. The Department will measure the quantity in square yards according to Subsection 501.04.01.

501.04.03 JPC Shoulders. The Department will measure the quantity in square yards according to Subsection 501.04.01. The Department will not measure rumble strips for payment, unless they are constructed in a separate operation because the shoulder was used to maintain traffic, and will consider them incidental to this item of work.

501.04.04 Rumble Strips, Type 3. The Department will measure the quantity in linear feet. The Department will not measure Type 3 rumble strips for payment unless they are constructed in a separate operation because the shoulder was used to maintain traffic.

501.04.05 Diamond Grinding. When listed as a bid item, the Department will measure the quantity according to Subsection 503.04. The Department will not measure diamond grinding for payment when it is performed at the Contractor's option or for corrective work and will consider it incidental to JPC Pavement.

501.04.06 Thickness. The Department will measure the pavement thickness tolerance according to KM 64-309. The Department will not measure the pavement thickness tolerance as a separate pay unit, but will use the pavement thickness tolerance to calculate an adjusted Contract unit price for JPC Pavement, PCC Base, or JPC Shoulders. The Department will not measure coring for payment and will consider it incidental to the concrete pay items.

501.04.07 Ride Quality. When the Contract specifies that rideability applies, the Department will measure the ride quality in terms of the IRI. The Department will not measure the IRI as a separate pay unit but will use the IRI to calculate a Ride Quality Adjustment payment.

501.05 PAYMENT. Department will make payment for the completed and accepted quantities under the following:

501.05.01 Thickness. The Department will adjust the Contract unit price for JPC Pavement, PCC Base, and JPC Shoulders by the Schedule for Adjusted Payment for Thickness Deficiency. The adjusted quantity is equal to the area of JPC Pavement, PCC Base, or JPC Shoulder specified in the Kentucky Method, multiplied by the Contract unit price for the item and the Price Adjustment. The Department will not make additional payment for average thicknesses of pavement, base, or shoulders in excess of the specified thickness.

501.05.02 Ride Quality. The Department will apply a Ride Quality Adjustment for each 0.1-lane-mile section tested. The Department will determine the Ride Quality Adjustments for each 0.1-lane-mile section using the Ride Quality Adjustment Schedule below. The Department will not apply positive ride quality adjustments to 0.1-lane-mile sections where thickness deductions have been applied. The sum of the pay value adjustments for the ride quality shall not exceed $0 for the project as a whole.

When requesting tests on partially completed pavement, the Department will perform one test at no charge. The Department will perform additional requested testing and retesting for corrective work or pavement replacement at a cost of $300.00 per lane-mile. The Department will deduct charges for additional requested testing and retesting for corrective work from monies due on the Contract.

Code	Pay Item	Pay Unit
02069-02071, 02073, 02075, 02084, 02086, 02088	JPC Pavement Non-Reinforced, thickness	Square Yard
02072, 02077, 02078, 02081-02083, 02087, 02089	JPC Pavement Non-Reinforced Shoulder, thickness	Square Yard
02061, 02064, 02065	PCC Base, thickness	Square Yard
02695	Rumble Strips, Type 3	Linear Foot
----	Rideability Testing	Each
10060	Ride Quality Adjustment, JPC	Each
02060	JPC Pavement Diamond Grinding	See Subsection 503.05

Schedule for Adjusted Payment for Thickness Deficiency

Thickness Deficiency (inches)	Price Adjustment (% of Contract Unit Bid Price)
0.00 to 0.20	100
0.21 to 0.30	80
0.31 to 0.40	72
0.41 to 0.50	68
0.51 to 0.75	57
0.76 to 1.00	50
Greater than 1.00	[1]

[1] Remove and replace these areas with concrete of the specified thickness at no expense to the Department when the Engineer directs.

RIDE QUALITY ADJUSTMENT SCHEDULES

CATEGORY A PROJECTS		CATEGORY B PROJECTS	
IRI	**Pay Value Adjustment[1]**	**IRI**	**Pay Value Adjustment[1]**
50 or less	$750	56 or less	$500
51	$630	57	$420
52	$520	58	$350
53	$420	59	$280
54	$330	60	$220
55	$250	61	$170
56	$180	62	$120
57	$120	63	$80
58	$70	64	$45
59	$30	65	$20
60 to 80	0	66 to 85	0
81	-$30	86	-$20
82	-$70	87	-$45
83	-$120	88	-$80
84	-$180	89	-$120
85	-$250	90	-$170
86	-$330	91	-$220
87	-$420	92	-$280
88	-$520	93	-$350
89	-$630	94	-$420
90	-$750	95	-$500
91 or higher	corrective work[2]	96 or higher	corrective work[3]

[1] *Contractor may correct areas to achieve a positive adjustment.*

[2] *When it is in the best interest of the Department, a minimum pay value deduction of $1200 per 0.1-lane-mile section may be applied in lieu of corrective work.*

[3] *When it is in the best interest of the Department, a minimum pay value deduction of $750 per 0.1-lane-mile section may be applied in lieu of corrective work.*

The Department will consider payment as full compensation for all work required under this section.

SECTION 502 — DOWEL BAR AND TIE BAR PLACEMENT

502.01 DESCRIPTION This specification applies when JPC Pavement is placed on a project using a mechanical paving system. Allowable tolerances are outlined for both dowel bar and tie bar placement in driving lanes and shoulders

This specification specifies the allowable tolerances for placement of dowel bars and tie bars in JPC pavement.

502.02 MATERIALS Conform to Subsection 501.

502.03 CONSTRUCTION

502.03.01 Dowel Bars Transverse dowel bars, which are generally in baskets, should be located in the center of the slab vertically. They should not be skewed or rotated. Contrary to Section 501 of the Standard Specification and Standard Drawing RPS-020-14, place dowel bars to the tolerances shown in the table below.

Dimension	**Tolerance**
Horizontal offset	± 1 inch
Longitudinal translation	± 3 inches
Horizontal skew	½ inch, max
Vertical skew	½ inch, max
Vertical depth	The minimum distance below the concrete pavement surface must be: DB=T/3 + ½ inch Where: DB = vertical distance in inches, measured from the concrete pavement surface to any point along the top of dowel bar; and T = actual concrete pavement thickness at joint location, in inches. The maximum distance below the surface to any point along the dowel bar should be 2T/3.

Dowel bars determined to be out of tolerance are to be marked in the field with marking paint. Corrective work will be required with the following circumstances:

- if 3 or more bars are higher than T/3 + ½ inch from the top of the slab or lower than 2T/3 (as measured from the top) for the bottom of the slab
- if 3 or more bars are translated longitudinally 3 inches or more
- if more than two consecutive joints have any bars that are skewed vertically or horizontally

Any corrective work shall be completed in accordance with the Current Version of SN 11J – Special Note for Full Depth Concrete Pavement Repair.

502.03.02 Tie Bars Install tie bars at a depth equal to ½ of the slab thickness. Tie bars shall be perpendicular to the longitudinal joint and parallel with the concrete pavement surface. Installation shall be to the tolerances outlined below.

- Not less than ½ inch below the saw cut depth of the joints
- 2” clearance from pavement surface and bottom of pavement

Corrective action will be required for the following circumstances:

- 2 consecutive tie bars are missing or outside of the tolerance listed above
- 4 or more bars in a slab are missing or outside of the tolerances listed (does not have to be consecutive)

The correction shall be made by cross-stitching to place the new tie bars accordingly.

502.04 TESTING REQUIREMENTS. Testing will include longitudinal joints between driving lanes and shoulders if the shoulders are constructed with JPC Pavement. Transverse joints in the shoulders will also be tested if constructed with JPC Pavement. No concrete patching will be tested except for corrective work repairs required on new JPC Pavement. JPC Pavement shall be cured for a minimum of 14 days prior to testing. The concrete should also be dry for at least 24 consecutive hours prior to testing.

502.04.01 Testing Limits. All driving lanes and shoulders requiring load transfer assemblies will be tested with Ground Penetrating Radar (GPR) equipment. All longitudinal joints will be tested. KYTC will arrange testing. Notify the Engineer at least 7 days prior to testing.

