Section 602. CONCRETE PAVEMENT CONSTRUCTION

602.01 Description. Construct a jointed Portland cement concrete pavement, unbonded overlay, base course, or shoulder, with or without reinforcement. Specific type of concrete pavement is shown on the plans. A concrete quality control plan must be in place according to section 604 before concrete production begins.

A. Classification. The term “pavement” is used in a general sense, and may include any of the following.

1. Concrete Pavement. Sections of standard widths and of lengths conducive to production paving. Typically includes mainline pavement, multiple lane ramps and collector-distributor roadways.

2. Concrete Overlay. Sections of standard widths and of lengths conducive to production paving. Concrete pavement placed on an existing pavement section.

3. Miscellaneous Concrete Pavement and Miscellaneous Concrete Overlay. Sections of variable widths and limited lengths not conducive to production paving. Typically includes single lane ramps, acceleration/deceleration lanes, approaches and intersections.

4. Temporary Concrete Pavement. Concrete pavements constructed for temporary duration.

5. Concrete Pavement with Integral Curb. Pavement and curb constructed monolithically.

6. Concrete Base Course. A concrete pavement that will be surfaced with hot mix asphalt (HMA) or concrete overlay.

7. Concrete Shoulders. Concrete pavements placed as shoulders.

602.02 Materials. Use materials meeting the following:

Concrete, Grades HE, P1, P2 ............................ 601
Curing Materials ........................................... 903
Epoxy Coated Lane Ties ............................... 905
Steel Reinforcement ................................. 905
Bond Breaker Material .............................. 914
Joint Materials ....................................... 914

Provide Grade P1 for concrete pavement, miscellaneous concrete pavement, concrete overlay and miscellaneous concrete overlay. Provide
Grade P2 or Grade P1 for concrete base course, concrete shoulders, and temporary concrete pavement. Furnish Grade HE where high-early strength gain is required. When concrete shoulders are cast monolithically with concrete pavement, use the grade designated for the concrete pavement.

Use a transparent compound for curing base course concrete; white or transparent compound for temporary concrete pavement; and white compound for all other pavement, shoulders, and curb surfaces. On concrete overlays, apply wax based, white curing compound over the hot mix asphalt bond breaker course at an application rate of 1 gallon per 22 square yards.

Install epoxy coated lane ties or deformed bars according to Standard Plan R-41 Series. For epoxy coated load transfer dowels delivered without the bond-breaking coating, submit written certification to the Engineer. Include the specification designation of the asphalt or equivalent material for the coating and certify that the material conforms to specification requirements.

602.03 Construction.

A. Equipment. Furnish and maintain all equipment necessary to complete the work.

1. Fixed Forms and Back-Up Rails. When paving with fixed forms, use back-up rails attached to the forms to raise equipment wheel flanges clear of previously cast pavement.

   Use metal forms with sufficient section rigidity to support the paving equipment.

   Use flexible or standard steel forms with flexible liners when the radius is less than 150 feet, except when temporary concrete pavement is specified.

2. Form Tamper. Use form tampers capable of thoroughly and uniformly compacting the base under fixed forms. Use mechanical form tampers for construction of concrete pavement. Use either hand tampers or mechanical tampers for adjusting short sections. For construction of concrete base course, miscellaneous concrete pavement, and temporary concrete pavement, use either hand tampers or mechanical tampers.
3. **Concrete Spreader.** Use an approved device to spread and strike off each layer of concrete and to finish the top layer of concrete. Provide sufficient weight and rigidity to properly strike off the concrete.

4. **Dowel Bar Inserter (DBI).** A DBI may be used in lieu of load transfer assemblies. Use an approved mechanical DBI that automatically installs load transfer bars, at the required depth, and properly consolidates the surrounding concrete.

5. **Lane-Tie Installer.** Use a mechanical installation device unless the lane ties are placed on chairs. Manual installation methods are permitted for temporary concrete pavement.

6. **Reinforcement Bridge.** Transfer reinforcement, not placed on chairs or mechanically picked up off the grade, from the hauling equipment to a movable bridge which spans the pavement being cast. Provide a bridge that can carry the reinforcement load without deflecting the form or rutting the track line.

7. **Internal Vibrator.** Provide sufficient internal vibrators to consolidate the concrete. Use approved mechanical internal vibrators that visibly affect the concrete for a distance of approximately one foot from the vibrator head. Connect the vibrators to start automatically with the forward movement of the equipment and stop automatically when the forward movement stops.

8. **Floating and Finishing Equipment.** Shape, screed, and float the concrete to form a dense, homogeneous pavement, requiring only minimum hand finishing.

   Provide hand floats and straightedges at least 10 feet long, rigid, and free from warping. Provide handles long enough to finish half the width of the pavement being placed. Provide box or channel hand floats with a floating face at least 6 inches wide.

   Use of a roller screed or other manual or semi-automated finishing equipment is permitted provided that use is limited to on one lane width or demonstrate to the satisfaction of the Engineer that the methods and equipment are according to subsections 602.03.A.3 and 6.

9. **Straightedges for Testing Surface Smoothness.** Furnish two 5-foot straightedges and one 10-foot straightedge, rigid and free from warping for the Engineer’s use.
10. **Stencils.** Furnish a template device for imprinting the pavement. Provide numerals 3 to 4 inches high and at least $\frac{3}{4}$ inch deep.

11. **Foot Bridges.** Provide at least one moveable bridge for use in finishing the pavement, installing monument boxes, doing wet checks, and crossing the pavement. Foot bridges spanning slab widths of 16 feet or more must be equipped with wheels unless these bridges are an integral part of the paving equipment. Design and construct foot bridges so they will not contact the concrete.