502.04.02 Validation. A minimum of one location per lane mile will be cored to verify GPR testing. Two 4-inch cores shall be obtained at each location. One core will be taken on each dowel bar end to expose both ends and allow physical measurements. KTC will conduct coring while the contractor shall patch all core holes.

502.04.03 Site Conditions Prior To Testing. Pavement surface shall be broom swept and free of debris prior to scanning. Area to be tested shall be clear of equipment, and necessary traffic control will be provided by the contractor.

502.05 MEASUREMENT. The Department will not measure dowel bars and tie bars for payment and will consider them incidental to pavement.

502.06 PAYMENT. The Department will not make separate payment for dowel or tie bars.

SECTION 503 — DIAMOND GRINDING JPC PAVEMENT

503.01 DESCRIPTION. Diamond grind existing JPC pavements. Eliminate faulting at joints and cracks, restore the ride quality to meet or exceed limits specified, and restore texture to the entire pavement surface.

503.02 MATERIALS AND EQUIPMENT.

503.02.01 Grinding Machine. Furnish a self-propelled grinding machine with diamond blades that is specifically designed to smooth and texture JPC pavement. Furnish a machine that is capable of cutting or planing at least 3 feet wide on each pass and that does not encroach on traffic movement outside the work area.

503.02.02 Joint Sealer. Conform to Section 807.

503.03 CONSTRUCTION.

503.03.01 Test Section. At the beginning of work, grind an initial test section at least 3 feet wide and 100 feet long. The Engineer will evaluate the initial test section to determine if the texture meets the requirements of this section. Modify the blade spacing or other features as necessary to produce the specified texture. Make similar modifications throughout the project to ensure acceptable surface texture.

503.03.02 Diamond Grinding. Grind the entire surface of the JPC pavement mainline. Grind ramps, tapers, acceleration and deceleration lanes, turn lanes, median crossovers, and bridge decks as the Contract specifies. Grind shoulders or gutters when necessary for proper pavement drainage.

Grind in a longitudinal direction and parallel to the pavement centerline. Begin and end at lines normal to the pavement centerline. When the end of the cut is subject to public traffic, grind a smooth transition from the smooth pavement to the non-ground pavement. Maintain a constant cross-slope between grinding extremities in each lane to ensure positive lateral drainage. Overlap the edge of grinding passes by less than 2 inches.

503.03.03 Cleaning. Remove solid residue from the pavement surface before traffic or wind blows it. Perform a separate washing operation to remove residue that may cause dust after the completion of grinding when the Engineer directs. Ensure that waste water and residue do not flow across the pavement, into gutters, or into drainage structures. Dispose of waste water and residue as the Engineer approves.

503.03.04 Lighting. Provide lighting, as the Engineer approves, when grinding between dusk and dawn.

503.03.05 Joint Seals.

A) **Resealing Existing Joints.** After grinding is complete on areas adjacent to the joints and after conforming to the ride quality requirements, clean and reseal the joints according to Subsection 501.03.

B) **Preserving Existing Joints Seals.** After grinding is complete and when the Engineer directs, remove and replace any damaged seals with new seals. The Engineer may require replacement of preformed compression joint seals when damage penetrates the top void of the seal and replacement of silicone joint seals when the seal shows loss of bond with the sides of the joint or significant loss of the profile of the seal. Remove damaged seals for the full traffic lane width, thoroughly clean the joint, and install new seals according to Subsection 501.03.18.

503.03.06 Pavement Marking. Remove existing pavement marking and provide temporary pavement markings according to Section 112 where the Contract specifies.

503.03.07 Texture. The Department will measure the dimensions of the longitudinal grooves. If the dimensions are not within the following limits, make adjustments to the grinding equipment to achieve the required texture:

Groove Dimension	Value (inch)
Width of grooves	Between 0.09 and 0.130
Width between grooves	Between 0.08 and 0.125
Height of groove (Peak to bottom)	Between 0.031 and 0.063

503.03.08 Alignment Tolerances. The Department will measure the transverse slope of ground pavement with a straightedge placed normal to the centerline. If a depression or misalignment of slope greater than 0.25 inch in 12 feet occurs, adjust the grinding equipment to correct the misalignment.

The Engineer will measure the alignment of the top of the pavement surface across the joint and cracks. Correct all misalignments that exceed 0.063 inch by additional grinding.

503.03.09 Ride Quality. Conform to Section 501 with the following exceptions:

1) All references are to diamond grinding in lieu of paving.
2) Achieve an IRI equal to or lower than the target IRI listed in the proposal for each 0.1-mile section. When no target is listed in the proposal, achieve an IRI of 70 or lower for each 0.1-mile section.
3) Perform corrective work to achieve the required IRI by regrinding the entire width of the traffic lane at areas having a high IRI. The Engineer may exclude pavement areas where grinding alone will not correct deficiency.
4) The Department will create a strip chart when the test results show that the IRI is greater than 70 or upon request for lower IRI values.

503.04 MEASUREMENT.

503.04.01 JPC Diamond Grinding. The Department will measure the quantity in square yards. The Department will measure the width as the width shown on the typical cross section of the Plans and the length horizontally along the centerline of each lane or ramp. The Department will not measure corrective work for payment. The Department will not measure the ride quality to calculate an adjusted unit price for this item of work.

503.04.02 Joint Sealing. The Department will measure Joint Sealing by linear feet. The Department will not measure removing existing joint material or cleaning joints for payment but will consider them incidental to this item of work.

503.05 PAYMENT. The Department will make payment for the completed and accepted quantities under the following:

Code	Pay Item	Pay Unit
02060	JPC Pavement Diamond Grinding	Square Yard
08540	Joint Sealing	Linear Foot

The Department will consider payment as full compensation for all work required under this section.

SECTION 504 — RUBBLIZING EXISTING CONCRETE PAVEMENT

504.01 DESCRIPTION. Rubblize existing concrete pavement for full depth and full panel width. Rubblizing operations are not to begin until all existing asphalt has been removed from the mainlines in the project area. The work required shall include recycling in-place the existing concrete pavement into a coarse aggregate base course, by breaking in-place with mechanical equipment and compacting and preparing the base to receive the asphalt concrete.

504.02 MATERIALS AND EQUIPMENT.

504.02.01 Asphalt Material. Conform to Subsection 403.02.

504.02.02 Impact Hammer. Break the pavement with an impact hammer capable of delivering sufficient energy to break the pavement. Furnish a hammer having a breaker equipped with a plate-type shoe designed to prevent penetration into the existing surface. The Department may approve other equipment according to Subsection 108.06. When necessary, provide a screen for the hammer to protect vehicles in the adjacent lane from flying concrete chips during the breaking process. Other types of equipment may be used if approved by the Engineer. The Engineer will determine if the proposed equipment has demonstrated that the pavement can be broken to the extent specified without excessive displacement of the concrete or damage to the subgrade.

504.02.03 Pneumatic-Tire Proof Roller. Furnish a pneumatic-tire proof roller, weighing a minimum of 35 tons, of one of the following types.

A roller having the following:

1) 4 rubber-tired wheels equally spaced across the full width and mounted in line on a rigid steel frame in such manner that all wheels carry equal loads, regardless of surface irregularities.
2) Roller tires capable of satisfactory operation at a minimum inflation pressure of 100 psi when inflated to the pressure necessary to obtain proper surface contact pressure to satisfactorily seat pavement slabs. The Department will allow tires to contain liquid.
3) A rubber-tired prime mover for towing.

or

1) Two-axles.
2) Self-propelled.
3) No more than 7 tires.
4) Tires capable of meeting inflation pressure and surface contact pressure requirements in 2) above.

504.03 CONSTRUCTION. Rubblize the existing pavement. Place specified succeeding leveling, asphalt base, and asphalt binder courses one lane at a time. Furnish and place asphalt mixtures according to Division 400 for the appropriate mixture.

Exercise care during rubblizing operations to prevent damage to underground utilities and drainage facilities.