12. **Membrane Sprayer.** Use mechanical equipment to apply curing compound to all mainline and full lane width pavements. The equipment must be a fully atomizing type, self contained, self supported and ride on wheels or tracks located outside the paving lane. Provide continuous stirring of the compound during application. Apply a continuous uniform film of curing compound to all exposed surfaces.

   The Engineer may approve hand spraying equipment for small and irregular shaped pours. This sprayer must be capable of applying a uniform film of atomized curing compound at the specified rate.

   Inspect curing compound application equipment prior to start of daily production to ensure the capability to properly apply compound.

13. **Joint Sealing Equipment.**
   
a. **Preformed Neoprene Joint Seal.** Use either power or hand-operated equipment, as recommended by the joint seal manufacturer, for applying the lubricant and installing the preformed joint seal.

   b. **Splicing Preformed Neoprene Joint Seal.** Submit a copy of the supplier’s splicing system details to the Engineer before sealing joints.

   c. **Hot-Poured Rubber-Asphalt Type Compound.** Furnish an indirect or double-boiler heating kettle for hot-poured rubber-asphalt type sealing compound, using oil as the heat transfer medium. Provide a thermostatically controlled heat source, built-in automatic agitator, and thermometers to show the temperature of the melted sealing material and the oil bath. The Engineer may require a demonstration that the equipment will consistently produce a joint sealant of proper pouring consistency.
Equip the kettle with a pressure pump, hose and nozzle that can force the sealing material to the bottom of the joint and completely fill it. Do not use direct flame heat on the nozzle to maintain the temperature of the sealing material.

d. **Cold-Applied Joint Sealing Compound.** Apply cold-applied joint sealing compound with pressure equipment that can force the sealing material to the bottom of the joint and completely fill it. Do not spill or overfill the material onto the surface of the pavement.

B. **Base Preparation.** Smooth, trim, compact and maintain the base to the required line, grade and cross section prior to pavement placement, according to subsections 302.03.A, B and C. Prepare the base far enough in advance of setting forms or slip-form paving to allow for testing and acceptance of the base by the Engineer.

Place concrete on a moist base. Do not place concrete on any underlying layer that is frozen, or if the grade exhibits poor stability from excessive moisture levels. Place concrete on a moist base, that is not muddy, soft, or frozen.

When using a slip-form paver with automatic elevation control referenced to the top of the base, cut the areas along which the paving equipment will travel to the accuracy required by subsection 602.03.C for side forms. When the slip-form paver has automatic elevation control cut the base to the accuracy required by subsection 302.03. If construction equipment has been permitted to use the prepared grade, check the base and make necessary corrections before placing the concrete.

C. **Placing Forms.** Trim the compacted base close to the staked grade using base preparation equipment. Check the base on which the forms are to be placed for line and grade and correct irregularities before placing the forms. Thoroughly compact the base outside the area to be paved, to support the forms.

Set forms before placing concrete to provide time for the Engineer to check them. Provide uniform bearing of the forms directly on the base throughout their length and width. Join, lock, and stake all forms with at least three stakes per segment. During paving, do not allow vertical and horizontal movement to exceed $\frac{1}{8}$ inch and $\frac{1}{4}$ inch, respectively. Brace flexible forms to prevent movement during concrete placement.
After the forms are set and cleaned of all hardened concrete or mortar, the Engineer will check them. When requested by the Engineer, fabricate stringlines for checking line and grade. Adjust form lines showing a variance from the staked line by more than $\frac{1}{2}$ inch or from the staked grade by more than $\frac{1}{8}$ inch.

Coat forms with a de-bonding compound before installing lane ties or placing reinforcement. Do not use oil as a de-bonding compound.

D. Placing Concrete. Set structure castings to grade and alignment before, or during, placement of concrete. However, the boxing-out method will be permitted for concrete base course and temporary concrete pavement. Clean all structure castings thoroughly to permit adhesion of the concrete.

Keep the top of the forms free of concrete and other substances during placing and finishing.

Inspect vertical surfaces of previously placed concrete and the adjacent grade and clean off all materials that would prevent an adjoining concrete pour to properly consolidate or conform to the plan dimensions. Before an adjoining pour, inspect the open-graded base for contamination by fines or debris. The Engineer will determine whether the contamination is sufficient to require removal and replacement. All costs associated with removal and replacement will be borne by the Contractor.

When pavement is constructed on a base that could sustain damage from hauling units, mechanically transfer the concrete from the hauling units to the grade. This equipment must be self contained, self supported and ride on wheels or tracks located outside the paving lane.

Spread and strike off the concrete as soon as it is deposited on the base. Avoid segregation. Consolidate the concrete along the faces of fixed or sliding forms and next to transverse dowel bar assemblies with an internal vibrator. If use of a reinforcement installer attains sufficient compaction of the concrete, the use of vibrators along the faces of forms may be omitted.

With slipform method, vibrate concrete for the full width and depth of the pavement. When the concrete is placed in two layers, the consolidation may be accomplished after the top layer has been placed.

Cease all vibratory and tamping action when the paving equipment stops.
Provide adequate labor, materials, and equipment to ensure continuity of the paving operation. The Engineer may limit the rate of production to prevent poor workmanship, overloading of equipment, or frequent delays if the equipment does not have sufficient capacity to keep pace with the other operations. Place the top layer of concrete within 30 minutes after the bottom layer is placed. In case of unavoidable interruption of the work for longer than 30 minutes, place a transverse end of pour joint, Symbol H.