504.03.01 Rubblization of Pavement. Where the rubblized pavement abuts concrete pavement that is to remain intact a joint shall be saw cut full depth and load transfer devices severed at all termini prior to rubblization. For jointed pavements, this saw cut should be at an existing joint.

A) Size Requirements. Rubblizing operations shall reduce the pavement into particles less than 12 inches at the surface of the existing slab. The maximum allowable piece size shall not exceed 24 inches in the largest dimension with 75% being less than 15 inches at the bottom of the slab. The Engineer may direct or allow larger maximum particle dimension. Determine the extent of the breakage based on cracks visible to unaided normal vision when the pavement surface is dry. Do not use water to detect additional cracks.

Accomplish breaking uniformly to produce the desired size without displacing the concrete more than 1/2 inch vertically above the original JPC pavement surface elevation.

Continuously monitor the breaking operation. Make adjustments in the striking pattern, striking energy, number of passes, or other factors to continually achieve acceptable breaking throughout the project.

All damage to pipes, valve boxes, manholes, or other fixtures resulting from the rubbilization effort shall be repaired or replaced as approved by the Engineer at the Contractor's expense. The Contractor has the option of using an alternative rubbilization method adjacent to fixtures or above pipe. In lieu of rubbilization, the pavement adjacent to fixtures or above pipe may be removed and the resulting void filled with filler aggregate.

B) Test Section. Before rubblizing operations begin, the Engineer will designate a test section. Break the test section using varying energy and striking patterns. When necessary, repeat passes of the equipment over the pavement until the test section is acceptably broken according to A) above. Use the extent of breakage of the test section as a guide for breaking the pavement on the remainder of the project. The Engineer may require additional test sections at any time during the course of the work when sizes do not conform to the size requirements of A) above.

The Engineer shall require the Contractor to excavate two test holes, approximately one square yard and extend the full depth of the existing slab, in the pavement during the first half workday to determine if the rubblization process is adequately breaking the pavement into the required sizes. For the remainder of the project, the Engineer may require the Contractor to excavate the equivalent of one test hole per lane mile. The excavated material shall be disposed of and the resulting void filled with filler aggregate.

504.03.02 Compaction of Rubblized Pavement. After breaking, seat the rubblized pavement by rolling with a pneumatic tire proof roller. Make at least 5 one-way passes with a minimum 50-ton roller, or 7 one-way passes with a minimum 35-ton roller. Use a rolling pattern that will ensure that the entire area of the broken pavement is well seated and is thoroughly and uniformly compacted. Remove any large rocking fragments and fragments that are displaced more than 1/2 inch above the original pavement surface elevation after seating and fill the resulting void with asphalt and compact or tamp.

504.03.03 Placement of Edge Drains. When the Contract includes installation of pavement edge drains, install the edge drains at least 2 weeks before rubblization operations.

504.03.04 Placement of Asphalt. Sweep the rubblized area clean of foreign material using mechanical sweepers and hand brooms.

Place the asphalt base following the rubblizing operation as closely as practical according to Subsection 403.03. Do not allow the broken pavement to remain exposed more than 24 hours. If the broken pavement is exposed more than 24 hours, suspend the Rubblizing operations until all broken existing pavement has been covered by at least one course of asphalt base.

Make any required changes to the cross slope with the paving of the base courses. Cure the fist course of base at least 8 hours before placing the second course. Do not open a lane to public traffic until 2 courses of asphalt (not including leveling courses) are in place. Offset the longitudinal joints in the asphalt 6 inches according to Subsection 403.03.07.

Perform leveling and wedging according to Subsection 403.03.09 on top of the first course of asphalt, and not on the existing pavement. However, at specific locations where the Engineer deems a substantial amount of leveling is necessary, level and wedge directly on the rubblized pavement. Correct deviations in the surface by leveling and wedging on each succeeding course unless the Engineer directs or approves in writing that the leveling and wedging be delayed until after placing the succeeding courses. Construct asphalt courses succeeding the first 2 courses according to the Contract.

504.04 MEASUREMENT.

504.04.01 Rubblize Pavement. The Department will measure the quantity in square yards. The Department will measure the width as the actual width of the original concrete pavement, and the length as the horizontal length along the centerline of each roadway or ramp.

The Department will not measure for payment pre-cracking the pavement, dust abatement, compaction, pavement removals adjacent to fixtures or above pipes, removing exposed reinforcement steel, disposal of all removed material as part of the rubblized effort, maintaining the compacted and stabilized condition of the rubblized pavement until overlaid and all other items necessary to complete the rubblization and will consider them incidental to this item of work.

504.04.02 Leveling and Wedging. The Department will measure quantity according to Subsection 403.04.

504.04.03 Asphalt Mixtures. The Department will measure quantity according to Subsection 403.04 for the appropriate mixture.

504.05 PAYMENT. The Department will make payment for the completed and accepted quantities under the following:

Code	Pay Item	Pay Unit
02108	Rubblize Pavement	Square Yard
00190	Leveling and Wedging, PG 64-22	See Subsection 403.05
----	Asphalt Mixtures	See Subsection 403.05

The Department will consider payment as full compensation for all work required under this section.

SECTION 505 — CONCRETE SIDEWALKS, STEPS, AND ENTRANCE PAVEMENTS

505.01 DESCRIPTION. Construct concrete sidewalks, steps, and entrance pavements, with or without reinforcement, on a prepared subgrade, in one course, to the dimensions and design specified in the Plans and Standard Drawings. This work does not include sidewalks constructed integral with bridges or culverts.

505.02 MATERIALS AND EQUIPMENT

505.02.01 Concrete. Conform to Subsection 601.02 and 601.03.

505.02.02 Steel Reinforcement. Conform to Section 811.

505.02.03 Joint Materials. Conform to Section 807, preformed fillers.

505.02.04 Aggregate. Conform to Section 804 and 805.

505.02.05 Forms. Conform to Subsection 601.02.

505.02.06 Detectable Warning Surface (Pavers). Conform to ASTM C 936, ASTM C 902 Class SX – Type I, or ASTM C 1272 – Type R or F. Ensure the concrete pavers have a minimum thickness of 2 inches and truncated domes as shown in the Standard Drawings. Ensure their color is homogeneous throughout the paver and contrasts visually with adjoining surfaces, either light-on-dark or dark-on-light. The Department will allow either yellow or red as colors.

505.02.07 Detectable Warning Surfaces. Conform to AASHTO M 333, AASHTO T388 and be listed in the Department's List of Approved Materials. Surfaces shall be anchored in the sidewalk and shall be replaceable. Adhesive only surface mounted surfaces nor cast in place stamping will be permitted. Adjacent detectable warning surfaces shall be from the same manufacturer. Ensure surfaces are configured as shown in applicable Standard Drawings. Ensure surface color is homogeneous throughout and contrasts visually with adjoining surfaces, either light-on-dark or dark-on-light. The Department will allow either Federal Yellow or Brick Red as colors.

505.02.08 Mortar. Conform to Subsection 601.03.03.

505.03 CONSTRUCTION. Construct sidewalks, steps, and entrance pavements on a prepared, compacted, smooth subgrade of uniform density formed by trenching or filling to the required elevation. Use Class A concrete according to Subsection 601.03. When desired, use Class P concrete according to Subsection 501.03 for the construction of entrance pavements. Remove large boulders and ledge rock found in the subgrade to a minimum depth of 6 inches below the finished subgrade elevation, backfill the space with material that the Engineer approves, and thoroughly compact by rolling or tamping. Furnish a template, and check the subgrade before depositing concrete. Moisten the subgrade immediately before placing concrete.

Place a 2-inch thick course of No. 610 coarse aggregate on the prepared subgrade before placing concrete for steps. Form all steps and cast them to the dimensions specified in the Contract. Reinforce all steps according to the Standard Drawings. Round all exposed edges and corners to a 1/4 inch radius. When there are 3 or more steps, install handrail of the type specified in the Contract according to Section 720.

505.03.01 Forming. Place sidewalks and entrance pavements by use of side forms or an approved slip form method according to Subsection 601.03.12.

A) Side Form Method. Deposit concrete on the moistened subgrade strike, and compact to the required thickness, and tamp sufficiently to bring mortar to the surface. Then, finish the surface smooth and even with wooden floats and brushes and broom for texturing.

B) Slip Forming. Correct any excess slumping or irregularities immediately after passage of the slip form machine, and finish and broom to blend with the general appearance of the adjacent concrete.

505.03.02 Straight edging and Edging. Before giving the concrete sidewalk and entrance pavement the final finish and brooming, check the surfaces with a 10-foot straightedge and eliminate all irregularities of more than 1/4 inch.

505.03.03 Joints.

A) Joints for Sidewalks. Either divide the surfaces of sidewalks into rectangular areas by means of a jointer having a radius of 1/4 inch and forming a groove no less than one inch in depth for the full width of the walk or saw the joints according to Subsection 501.03.17 and the Contract. Ensure that the length of the rectangles formed does not exceed the width of the sidewalk being constructed.

When the sidewalk is constructed integral with the curb, ensure that the width and spacing of the joints conform to that in the curb. Round the edges of the sidewalk at all expansion joints with an approved edging tool to a 1/4 inch radius. Install 1/2-inch premolded expansion joint material to the full depth of the sidewalk where the sidewalk abuts any rigid structure or fixture, such as curbs, columns, castings, buildings, and light standards.

B) Joints for Entrance Pavements. Construct 1/4-inch wide sawed contraction joints in entrance pavements according to Subsection 501.03.17. Construct these joints at locations shown on the Standard Drawings. The Department will not require steel reinforcement in contraction joints. Saw the joints to a minimum depth of 2 inches. Install 1/2-inch wide expansion joints where shown on the Standard Drawings. Seal both expansion joints and contraction joints according to Subsection 501.03.18 and the Standard Drawings.

505.03.04 Detectable Warnings. Install detectable warning surfaces at all sidewalk ramps and on all commercial entrances with traffic control devices according to the Standard Drawings.

A) Cast-in-Place Detectable Warnings. Install in freshly placed concrete per manufacturer's recommendation. Ensure surface is flush with the top of the concrete surface and no "trip edges" have been created.

B) Surface Mount Detectable Warnings. Install per manufacturer's recommendation and ensure no "trip edges" have been created.

C) Detectable Warning Pavers. Install in mortar. Ensure surface is flush with the top of the concrete surface and no "trip edges" have been created.

For retrofit applications which include pavers or cast-in-place detectable warning surfaces, remove existing sidewalks to meet the requirements of the standard drawings applicable to the project.

505.03.05 Curing and Backfilling. Cure concrete sidewalks, steps, and entrance pavements according to Subsection 601.03.17.

After the concrete has set sufficiently, remove forms and backfill areas adjacent to the concrete. Compact and grade the backfill.

505.04 MEASUREMENT.

505.04.01 Concrete Sidewalk. The Department will measure the quantity in square yards.

505.04.02 Concrete Entrance Pavement. The Department will measure the quantity in square yards.

505.04.03 Class A Concrete for Steps. The Department will measure the quantity according to Subsection 601.04. The Department will not measure excavation, steel reinforcement, or crushed aggregate for steps for payment and will consider them incidental to this item of work.

505.04.04 Detectable Warnings. The Department will measure the quantity in square feet. The cost associated with the removal of the existing sidewalk will be incidental to the detectable warnings bid item or incidental to the bid item for the construction of the concrete sidewalk unless otherwise noted.

505.04.05 Roadway Excavation. The Department will measure the quantity according to Subsection 204.04.

505.04.06 Embankment-In-Place. The Department will measure the quantity according to Subsection 206.04.

505.05 PAYMENT. The Department will make payment for the completed and accepted quantities under the following:

Code	Pay Item	Pay Unit
02719, 02720, 02723	Sidewalk, Thickness, Concrete	Square Yard
02101, 02099	Cement Concrete Entrance Pavement, Thickness	Square Yard
02551	Concrete, Class A for Steps	See Subsection 601.05
02200	Roadway Excavation	See Subsection 204.05
02230	Embankment-In-Place	See Subsection 206.05
23158ES505	Detectable Warnings	Square Foot

The Department will consider payment as full compensation for all work required under this section.

SECTION 506 — CONCRETE CURBS AND GUTTERS

506.01 DESCRIPTION. Construct, on a prepared subgrade according to the Standard Drawings, concrete curb and gutter, concrete valley gutter, concrete header curb, and concrete integral curb.

506.02 MATERIALS.

506.02.01 Concrete. Conform to Subsection 601.02 and 601.03.

506.02.02 Steel Reinforcement. Conform to Section 811.

506.02.03 Joint Fillers. Conform to Section 807, preformed fillers.

506.02.04 Forms. Conform to Subsections 501.02. and 601.02.

506.02.05 Fine Aggregate. Conform to Section 804.

506.02.06 Coarse Aggregate. Conform to Section 805.

506.03 CONSTRUCTION.

506.03.01 Header Curb, Valley Gutter, and Curb and Gutter (Combination). Use combination curb and gutter in conjunction with asphalt pavements. Construct combination curb and gutter according to the typical section in the Plans. Use header curb in conjunction with either asphalt or JPC pavement where the depth of pavement is a minimum of one foot or where the thickness of asphalt pavement is variable. Construct header curb before placing pavement. Construct valley gutter according to the Plans and Standard Drawings.

Prepare the foundation by excavating or constructing the embankment to the required subgrade elevation on which the curb, gutter, or combination curb and gutter is to be placed. Remove all soft, yielding, or otherwise unsuitable material, and replace it with stable materials according to Section 207, and compact and finish the subgrade to a firm even surface.

Use Class A concrete according to Subsection 601.03. Place concrete either by use of side forms or by an approved slip forming method according to Subsection 501.02.11.

When indicated or directed, form entrance and drainage openings of the required dimensions through the curbs at the designated location.

Prepare the subgrade as required and moisten before placing concrete. During placement, thoroughly spade the concrete and vibrate or tamp it until the mortar entirely covers the surface and eliminate all honeycomb and voids. Place concrete so that no concrete reaches initial set before placing the following lift. Strike off and float surfaces so all coarse aggregate is well below the surface.

Place reinforcing steel according to the details specified in the Contract. Construct contraction joints as specified in Subsection 501.03.17 D).

Construct expansion joints at all breaks in alignment, at all drainage boxes and other fixed objects, at the beginning and ending points of curves, and at the beginning, quarter, middle, and ending points of semicircular curves, except the Engineer will not require joints at the quarter points for semicircles having radii of 5 feet or less.

Give the top surfaces of curbs a uniform float finish and round edges according to the Standard Drawings. Correct all honeycombed areas by filling with mortar. Do not plaster. Finish the top and face of all curbs while the concrete is plastic by wetting and rubbing with a carborundum brick or wooden block. Finish the face of header curbs to 2 inches below the gutter line or the finished groundline. Before giving the concrete the final finish, check surfaces with a 10-foot straightedge and eliminate all irregularities of more than 1/4 inch. Finish concrete to a smooth surface, presenting a uniform texture and color.

Cure the concrete according to Subsection 501.03.15.

Construct precast curbs to the length and shape, and reinforce according to the Standard

Drawings. Cast, finish, and cure precast curbs according to Section 605.03. Set precast curbs to conform to the line and grade specified in the Plans with tight joints. Fill all joints except expansion joints with mortar. When the precast curb is set, fill all remaining excavated areas with material that the Engineer approves in lifts not exceeding 6 inches in depth and tamp.

506.03.02 Integral Curb. Use integral curb in conjunction with JPC pavements where a portion of the JPC pavement is the gutter. Construct according to Subsection 506.03.01 except for the following:

1) Use either Class A concrete according to Subsection 601.03, or Class P concrete according to Subsection 501.03.
2) Construct integral curbs monolithic with the pavement or as a separate operation by anchoring to the pavement.