Operate equipment to prevent damage to pavements and bridge decks and to maintain proper grade in transitioning from the pavement to the deck.

Do not permit vehicles or equipment, other than joint saws or ride quality measurement equipment, on new pavement, or portions of it, until the concrete strength complies with subsection 104.11.

Keep existing pavements clean of materials that may interfere with finishing operations or cause damage to the surface.

When slipform pavement is placed in two layers, the first layer may be cast 3 to 6 inches narrower (but at least twice the largest size aggregate dimension) on each side than the proposed pavement slab. Cast full depth pavement at the edges with the second layer.

Finish all concrete placed each day during daylight unless sufficient artificial light is provided. All costs associated with providing this artificial light will be borne by the Contractor.

Where gapping of concrete pavement is specified for maintaining traffic, either leave the gaps or place a temporary bridge or pavement crossing according to section 812 and as approved by the Engineer.

E. Placing Pavement Reinforcement. Place the reinforcement from a reinforcement bridge, or by other approved means that will not contaminate the concrete. Place only reinforcement that is free of loose rust and other contaminants.

F. Constructing Joints.

1. Longitudinal Lane Tie Joints with Straight Tie Bars (Symbol D). Place tie bars at the required depth, parallel to the finished surface, at right angles to the joint and at the spacing called for on the plans. Install lane tie bars, except in temporary concrete pavement,
using approved chairs or mechanical devices. Do not place lane tie bars in the concrete by hand methods.

The installation of lane tie bars and the sawing of joints will not be required for temporary concrete pavement unless specified in the contract documents.

2. **Longitudinal Bulkhead Joints (Symbol B).** Install epoxy coated bent bars parallel to the surface of the pavement and approximately at right angles to the edge of the pavement. Install the bent bars to allow consolidation around the bar without causing an edge slump. Straighten bent tie bars after the concrete has gained sufficient strength. Straighten tie bars to be approximately parallel to the surface of the pavement and approximately perpendicular to the edge of the pavement. Install and straighten bent tie bars so that the epoxy coating is not torn or loosened within 6 inches of the joint face. Repair all tears or loosening of the epoxy within 6 inches of the joint face using the coating material recommended by the coating manufacturer.

Space and install lane ties so that the lane ties will meet the pull-out resistance shown in Table 602-1. If the test results on the ties from the first day of placement meet specifications, additional testing will be at the discretion of the Engineer.

If the average pull-out resistance is less than the minimum requirements, install additional epoxy-anchored lane ties according to Standard Plan R-41 Series to meet the specifications. No additional payment will be made for this work.

Do not place adjacent pavement until the Engineer has tested the lane ties. The Engineer may waive verification tests for projects having less than 1000 feet of longitudinal bulkhead joints.
Table 602-1 Lane Tie Pull-Out Resistance

<table>
<thead>
<tr>
<th>Distance From Joint Being Constructed to Nearest Free Edge of Completed Pavement (a)</th>
<th>Average Pull-out Resistance Per Foot of Joint, lbs, Minimum (b) (c)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 feet or less</td>
<td>2200</td>
</tr>
<tr>
<td>Over 12 feet to 16 feet</td>
<td>3200</td>
</tr>
<tr>
<td>Over 16 feet to 23 feet</td>
<td>4500</td>
</tr>
<tr>
<td>Over 23 feet to 27 feet</td>
<td>5200</td>
</tr>
<tr>
<td>Over 27 feet to 35 feet</td>
<td>6800</td>
</tr>
<tr>
<td>Over 35 feet</td>
<td>(d)</td>
</tr>
</tbody>
</table>

a. Includes combinations of tied lane widths, valley gutter, curb and gutter, or concrete shoulder.
b. Slippage must not exceed $\frac{1}{16}$ inch.
c. Refer to Section D7 of the Materials Quality Assurance Manual for inspection procedure
d. As directed by the Engineer

3. Transverse Joints. Saw all transverse contraction and expansion joints according to subsection 602.03.N. Construct transverse plane-of-weakness joints in pavements without load transfer bars according to the details shown on the plans.

When placing pavement in part-width slabs, place transverse joints in the adjacent slab in line with like joints in the first slab. When widening existing pavements, place transverse joints in line with like joints in the existing pavement and, when directed by the Engineer, in line with "working" cracks functioning as joints. Construct expansion joints as specified for pavement placed after September 15 if it is anticipated that adjacent slabs will be placed after September 15.

a. Set the transverse joint assemblies containing the load transfer bars before placing concrete to provide time for the Engineer to check them for condition, line, and grade. Stake the load transfer assemblies in place, then remove shipping wires before placing concrete. Cut both ends of the shipping tie wire next to the connection with longitudinal support wire.

For expansion joints, equip the free end of the bar with a close-fitting cap of approved design.
Where more than one section of premolded joint filler is used in a joint, tightly butt the sections together. Place the bottom edge of the premolded filler in contact with the base and the top edge at the required depth below the surface of the pavement. Place the expansion joint filler perpendicular to the surface of the pavement and at right angles to the centerline of the pavement.

b. Construct end-of-pour joints (Symbol H) when it is anticipated that 7 days or more will elapse between casting adjacent pours. When operations are to resume before 7 days, construct the joint at a contraction or expansion joint. Form the joint by placing a bulkhead in the center of the load transfer device.

c. When a dowel bar inserter (DBI) is used to install load transfer bars, space the bars according to Standard Plan R-40 Series for dowel bar inserters. Place and consolidate the pavement full-depth before insertion of the dowel bars.

Insert dowel bars into the full-depth plastic concrete, and consolidate the concrete around the dowel bars leaving no voids. Do not use hand-held vibrators. Align dowel bars in both the vertical and horizontal planes to within $\frac{1}{4}$ inch over the length of the bar. Center dowels across the transverse joint within 2 inches.

Verify that the inserted dowels meet the specification tolerances. The Engineer will witness these measurements. Provide documentation to the Engineer when requested. Daily wet checks of the dowel bars are required as part of the concrete quality control plan. Mark and replace all joints that are out of tolerance. All costs associated with this replacement will be borne by the Contractor.

Locate the night header at a planned or relocated (as approved by the Engineer) transverse joint. Place a test joint beyond the night header. Saw this joint full-depth and remove for inspection of the dowel bar placement before startup the following day. Install dowels in the night header by excavating into the plastic concrete or place them in drilled or preformed holes after removal of the test joint. If the Contractor’s paving operation does not stop at night, the Engineer will determine the test joint location. The Engineer may waive the test joint requirements if three successive days of satisfactory performance are documented.
G. **Screeding.** Screed and consolidate concrete pavement to the final cross section. Use machine methods that avoid material segregation.

Manual methods may be used for concrete pavement gaps less than 160 feet in length and a maximum of one lane width, or when the pavement is entirely concrete base course.

Do not use water to enhance finishing operations, unless directed by the Engineer. When permitted, apply the water as a fog spray or fine mist.

H. **Finishing Surface.** Screed or extrude the finished surface to a smooth, sealed, uniform appearance conforming to the final cross section.

I. **Straightedge Testing, Surface Correction, and Edging.** While the concrete is still plastic, test the slab surface for trueness to the required grade and cross section using a 10-foot straightedge or other method approved by the Engineer.

If high or low spots exceeding \( \frac{1}{8} \) inch in 10 feet (\( \frac{1}{4} \) inch for concrete shoulders and inch for concrete base course and temporary concrete pavement) are found, suspend paving operations and correct the finishing procedures. Correct high spots in pavements that exceed these tolerances. Obtain the Engineer’s approval before resuming paving.

The Engineer will evaluate high or low spots more than \( \frac{1}{2} \) inch in 10 feet or more than \( \frac{3}{4} \) inch in 50 feet according to subsection 104.04.

Correct edge settlement that exceeds \( \frac{3}{4} \) inch before the concrete has hardened. Suspend paving when edge settlements more than \( \frac{1}{4} \) inch persist and make corrections before resuming paving.

Leave pavement edges, other than on temporary concrete pavement, with no overhanging projections.

The final elevation of drainage structure castings must comply with this section. The Engineer will evaluate all drainage structures not meeting the requirements of this section according to subsection 104.04.

J. **Ride Quality.** Provide ride quality according to the contract documents.
K. **Texturing.** When the pavement has set sufficiently to maintain a texture, drag the surface longitudinally using one or two layers of an approved damp fabric material. Maintain fabric contact with the surface across the entire width of concrete being placed.

Immediately after dragging, groove all surfaces other than concrete base courses and shoulders. Orient the grooves generally perpendicular to the centerline and form the grooves in the plastic concrete cleanly without slumping of the edges or severe tearing of the surface. Provide a surface texture consisting of $\frac{1}{8}$ inch wide grooves spaced $\frac{1}{2}$ inch on center and $\frac{1}{8}$ to $\frac{1}{4}$ inch deep. Some randomness in spacing is desirable.

Correct pavement surfaces not grooved as specified. Submit a corrective action plan for the Engineer’s approval. Retexturing or removal and replacement are allowable options. Include collection and disposal of the residue from retexturing, if applicable. All costs associated with this corrective work will be borne by the Contractor.

Texture the plastic concrete before applying curing compound. However, if the Engineer determines that texturing is delaying curing, curing will take precedence over texturing. If texturing has not been completed before placing curing compound, complete the surface texturing after the pavement has achieved the minimum specified open to traffic strength. Submit a plan for the Engineer’s approval for texturing the pavement. All costs associated with texturing after curing will be borne by the Contractor.

L. **Stenciling Pavement.** After texturing, stencil survey station numbers into the surface. Stencil stationing about 12 inches from the edge of the pavement to be read in the direction of traffic by a person driving on the outside shoulder. On two-way roadways, place station numbers to read in the direction of stationing.

Stencil the month, day, and year at the beginning and end of each day’s pour near the edge of the slab opposite that used for stationing. Place this date so that it can be read in the direction of the pour.

Do not stencil concrete base courses and temporary pavements.

Mark underdrain outlets in concrete shoulders, according to section 404. Stencil the marker into the concrete surface, after texturing.
M. Curing. Curing operation will take precedence over texturing. Do not delay curing to accomplish texturing. Refer to subsection 602.03.L. After texturing operations have been completed and after the free water has left the surface, coat and seal the pavement surface and sides of slip-formed pavement with a uniform layer of membrane curing compound.

Apply one coat of curing compound on non-grooved surfaces and two coats on grooved surfaces. Apply not less than one gallon per 25 square yards of surface for each application. Apply the second coat after the first coat has dried sufficiently but do not exceed two hours between coats.

Keep the compound thoroughly mixed according to the manufacture’s recommendation. Do not thin curing compound.

For miscellaneous concrete pavement more than one lane in width, where a manually operated pressure-type sprayer is used, apply the compound from a foot bridge.

Reapply curing compound immediately to all surfaces damaged by rain, joint sawing, Contractor’s foot traffic or other activities.

If fixed-forms are removed during the curing period, coat the entire area of the sides of the pavement with curing compound immediately after removal of the forms.