   For integral curbs constructed monolithic with the pavement in a separate operation from placement of the pavement concrete, place the curbs immediately following completion of the pavement finishing operations and before the concrete has taken its initial set. Do not exceed an elapsed time between placing concrete in the pavement and in the curb of one hour. Obtain a thorough bond between the pavement and curb by roughening the surface of the pavement covered by the curb by means of a trowel or wire brush. Place stirrups according to the Standard Drawings in the freshly finished concrete at intervals of 2 1/2 feet before placing the curb. Do not place stirrups closer than 3 inches to the center of sawed construction joints.

   When the curb is constructed as a separate operation, clean the surface of the concrete in the pavement of all foreign material before placing concrete in the curbs. Should it be necessary for stirrups to be bent in order to allow equipment to pass over the bars at the beginning of a days run, bend the bars before installation.
3) Insert preformed joint filler, and cut it to conform to the cross section of the curb, in the curb directly over the expansion joint in the pavement while placing the curb. Construct contraction joints at the same locations as those in the pavement.
4) Use side forms with a depth equal to that of the curb. Ensure that the forms are joined neatly, fastened securely, and held rigidly in place by adequate connections and bracing. Check curb forms for grade and alignment to the same degree of accuracy required for pavement forms. After the concrete in the curb has hardened sufficiently, but in no less than 6 hours after placement, remove the inside forms and finish the inside face of the curb to a uniform color and texture by rubbing with a wooden block or a carborundum brick. Correct any honeycomb or other surface defects by pointing with mortar of the same proportions of cement and sand used in the concrete.

To obtain a neat line on the thin edge of the integral curb lip, construct by placing a one-inch by 4-inch board, at least 10 feet long and surfaced on all 4 sides, on the concrete slab to act as a guide when forming the curb, or use other approved methods.

Seal all pavement joints according to Subsection 501.03.17 before integral curb is constructed. If the integral curb is constructed monolithically with the pavement, seal the curb in the same manner as the pavement.

506.04 MEASUREMENT.

506.04.01 Header Curb. The Department will measure the quantity in linear feet along the face of the curb.

506.04.02 Valley Gutter. The Department will measure the quantity in linear feet along the flowline of the gutter.

506.04.03 Curb and Gutter (combination). The Department will measure the quantity in linear feet along the flowline of the gutter.

506.04.04 Integral Curb. The Department will measure the quantity in linear feet along the top of the curb.

506.05 PAYMENT. The Department will make payment for the completed and accepted quantities under the following:

Code	Pay Item	Pay Unit
01875-01877, 01880, 01885, 01890, 01891	Type, Header Curb	Linear Foot
01895	Valley Gutter	Linear Foot
01810, 01811, 01815, 01820, 01821, 01825	Type, Curb and Gutter	Linear Foot
01830, 01831, 01840, 01841, 01845, 01847	Type, Integral Curb	Linear Foot

The Department will consider payment as full compensation for all work required under this section.

SECTION 507 — CONCRETE MOUNTABLE MEDIAN AND STANDARD BARRIER MEDIAN

507.01 DESCRIPTION. Prepare the foundation for the mountable median or standard barrier median, furnish, place, consolidate, finish, and cure concrete, and construct all joints necessary for completing the work.

507.02 MATERIALS.

507.02.01 Concrete. Conform to Subsection 601.02 and 601.03.

507.02.02 Steel Reinforcement. Conform to Section 811.

507.02.03 Joint Material. Conform to Section 807, preformed fillers.

507.02.04 Forms. Conform to Subsection 601.02.

507.03 CONSTRUCTION. Construct concrete mountable medians or standard barrier medians on the accepted prepared subgrade, or the completed and accepted base course or old pavement. Use Class A concrete according to Subsection 601.03 or Class P concrete according to Subsection 501.03. When required, place dowel bars according to the Contract. Place concrete either by use of side forms or by an approved slip forming method according to Subsection 601.03.12.

When constructing medians in conjunction with JPC pavement, construct transverse joints at the same intervals and locations as joints in the adjacent pavement. When constructing medians in conjunction with asphalt pavement, space transverse joints at intervals of 30 feet or less to provide uniform spacing. Construct all median joints as either 1/2-inch expansion joints filled with preformed joint filler or 1/8-inch sawed joints. When sawing, construct median joints according to Subsection 501.03.17. The Engineer will not require steel dowels in either type of joint.

Cure concrete placed in the median according to Subsection 501.03.15.

507.04 MEASUREMENT.

507.04.01 Standard Barrier Median. The Department will measure the quantity in square yards.

507.04.02 Mountable Median. The Department will measure the quantity in square yards.

507.05 PAYMENT. The Department will make payment for the completed and accepted quantities under the following:

Code	Pay Item	Pay Unit
01915-01923	Standard Barrier Median, Type	Square Yard
01935-01950	Mountable Median, Type	Square Yard

The Department will consider payment as full compensation for all work required under this section.

SECTION 508 — PERMANENT CONCRETE MEDIAN BARRIERS

508.01 DESCRIPTION. Prepare the foundation for the median barrier; furnish, place, consolidate, finish, and cure the barrier; construct all transverse joints; construct other incidentals necessary to complete the work; and attach delineators and other appurtenances when specified in the Contract.

508.02 MATERIALS AND EQUIPMENT.

508.02.01 Concrete. Conform to Subsection 601.02 and 601.03.

508.02.02 Steel Reinforcement. Conform to Section 811.

508.02.03 Joint Material. Conform to Section 807, preformed fillers.

508.02.04 Dowel Bars. Conform to Section 811.

508.02.05 Tie Bars for Precast Sections. Conform to Section 811.

508.02.06 Mortar Sand. Conform to Section 804.

508.02.07 Cement. Conform to Section 801.

508.02.08 Water. Conform to Section 803.

508.02.09 Masonry Coating. Conform to Section 828.

508.02.10 Delineators for Barriers. Use Stimsonite Marker 962, AKT Corporation Marker No. 181, or a Department approved equal.

508.02.11 Forms. Conform to Subsection 601.02. In addition to the requirements for slip forms, use a slip form or extrusion machine that is equipped with automatic guidance controls capable of sensing grade and alignment from an outside reference consisting of a taut line or wire.

508.03 CONSTRUCTION. Construct concrete median barriers of each type to the lines, grades, cross section, and details specified in the Plans and Standard Drawings. Use Class AA concrete according to Subsection 601.03. When it is necessary to transition the concrete median barrier into a section different from the uniform section specified in the Plans, such as at a bridge pier, sign pedestal, or bridge end wall, do so in a smooth, uniform manner as shown on the Standard Drawings. Provide concrete median barrier that are precast, cast-in-place using fixed forms, or slip formed according to Subsection 601.03.12.

Bevel the upper longitudinal edge of the barrier 7/8 inch, or construct it to a radius satisfactory to the Engineer.

When required, construct items such as delineators and conduit according to the Contract. Secure conduit to prevent movement.

Cure cast-in-place concrete median barriers according to Subsection 501.03.15. Use the same method of curing on each continuous section of the barrier. Cure precast concrete median barriers according to Subsection 605.03.05.

508.03.01 Fixed Form Construction. Construct 1/2-inch transverse expansion joints throughout the entire cross section at uniform intervals of no less than 15 feet or greater than 25 feet. For construction in conjunction with JPC pavements, locate transverse expansion joints so that a joint occurs at the same stations as that of the rigid pavement transverse joints. Construct additional transverse contraction joints in the barrier if necessary to maintain the 15 to 25-foot interval. Fill all transverse and longitudinal joints with preformed

joint filler. Construct one-inch expansion joints over expansion joints in rigid pavement or base. Construct 1/2-inch expansion joints when the barrier abuts a bridge and at all box inlets, lamp posts, sign posts, and similar structures that project through, into, or against the concrete median barrier.

The Department will allow construction of joints according to Subsection 508.03.02.

Conform to the tolerance requirements of Appendix A, Tabulation of Construction Tolerances. Uniformly coat the median barriers with masonry coating.