When the Engineer approves, curing compound may be omitted if cold-weather protection is used during the curing period.

These requirements for curing are minimum requirements only. Repair or replacement of any concrete showing injury or damage due to inadequate curing is required. All costs associated with this corrective work will be borne by the Contractor.

N. Sawing Joints. Saw joints according to the standard plans. The concrete saw is permitted on the pavement to saw the joints. The water supply truck is not permitted on the pavement until the pavement has attained the strength specified in subsection 104.11.

1. Longitudinal Joints. Saw symbol (D) longitudinal joints after the concrete has hardened enough that no excess raveling or spalling occurs but before random cracks develop.
2. **Transverse Contraction and Expansion Joints.** Construct the joint groove in expansion joints as shown in the standard plan. Flush loose concrete and slurry from the groove and the immediate area.

If the specified seal is not installed within 7 days of final sawing, temporarily seal the joint groove with a suitable material or device to prevent the infiltration of foreign material.

Install either the permanent seal or a temporary seal before allowing vehicles over the full width joint grooves. Saw joints in two stages.

For joints constructed in one operation, saw the joint groove before transverse cracks develop. Repair raveling or spalling along the joint by either sawing a wider groove and installing a neoprene joint seal of proportionate size or repairing the raveled and spalled areas according to subsection 602.03.P.

Saw joints in two stages as follows.

**First Stage.** Place a relief cut directly over the center of the load transfer assembly or over the preformed joint filler. Make the relief cut when the concrete has hardened enough that no excess raveling or spalling occurs but before random cracks develop. For closely spaced joints in non-reinforced pavements, relief cut alternately spaced joints provided all sawing is completed before random cracking develops. Do not permit traffic over the expansion joint relief cuts.

**Second Stage.** Begin second stage sawing after the concrete has attained at least 1000 psi compressive strength. Center the joint groove over the relief cut. Adjust the groove width to compensate for change in the relief cut due to pavement contraction. If necessary, maintain the curing of the concrete near the joint by installing the permanent joint sealant or by placing temporary cover material. Give second stage sawing of expansion joints priority over contraction joints when higher pavement temperatures are pending.

O. **Coring Pavement.** Coring the pavement for information is permitted the day following casting. These cores are for the Contractor’s information only. The Department will not test them. The Department will core for thickness and steel location according to section 602.04.

Use portable lightweight equipment that will not damage the pavement. Extract a maximum 4-inch diameter core. A maximum of six cores per mile (maximum of one per slab) is permitted, to monitor pavement...
thickness and steel location. Fill core holes with fresh concrete, consolidate and finish the same day cores are taken. Reapply the curing compound on the pavement in all areas disturbed during the coring.

P. Patching Transverse Joints. After sawing and cleaning the joints, inspect for spalls and voids. Remove loose, unsound, or damaged concrete to the satisfaction of the Engineer. Repair joints in concrete base course and temporary concrete pavement when the spalls are intermediate or major in size.

1. Minor Spalls. Repair minor spalls by patching with an approved epoxy mortar before installing the seal. Minor spalls or voids are less than 36 square inches (length times width beyond joint face) but exceed the following limits.

   a. Spalls that extend more than $\frac{1}{4}$ inch from the joint face and over $\frac{1}{2}$ inch below the surface of the pavement.

   b. Spalls that extend more than $\frac{1}{4}$ inch from the joint face and 2 inches or more in length, regardless of the depth of spall below the surface of the pavement.

   c. Void areas larger than $\frac{1}{2}$ inch in diameter in the upper 1 inch of the joint face or larger than 1 inch diameter in any location.

Sandblast or power wire brush the spalled concrete surface. The Engineer may permit hand wire brushing for limited patching. Blow the patch clean with a jet of oil-free compressed air. Insert a rigid polyethylene sheet, or other rigid material covered with polyethylene film, into the joint groove and hold tightly against the joint face being patched.

The concrete must be clean and dry at the time the epoxy mortar is placed. When the surface of the concrete is 32 °F or lower, heat the surface to remove frost. Use a clean source of heat that will not leave a deposit of carbon on the concrete. Heat gradually and evenly.

Use Type I epoxy binder for temperatures from 60 to 104 °F and Type II for temperatures from 36 to °60 F according to subsection 914.05.

Mix two parts epoxy resin to one part curing agent, by volume, or according to the epoxy manufacturer. Unless the entire contents of the original containers are used in one batch, use a mechanical
volumetric dispensing device that dispenses each component within an accuracy of ±2 percent by volume. The Engineer must approve the dispenser.

Mix in a clean metal or polyethylene vessel. Gradually add the curing agent to the epoxy resin, constantly stirring. Use a low speed air or electrically driven mixer. Continue stirring for 2 to 3 minutes to obtain a uniform mixture.

Thoroughly mix the epoxy binder and set aside a small portion for priming. Blend the dry masonry sand uniformly into the balance of the mixture to produce an epoxy mortar of stiff but workable consistency (approximately 3.5 parts of dry sand, by volume, to 1 part of mixed binder).

Prime the spalled surface with the freshly mixed epoxy binder. Scrub the prime coat into the surface with a suitable brush to ensure complete wetting and coverage of all areas to which the epoxy mortar must bond. Immediately after priming, place the epoxy mortar in the spalled area and finish to the shape of the original pavement surface. If the bond coat is not tacky when the mortar is placed, due to hot weather or delays, apply a second time. Form the edge of the patch to the adjacent joint groove. Sprinkle dry masonry sand onto the fresh epoxy mortar surface to eliminate gloss. Cure the epoxy mortar so that it will not be damaged during sealing and carefully remove the polyethylene insert.