508.03.02 Slip Form Construction. Suspend reference lines from supports set at intervals no greater than 10 feet on vertical and horizontal curves or 25 feet on uniform grades or tangents. Do not use ski or shoe sensors to reflect the grade of the subgrade unless the ski or shoe can ride on the completed pavement surface.

Provide a construction joint between the base and the barrier. Construct a 2 by 4-inch key, either depressed or raised, in the base. Insert steel dowels in the plastic concrete immediately behind the slip form machine at the locations shown on the Standard Drawing. Place the base using slip form or extrusion methods.

Immediately repair all surface pits larger than 1/2 inch in diameter and all gouges behind the slip form machine. The Engineer will not require further finishing, other than a light longitudinal brushing or brooming.

Provide short sections, such as sections adjacent to structures, terminal sections, etc. that are cast using fixed forms.

Construct one-inch transverse expansion joints at intervals no greater than 500 feet. Construct one-inch transverse expansion joints over all transverse expansion joints in rigid pavement or base. Construct 1/2-inch expansion joints when the barrier abuts a bridge and at all box inlets, lamp posts, and similar structures that project through, into, or against the concrete median barrier. Fill all transverse and longitudinal joints with preformed joint filler.

Construct 1/8-inch transverse contraction joints 2 inches deep at uniform intervals of 20 to 30 feet. Make contraction joints by cutting into the plastic concrete using an edging tool and trowel, using removable inserts, or sawing. When sawing contraction joints, saw as soon as practical after the concrete has set sufficiently to preclude raveling, and before any shrinkage cracking occurs in the concrete. The Engineer will not require sealing of contraction joints.

Construct construction joints as one-inch expansion joints. When constructing a concrete median barrier over JPC pavement or base, locate transverse joints in the barrier to match transverse joints in the pavement or base. Construct additional transverse contraction joints in the barrier if necessary to maintain the 20 to 30-foot interval specified above. When constructing transverse joints in the JPC pavement or base at variable intervals, adjust the joint interval in the wall to match the joint interval in the pavement or base and construct additional joints as necessary to avoid exceeding the maximum interval.

Conform to the tolerance requirements of Appendix A, Tabulation of Construction Tolerances.

508.03.03 Precast Construction. Construct precast units according to Section 605 and approved drawings. Place the precast units on a bed of mortar, and trim and discard excess mortar. Uniformly coat the median barriers with masonry coating.

When precast concrete median barriers are specified or allowed for installation on an existing facility, anchor them as the Plans specify.

When using precast units, cast short sections, transitions, terminal sections, and other supplemental sections using fixed forms.

When casting threaded inserts into the barrier for use in lifting, protect the inserts by installing a solid, full-length, threaded, plastic bolt, coated with waterproof grease. Install the bolt immediately after manufacturing the barrier section. Leave the bolt in place at all times while the barrier is in storage or in service, except when using the insert for lifting.

Entirely fill joints between units, including the 2 by 10-inch groove, with grout composed of one part mortar sand and 2 parts cement with enough water to make the mixture plastic.

When the barrier abuts a bridge or other rigid structure, cut off the tie bars or fill the groove with grout, as applicable, and install 1/2-inch preformed joint filler in the joints.

Install 1/2-inch preformed joint filler at all box inlets, lamp posts, sign posts, and similar structures that project through, into, or against the concrete median barrier.

Conform to the tolerance requirements for cast-in-place construction of Appendix A, Tabulation of Construction Tolerances.

Ensure that all concrete median barrier are uniform in appearance, and true to line and grade. Repair or remove and replace all portions of the barrier that are not within the specified tolerances, or precast units that cannot be correctly installed.

508.04 MEASUREMENT.

508.04.01 Concrete Median Barrier. The Department will measure the quantity in linear feet along the top centerline of the barrier. The Department will not measure furnishing, installing, or maintaining lifting devices in precast median barriers for payment and will consider them incidental to this item of work. The Department will not measure portions of the barrier that are not within the specified tolerances, precast units that are not correctly installed, or damaged units.

508.04.02 Concrete Terminal Sections. The Department will measure the quantity by each individual unit.

508.04.03 Delineators for Barriers. The Department will measure the quantity by each individual unit.

508.04.04 Masonry Coating. The Department will measure the quantity according to Subsection 601.04.

508.05 PAYMENT. The Department will make payment for the completed and accepted quantities under the following:

Code	Pay Item	Pay Unit
01953, 01955, 01988, 01989, 01992, 01999, 01967-01977	Concrete Median Barrier, Type	Linear Foot
01956-01957	Concrete Terminal Section, Type	Each
01984, 01985	Delineator for Barrier, Color	Each
02998	Masonry Coating	See Subsection 601.05

The Department will consider payment as full compensation for all work required under this section.

SECTION 509 — TEMPORARY CONCRETE MEDIAN BARRIERS

509.01 DESCRIPTION. Furnish, install, maintain, and remove temporary precast concrete median barriers. The Department will furnish the concrete median barriers when specified in the Contract.

The Department may allow the use of similar units that conform to the National Cooperative Highway Research Program (NCHRP) 350 Test Level 3 (TL-3) requirements and the typical features depicted by the Standard Drawings. Obtain the Engineers approval prior to use. Ensure the barrier wall shape, length, material, drain slot dimensions and locations typical features are met and the reported maximum deflection is 3 feet or less from the NCHRP 350 TL-3 for Test 3 – 11 (pickup truck impacting at 60 mph at a 25-degree angle.)

509.02 MATERIALS.

509.02.01 Concrete. Conform to Subsection 601.02 and 601.03.

509.02.02 Steel Reinforcement. Conform to Section 811.

509.02.03 Connector Bar Pins. Conform to ASTM A 36. Galvanize after forming according to AASHTO M 111.

509.02.04 Top Connectors. Conform to ASTM A 36. Galvanize after forming according to AASHTO M 111.

509.02.05 Bottom Connectors. Conform to ASTM A 36. Galvanize according to AASHTO M 111 after forming.

509.02.06 Tack Welding. Conform to Subsection 605.03.04.

509.02.07 Delineators for Barriers. Use either Stimsonite Marker 962, AKT Corporation Marker No. 181, or a Department approved equal.

509.02.08 Connector Pins. Conform to ASTM A 307, bolt grade A, national coarse thread 7 threads per inch.

509.03 CONSTRUCTION. Construct concrete median barriers according to Section 605 and the Standard Drawings. Use Class A concrete and provide all concrete with an ordinary surface finish according to Subsection 601.03.18. Place delineators according to the Standard Drawings.

Lift and place the barrier units using a 2-point pickup, or another approved method. Do not lift units by the connectors. When casting threaded inserts into the barrier for use in lifting, protect the inserts by installing a solid, full-length, threaded, plastic bolt, coated with waterproof grease. Install the bolt immediately after manufacturing the barrier section. Leave the bolt in place at all times while the barrier is in storage or in service, except when using the insert for lifting.

Do not use any unit which has been cracked, chipped, scarred, or otherwise damaged or disfigured unless the Engineer approves.

Install the units at the locations specified in the Plans, and connect them in the manner detailed on the Plans and Standard Drawings. Keep delineators clean and provide replacement delineators when necessary. For all units in a continuous run, use units of the same type and height, and provide a smooth transition. Replace all units damaged after installation with an undamaged unit. When the units are no longer needed, remove the units from the project. Take ownership of all units except Department furnished units. Transport Department furnished units to the location specified in the Contract.

509.04 MEASUREMENT.

509.04.01 Temporary Concrete Median Barrier. The Department will measure the quantity furnished, installed, maintained, and removed by multiplying the nominal length of each unit in linear feet by the number of units. The Department will measure units installed to replace units damaged by traffic. The Department will not measure the disposal of units or units installed to replace units damaged by construction operations for payment and will consider them incidental to this item of work. The Department will not measure furnishing, installing, or maintaining lifting devices for payment and will consider them incidental to this item of work.