2. Intermediate Spalls. Intermediate spalls are those larger than 36 square inches which do not exceed either of the following limits.

   a. Extend below the reinforcement in reinforced pavement.

   b. Greater than 4 inches in depth in non-reinforced pavement.

Saw cut parallel to the joint groove at the outer extremity of the spalled area. Cut at least 1 inch deep. Chip the concrete out to the saw cut so that a vertical face is formed at the back of the repair area. Cut the two ends of the repair area to approximately vertical faces. Sandblast the entire area to remove all loose particles. Blow clean with a jet of oil-free compressed air to remove the sand and all other foreign materials. Flush the entire area with clean water. Blow out the excess water with oil-free compressed air. Insert a rigid polyethylene sheet, or other rigid materials covered with poly-
ethylene film, into the joint groove and hold tightly against the joint face being patched.

Prime the bottom and vertical faces of the repair area with Type R-1 grout of creamy consistency. Scrub this prime coat into the surface with a suitable brush to ensure complete wetting and coverage of all areas to which the Portland cement mortar must bond. Apply this cement grout carefully to eliminate pooling in the rough surfaces of the spall area. Apply it immediately before placing the fresh mortar so that the prime coat is still wet when covered by mortar.

Tamp the Portland cement patching material into the primed repair area and finish flush to the pavement surface. Use a Type R-2 mortar of stiff consistency. Add a liquid air-entraining admixture to maintain an air content of 8 to 11 percent. The Engineer may require or permit calcium chloride, not to exceed 2 percent of the cement content, to be added as an accelerator. Make the edge of the patch at the joint face conform with the rest of the joint groove. Spray white membrane curing compound on the patch surface immediately after the mortar is placed and finished. Remove the polyethylene form after 72 hours.

If there are only a few intermediate spalls to be patched, the Engineer may approve the epoxy primer and mortar system specified for minor spalls, provided the area is saw cut and chipped as described for intermediate spalls.

3. Major Spalls. Patch major spalls as directed by the Engineer. Major spalls are those which
   a. Extend below the reinforcement in reinforced pavement, or
   b. Are greater than 4 inches in depth in non-reinforced pavement.

Q. Repair of Longitudinal Joints and Edges. Patch spalls that occur between adjacent lanes of concrete according to subsections 602.03.P.1.a and b.

Where a concrete pavement will abut HMA surface, patch all spalls that extend more than ⅜ inch from the joint face and more than ⅜ inch below the surface of the pavement. In addition, patch spalls less than ⅜ inch from the joint face and more than ⅛ inch below the surface of the pavement when the cumulative total of spall lengths exceeds 20 feet per mile of pavement joint.
Patch these spalls according to Subsection 602.03.P.1.

The Engineer will direct the repair of all spalls greater than 36 square inches in 10 feet. The required repair can include up to removal and replacement of pavement. All costs associated with required removal and replacement will be borne by the Contractor.

R. Cleaning Joints. Clean all joints, including the surface of the pavement next to the joint groove, with appropriate tools and equipment to remove slurry, stones, or other foreign materials.

The faces of joints to be sealed with preformed neoprene do not need to be blast cleaned. Blast clean the faces of all other joints (longitudinal and transverse) with an oil-free dry abrasive just before sealing.

Give all joints a final cleaning with a jet of compressed air, free of oil and water, having a minimum pressure of 90 psi.

S. Sealing Joints.

1. General. Seal longitudinal joints before sealing the transverse contraction joints. Seal longitudinal joints and end-of-pour joints with one application of a hot-poured sealant. Seal transverse contraction joints according to the plans. Seal transverse expansion joints with a hot-poured sealant.

2. Sealing Joints with Preformed Neoprene Joint Seal. Apply the high-solids lubricant-adhesive to the joint groove faces immediately before the installation of the preformed seal. If the method of installation requires, apply the lubricant-adhesive to the sides of the preformed seal. Install the preformed seal with a suitable hand roller or machine. Ensure that the lubricant-adhesive covers both sides of the seal over the full area of contact with the joint groove faces. Use of a low-solids lubricant in quantities only as necessary to permit placement of the seal into the joint is permitted if lubricant pumps are unable to pump the high-solids lubricant-adhesive. The high-solids lubricant-adhesive must still be applied to the joint faces.

Install the seal in a compressed condition and below the surface of the pavement. Remove excess lubricant-adhesive from the top of the seal after installation.

When placing the preformed seal in the joint groove, do not exceed a maximum longitudinal stretch of 5 percent and a maximum longitudinal compression of 2 percent.
At the intersection of the longitudinal joint and the transverse contraction joint, leave a small gap in the longitudinal seal so that the transverse seal may be continuous across the longitudinal joint. Install transverse joint seals in one continuous piece.

3. **Splicing Preformed Neoprene Joint Seal.** Splicing is permitted only when required by project staging or as approved by the Engineer. Submit a written request with justification, proposed splicing details, and the actual locations where splicing is proposed. Demonstrate the splicing technique to the Engineer before field splicing. Limit the maximum number of splices to one per transverse joint. Place splices 12 to 24 inches from a longitudinal joint, and only between lanes constructed at different times. Align all edges at the splice to within $\frac{1}{16}$ inch. Completed splices must have full adhesion along all contact surfaces, and be free from protrusion of excess adhesive on the exterior walls of the seal.

4. **Sealing Joints with Hot-Poured Sealants.** Seal the joints immediately after the joints are cleaned. Joint surfaces must be dry when sealed. Do not place sealant when temperature is less than 50 °F.

Melt sealant in the heating kettle. Do not heat directly. Do not use sealants heated to more than the safe heating temperature recommended by the manufacturer.

Apply hot-poured joint sealant using a pressure applicator with a nozzle that extends into the groove. Remove all sealant from the surface of the pavement. Cure the sealant sufficiently to resist pickup before allowing traffic over the sealed joint.

**T. Weather and Temperature Limitations.**

1. **Protection Against Rain.** Protect the concrete from being damaged by rain.

2. **Protection from Cold Weather.** Protect the concrete from freezing until the concrete has attained a compressive strength of at least 1000 psi. Remove and replace concrete damaged by frost action. All costs associated with this removal and replacement will be borne by the Contractor.
3. **Cold Weather Limitations.** Do not place concrete unless the temperature of the air away from artificial heat is at least 25 °F and rising, unless specifically approved by the Engineer. Do not place concrete if portions of the base, subbase, or subgrade layer are frozen, or if the grade exhibits poor stability from excessive moisture levels.

4. **Hot Weather Limitations.** Include specific provisions for protecting pavement during hot weather conditions in the concrete quality control plan. Refer to Figure 706-1 for determination of hot weather conditions.

5. **Concrete Temperature Limitations.** Do not place concrete when the temperature of the plastic concrete at the point of placement is above 90 °F.

U. **Freeway Shoulders.** Construct either a hot mix asphalt shoulder or a concrete shoulder when freeway shoulders are specified and described on the plans.

### 602.04 Measurement and Payment

<table>
<thead>
<tr>
<th>Contract Item (Pay Item)</th>
<th>Pay Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conc Pavt, Reinf, __ inch</td>
<td>Square Yard</td>
</tr>
<tr>
<td>Conc Pavt, Nonreinf, __ inch</td>
<td>Square Yard</td>
</tr>
<tr>
<td>Conc Pavt, Ovly, Furnishing and Placing</td>
<td>Cubic Yard</td>
</tr>
<tr>
<td>Conc Pavt, Ovly, Finishing and Curing</td>
<td>Square Yard</td>
</tr>
<tr>
<td>Conc Pavt with Integral Curb, Reinf, __ inch</td>
<td>Square Yard</td>
</tr>
<tr>
<td>Conc Pavt with Integral Curb, Nonreinf, __ inch</td>
<td>Square Yard</td>
</tr>
<tr>
<td>Conc Pavt, Misc, Reinf, __ inch</td>
<td>Square Yard</td>
</tr>
<tr>
<td>Conc Pavt, Misc, Nonreinf, __ inch</td>
<td>Square Yard</td>
</tr>
<tr>
<td>Conc Pavt, Ovly, Misc, Furnishing and Placing</td>
<td>Cubic Yard</td>
</tr>
<tr>
<td>Conc Pavt, Ovly, Misc, Finishing and Curing</td>
<td>Square Yard</td>
</tr>
<tr>
<td>Conc Pavt, Reinf, __ inch, Temp</td>
<td>Square Yard</td>
</tr>
<tr>
<td>Conc Pavt, Nonreinf, __ inch, Temp</td>
<td>Square Yard</td>
</tr>
<tr>
<td>Conc Base Cse, Reinf, __ inch</td>
<td>Square Yard</td>
</tr>
<tr>
<td>Conc Base Cse, Nonreinf, __ inch</td>
<td>Square Yard</td>
</tr>
<tr>
<td>Shoulder, Reinf Conc</td>
<td>Square Yard</td>
</tr>
<tr>
<td>Shoulder, Nonreinf Conc</td>
<td>Square Yard</td>
</tr>
<tr>
<td>Shoulder, Freeway</td>
<td>Square Yard</td>
</tr>
<tr>
<td>Cement</td>
<td>Ton</td>
</tr>
<tr>
<td>Joint, Contraction, (type)</td>
<td>Foot</td>
</tr>
<tr>
<td>Joint, Expansion, (type)</td>
<td>Foot</td>
</tr>
<tr>
<td>Joint, Plane-of-Weakness, (type)</td>
<td>Foot</td>
</tr>
<tr>
<td>Conc, Grade __</td>
<td>Cubic Yard</td>
</tr>
<tr>
<td>Pavt Gapping</td>
<td>Foot</td>
</tr>
</tbody>
</table>
A. Concrete Pavement and Base Course. All concrete pavement and base course will be measured and paid for by area in square yards based on plan quantities. The pay items used will be based on whether or not reinforcement is required, the thickness specified, and the type of pavement specified (Conc Pavt; Conc Pavt with Integral Curb; Conc Pavt, Misc; Conc Pavt, Temp or Conc Base Cse).

When Conc Pavt with Integral Curb is specified, it will be measured by area in square yards, including the area occupied by the curbs.

Transition areas between concrete valley gutter and concrete curb and gutter and also the concrete pavement cast integrally with concrete valley gutter at the apex of gore areas will be divided in half and each half measured in the units of the adjacent item.

Concrete headers abutting bridges and track crossings that are constructed by thickening the pavement, will not be measured separately but will be included in the contract unit price bid for the pavement or base course.

B. Concrete Shoulder.

1. Shoulder, Reinf Conc and Shoulder, Nonreinf Conc will be measured and paid for by area in square yards based on plan quantities.

2. Shoulder, Freeway will be measured and paid for by area in square yards based on plan quantities. When the Contractor chooses to use concrete for the shoulder, all the transverse joints in the shoulder and the external longitudinal pavement joint will be considered a part of the work of Shoulder, Freeway and will not be paid for separately.