509.04.02 Install Temporary Concrete Median Barrier. The Department will measure the quantity, installed, maintained, and removed by multiplying the nominal length of each unit in linear feet by the number of units. The Department will furnish the barrier. The Department will measure units installed to replace units damaged by traffic. The Department will not measure the disposal of units or units installed to replace units damaged by construction operations for payment and will consider them incidental to this item of work. The Department will not measure furnishing, installing, or maintaining lifting devices for payment and will consider them incidental to this item of work.

509.04.03 Relocate Temporary Concrete Median Barrier. The Department will measure the quantity relocated by multiplying the nominal length of each unit in linear feet by the number of units.

509.04.04 Delineator for Barrier. The Department will measure the quantity by the individual unit, including replacement units.

509.05 PAYMENT. The Department will make payment for the completed and accepted quantities under the following:

Code	Pay Item	Pay Unit
03171	Concrete Barrier Wall Type, 9T[(1)]	Linear Foot
01992	Install Temporary Concrete Median Barrier [(2)]	Linear Foot
02003	Relocate Temporary Concrete Median Barrier	Linear Foot
01984, 01985	Delineator for Barrier, Color	Each

[(1)]The Department will pay 90 percent of the quantity upon satisfactory installation of the units. The Department will pay the remaining 10 percent upon removal of the units from the project or upon placement to their final location.

[(2)]The Department will pay 75 percent of the quantity upon satisfactory installation of the units. The Department will pay the remaining 25 percent upon removal of the units from the project or upon placement to their final location.

The Department will consider payment as full compensation for all work required under this section.

SECTION 510 — SEALING AND PATCHING CONCRETE WITH EPOXY RESIN

510.01 DESCRIPTION. Seal concrete surfaces, except JPC pavement, with an epoxy resin seal, and patch concrete surfaces, except JPC pavement, with an epoxy resin mortar patch. Fill low areas with the patch material.

510.02 MATERIALS AND EQUIPMENT.

510.02.01 Epoxy Resin. Conform to Section 826.

510.02.02 Mortar Sand. Conform to Section 804.

510.02.03 Sand for Epoxy Seal Coats. Conform to Section 804.

510.02.04 Sandblasters. Provide sandblasters that are equipped with traps to prevent water or oil from being deposited on the surface.

510.02.05 Drills. Provide rotary, electric, 1/2-inch drills with a paddle or other mixing devices approved by the Engineer.

510.03 CONSTRUCTION. Allow new concrete to cure at least 14 calendar days before applying any epoxy sealant or epoxy mortar patch. Do not apply to JPC pavement. Seal and patch JPC pavement as specified in the Contract. Ensure that the surface temperature of concrete surfaces to be sealed or patched is at least 60 °F. In cool weather, provide artificial heat using space heaters or infrared heaters. When providing artificial heat, maintain a surface temperature between 60 and 95 °F until the epoxy seal or epoxy mortar patch has cured.

510.03.01 Preparation of Concrete Surface for Sealing or Patching. Prepare concrete surfaces to be epoxy sealed or epoxy mortar patched by removing all laitance, deteriorated concrete, and deposits of oil, grease, and other adherent foreign materials. Remove oil, grease, and other adherent foreign materials using solvents, heavy detergents, or mechanical means such as scraping. Then, prepare the surfaces by grinding, sandblasting, retexturing, or chipping to remove all laitance and unsound concrete. Immediately before applying the epoxy seal or epoxy mortar patch, remove all dust, grit, and debris from the surface.

510.03.02 Mixing Epoxy Resin. Thoroughly stir the contents of the separate packages containing component A and component B before combining the 2 components. Do not use the same mixer or paddle to mix component A as is used to mix component B. Combine the 2 components in a clean metal or polyethylene vessel. Combine the components in the proportions and mix them according to the manufacturer's recommendations. Only mix the material in quantities that can be used within the pot life of the mixture.

510.03.03 Mixing Epoxy Mortar for Patching. Establish the proportions of epoxy resin and mortar sand for the epoxy mortar mixture according to the manufacturer's instructions. Mix the epoxy mortar with a drill equipped for mixing. Gradually add mortar sand to the epoxy resin, and continue mixing the materials to obtain a uniform mixture.

510.03.04 Application of Epoxy Mortar for Patching. Prime areas to be patched immediately before placing the epoxy mortar. Thoroughly brush or scrub the epoxy resin for the prime onto the prepared surface to be patched. Then place the epoxy mortar over the primed area. Tamp, rod, and consolidate the epoxy mortar into place to exclude internal voids within the mortar mixture. Level or finish the mortar surface to the specified surface. Finish or treat the surface to conform to the surface texture of the concrete surrounding the patched area.

After the patch has cured, broom, vacuum, or blow away all loose material from the area, and remove it from the pavement or deck. Do not allow traffic on the patched areas until the resinous material has hardened for the amount of time specified in the manufacturer's specifications.

510.03.05 Epoxy Seal Coat. Place the epoxy seal coat and the sand for the epoxy seal coat according to the manufacturer's instructions.

510.04 MEASUREMENT. The Department will not measure concrete sealing or patching for payment and will consider them incidental to the bid item being patched or sealed.

510.05 PAYMENT. The Department will not make payment for concrete sealing or patching.

SECTION 511 — GROUTING AND EPOXY BOND COAT

511.01 DESCRIPTION. Install steel dowel bars or deformed reinforcement steel bars into existing concrete using grout that provides a bond between the steel and concrete, and bond plastic concrete to hardened concrete using an epoxy bond coat.

511.02 MATERIALS.

511.02.01 Epoxy Resin. Conform to Section 826.

511.02.02 Cement. Conform to Section 801.

511.02.03 Water. Conform to Section 803.

511.02.04 Mortar Sand. Conform to Section 804.

511.02.05 Steel Reinforcement. Conform to Section 811.

511.02.06 Dowel Bars. Conform to Section 811.

511.03 CONSTRUCTION.

511.03.01 Grouting. Drill holes of the size recommended by the manufacturer for the insertion of bars using masonry bits to the depth specified in the Contract or the manufacturer's specifications and to the tolerances in Appendix A, Tabulation of Construction Tolerances. Keep holes clean and dry at all times. Blow holes clean before grouting. Use bars that are free of rust, mill scale, oil, grease, and other foreign substances. Grout with epoxy grout, expanding grout, or other grout on the Department's List of Approved Materials. For epoxy grout, mix the epoxy resin according to Subsection 510.03.02. For expanding grout, mix it according to the manufacturer's instructions. Pour or force the grout into the drilled holes, and apply a coating of at least 0.02 inch of grout to the portions of the bars being inserted into the holes. Slowly insert the coated bars into the full depth of the holes with a twisting motion.

After insertion, look for a light overflow of grout, which indicates complete filling of the drill holes. When this overflow does not occur, immediately remove the bars, place additional grout in the holes, and reinsert the bars. Wipe away all excess grout. After placement and during the hardening of the grout, do not disturb the bars.

511.03.02 Epoxy Bond Coat. Mix the epoxy resin according to Subsection 510.03.02. Mix and apply the epoxy bond coat mixture according to the manufacturer's instructions. Apply the epoxy bond coat only to clean, dry, structurally sound concrete surfaces. Clean surfaces as specified in the Plans or as directed by the Engineer before applying the epoxy mixture.

511.04 MEASUREMENT. The Department will not measure grouting or epoxy bond coat for payment and will consider them incidental to the bid item being grouted or epoxy bond coated.

511.05 PAYMENT. The Department will not make payment for grouting or epoxy bond coat.

SECTION 512 — HOOK BOLTS WITH EXPANSION ANCHORS

512.01 DESCRIPTION. Furnish and install epoxy coated hook bolts with expansion anchors for use in JPC pavement widening or concrete culvert extensions.

512.02 MATERIALS.

512.02.01 Hook Bolts with Expansion Anchors. Conform to Section 811. In addition, ensure that the installed bolts, when tested just before placement of the adjoining concrete, can resist a pull-out load of 9,000 pounds.

512.02.02 Epoxy Coating Material. Conform to Section 811.

512.03 CONSTRUCTION. Epoxy coat and install hook bolts according to the installation requirements for epoxy coated steel reinforcement bars in Subsection 602.03 and the Standard Drawings. Install hook bolts with expansion anchors at the location specified in the Plans or directed by the Engineer according to the manufacturer's instructions.

512.04 MEASUREMENT.

512.04.01 Hook Bolts with Expansion Anchors. The Department will measure the quantity by each individual unit. The Department will not measure epoxy coating for payment and will consider it incidental to this item of work.

512.05 PAYMENT. The Department will make payment for the completed and accepted quantities under the following:

Code	Pay Item	Pay Unit
02587	Hook Bolt with Expansion Anchor	Each

The Department will consider payment as full compensation for all work required under this section.

SECTION 513 – POLYMER CONCRETE OVERLAY SYSTEMS

513.01 DESCRIPTION. Polymer concrete overlay systems include high friction surface systems and bridge deck overlay systems.

513.02 MATERIALS. Conform to Section 847.

513.03 CONSTRUCTION. Ensure that a manufacturer's representative is on site to provide technical assistance during the start-up operations and as necessary during the surface preparation, material placement, and during any necessary remedial work.

513.03.01 Surface Preparation. Utilities, drainage structures, curbs, bridge joints, and any other structure within or adjacent to the high friction surface treatment location shall be protected from surface preparation activities and application of the surface treatment materials. Cover and protect all existing pavement markings that are adjacent to the surface treatment location. Pavement markings that conflict with the surface application shall be removed prior to performing the required surface preparation.
Prepare all surfaces in accordance with the following requirements. Ensure surfaces are dry and meet the requirements of the section immediately prior to installation of the high friction surface treatment. Surfaces contaminated with oils, greases, or other deleterious materials not removed by the required surface preparation shall be washed with a mild detergent solution, rinsed with clean potable water, and dried using a hot compressed air lance.

A) **Asphalt Pavement.** Clean asphalt pavement surfaces using mechanical sweepers and high-pressure air wash. Mechanically sweep all surfaces to remove dirt, loose aggregate, debris, and deleterious material. Air wash all surfaces using a minimum of 180 CFM clean and dry compressed air. Maintain the air lance perpendicular to the surface and the tip of air lance within 12 inches of the surface. For applications on new asphalt pavement, ensure the surface has cured a minimum of 30 days prior to performing surface preparation and installation of the high friction surface treatment.
B) **Concrete Pavement.** Clean concrete pavement surfaces by shot blasting and vacuum sweeping. Shot blast all surfaces to remove all curing compound, loosely bonded mortar, surface carbonation, and deleterious material. The prepared surface shall comply with the International Concrete Repair Institute (ICRI) standard for surface roughness CSP 5. After shot blasting, vacuum sweep all surfaces to remove all dust, debris, and deleterious material.
C) **Concrete Bridge Deck.** Clean the entire area of the deck surface and vertical faces of curbs, barrier walls and plinths up to a height of one inch above the top elevation of the overlay, and areas to receive epoxy-sand slurry, by shot blasting and vacuum sweeping. Shot blast all surfaces to remove all curing compound, loosely bonded mortar, surface carbonation, and deleterious material. Areas to receive epoxy-sand slurry shall be cleaned to a bright, clean appearance. The prepared bridge deck surface to receive high friction surface treatment shall comply with the International Concrete Repair Institute (ICRI) standard for surface roughness CSP 5. After shot blasting, vacuum sweep all surfaces to remove all dust, debris, and deleterious material.

513.03.02 Pre-Treating. Pre-treat joints and cracks greater than 1/4 inch in width and depth with properly proportioned and mixed polymer resin binder. Once the binder in the pre-treated areas has gelled, the installation of the high friction surface treatment may proceed.

513.03.03 Application.

A) **Mechanized Application.** Do not apply surface treatment on a wet surface, when the ambient air or surface temperature is below 50°F or above 110°F, or when the

anticipated weather conditions or surface temperature would prevent the proper application of the surface treatment as determined by the manufacturer.

Apply the polymer resin binder by a truck or trailer mounted application machine that must be capable of continually mixing and delivering the binder components on demand within the temperature range specified in varying widths of up to 12 feet wide at a uniform application thickness. Ensure that the mechanically applied distributing equipment includes accurate measuring devices and/or calibrated containers and thermometers for measuring the binder temperature prior to placement should heating be required. Operations will proceed in such a manner that will not allow the binder material to separate in the mixing lines, cure, dry, or otherwise impair retention bonding of the high friction surfacing aggregate. The application machine shall be equipped with flushing systems such that blockages of lines will not occur, and installation operations are not delayed, stopped, or otherwise compromised. Ensure that mechanical applications are capable of applying binder uniformly at a minimum rate of 10 gallons per minute. The mixed components are mechanically applied onto a prepared surface with a minimum coverage rate of 3.5 square yards per gallon at a minimum uniform thickness of 50 mils onto the surface. In addition, ensure that the application machine complies with the requirements of the binder manufacturer.

The aggregate shall be applied within 120 seconds of the binder application onto the surface. Uniformly spread aggregate immediately without causing excessive overlap of aggregate outside of coverage area. Ensure that the mechanical aggregate spreader is capable of applying a continuous application of varying widths up to 12 feet wide, in a manner to not violently disturb the wet binder film, at a rate of approximately 13-15 lbs per square yard. Complete coverage of the "wet" binder with aggregate is necessary to achieve a uniform surface. No exposed wet spots of the binder shall be visible once the aggregate is installed. The operations should proceed in such a manner that will not allow the mixed binder material to separate, cure, dry, be exposed, or otherwise harden in such a way as to impair retention and bonding of the high friction surfacing aggregate. Do not use reclaimed aggregate. Do not use vibratory or impact type compaction on the aggregate after placement.

B) Hand Application. At the Engineers discretion, corrective work and application to areas such as intersections or areas less than 300 square yards, or where truck mounted application machines are not applicable to the specified locations because of logistical restrictions, may be performed by hand application of the high friction surface treatment.

Do not apply surface treatment on a wet surface, when the ambient air or surface temperature is below 50ºF or above 110ºF, or when the anticipated weather conditions or surface temperature would prevent the proper application of the surface treatment as determined by the manufacturer.

The polymer resin binder components Part (A) and Part (B) shall be proportioned to the correct ratio (+/- 2% by volume), mixed using a low-speed high torque drill fitted with a helical stirrer.

The mixed components shall be hand applied onto a prepared surface at a minimum coverage rate of 3.5 square yards per gallon at a minimum uniform thickness of 50 mils onto the surface. Hand applied binder will be uniformly spread onto the prepared surface by the use of a continuous V notch serrated edged squeegee.

Immediately after placing the binder, apply the aggregate, in a manner to not violently disturb the wet binder film, at a rate of approximately 13-15 lbs per square yard. Do not use reclaimed aggregate. Do not use vibratory or impact type compaction on the aggregate after placement.

513.03.04 Curing. Allow the installed high friction surface treatment to cure in accordance with manufacturer recommendations (approximately 3 hours at an ambient air temperature of at least 50 degrees Fahrenheit). Protect treated surfaces from traffic and environmental effects until the area has cured.

513.03.05 Removal of Excess Aggregate. Remove the excess aggregate from the treatment area and all adjacent surfaces by mechanical sweeping or vacuum sweeping the surfaces a minimum of 3 times before applying additional application and/or opening to traffic. In addition, re-sweep the treatment area and adjacent surfaces using mechanical sweeping or vacuum sweeping 48 hours after opening to traffic to remove all additional loose aggregate and aggregate shed by the action of traffic.

513.04 MEASUREMENT.

513.04.01 High Friction Surface Treatment. The Department will measure the installed quantity in square yards. The Department will not measure surface preparation, curing, cleaning, protection, and aggregate removal and will consider them incidental to this item of work. Payment shall not be made prior to the final and accepted sweeping of the surface, 48 hours after installation.

513.05 PAYMENT. The Department will make payment for the completed and accepted quantities under the following:

Code	Pay Item	Pay Unit
23229EC	High Friction Surface Treatment	LS

The Department will consider payment as full compensation for all work required under this section.