C. Concrete Overlay.

1. Conc Pavt, Ovly, Furnishing and Placing used for concrete pavements and shoulders will be measured and paid for by volume in cubic yards. The Engineer will determine the volume of concrete used each day, or faction thereof, based on the number of batches used for pavement and shoulders, and the nominal volume of concrete per batch. This amount will be documented by the batch ticket printouts. Payment for this item includes all work necessary to furnish and place the concrete mixture.
2. **Conc Pavt, Ovly, Finishing and Curing** used for concrete pavements and shoulders will be measured in place and paid for by area in square yards. Payment for this item includes all work necessary to finish and cure the concrete overlay and construct the longitudinal joints. Construction of transverse joints and removal of the existing pavement will be paid for separately.

3. **Conc Pavt, Ovly, Misc, Furnishing and Placing** and **Conc Pavt, Misc, Nonreinf, Finishing and Curing**, will be used for ramp reconstruction, ramp overlay, gore areas and approach areas. These items will be measured and paid for as described above.

D. The additional cement required for Grade HE concrete over the amount required for the standard strength concrete normally used, up to an additional 5.5 pounds per cubic foot for Grade P2 concrete and 3.5 pounds per cubic foot for Grade P1 concrete, will be measured in tons of cement required for the number of square yards indicated on the plans, or directed by the Engineer, to be constructed with Grade HE concrete.

When the Contractor is approved to substitute a higher grade of concrete for a lesser grade (i.e., P1 for P2), the higher grade of concrete will be paid using the original bid item with no increase in contract unit price.

E. **Pavement Gapping or Bridging**. Payment for **Pavt Gapping** includes all costs associated with the interruption of paving operations, moving back to pave the gap, and maintaining cross traffic. Gapping of curbs, curb and gutter, gutters, driveways, and sidewalks is included in the unit price bid for the contract item being constructed and will not be paid for separately.

The concrete furnished and placed in the pavement gap, including all additional cement required by the plans, or as directed by the Engineer, to provide high-early-strength concrete will be measured and paid for at contract unit prices. **Pavt Gapping** will be measured by length parallel to the centerline of the project from end of concrete to end of concrete. Each individual lane of concrete pavement that is gapped will be measured separately.

F. **Joints**. The transverse end-of-pour joint Symbol (H) and the transverse plane-of-weakness joint Symbol (U) will not be paid for separately. All other transverse joints will be paid for by length in feet, based on plan dimensions, for the type of joint required.
The payment for the transverse contraction, expansion, and plane-of-
weakness joints includes furnishing all joint materials required, such
as load transfer assemblies, expansion joint fillers, and joint seals or
sealants; sawing, forming, and cleaning the joints; furnishing and
applying bond breaker where required; and furnishing and placing pre-
formed neoprene seals or poured joint sealant as applicable.

Where preformed neoprene seal is called for on the plans for Detail D
curb and gutter or valley gutter sections, the estimated length of con-
traction joint will be included in the contract quantities and the length
of the joint will be based on the nominal width of the applicable curb
and gutter or valley gutter section. Where expansion or contraction
joints are called for on the plans for concrete shoulders, the estimated
length of expansion and contraction joints required will be included in
the contract quantities.

The standard plan indicates whether the transverse joint is located in
the pavement, shoulder, curb and gutter, valley gutter, or base course;
whether or not the joint requires a load transfer assembly and/or expan-
sion joint filler; and the type of sealant or seal required.

Internal and external longitudinal joints will not be paid for separately
but are included in the cost of other contract items.

G. Concrete accelerators are only to be used when called for on the
plans or as approved by the Engineer. Concrete accelerator usage, ap-
proved for payment as extra work, will be paid for at the invoice cost
plus 15 percent.

H. Price Adjustment for Pavement, Shoulder, and Base Course Based
on Thickness and Depth of Reinforcement. Cores will be taken from
the pavement before final acceptance to determine the thickness of
the pavement and, if required, the depth of reinforcement below the
pavement surface. When a pavement is specified to be reinforced with
two layers of reinforcement, only the top layer of steel will be measured
for proper depth. Temporary concrete pavement, pavement within 4
feet of an obstruction, pavement areas less than 300 square yards, or
pavement less than 3 feet wide will not be cored. Determination of
pavement units and core location and evaluation of cores will be ac-
cording to MTM 201.

The contract unit price for areas of concrete pavement where thickness
or location of reinforcement (steel) exceed acceptable tolerances will
be adjusted.
Tables 602-2 will be used to classify cores and determine price adjustment according to thickness. Either Table 602-3A or Table 602-3B will be used to classify cores and determine price adjustment according to depth of steel. These adjustments will be applied cumulatively to the pavement unit being evaluated.

1. **Initial Core.** Each initial core will be classified with a one-or two-letter core type code. The first letter (A, B or C) represents the thickness classification according to Table 602-2 and the second letter (X, Y or Z), if applicable, represents the depth of steel classification according to Table 602-3A.

   When an initial core from a pavement unit is classified Type AX, indicating both thickness and depth of steel are within acceptable tolerances, no pay adjustment is applied and no additional cores are taken.

2. **Additional Cores.** When an initial core from a pavement unit is classified as other than Type AX, additional cores will be taken. Only the dimension(s) not within the A (thickness) or X (depth of steel) range for the initial core will be considered for adjustment based on subsequent cores. The Engineer will base acceptance and payment decisions, up to and including 100 percent price adjustment or remove and replace, on the initial and additional cores.

3. **Price adjustment for thickness.**

   a. Initial Core A-Thickness is within allowable tolerance. No additional cores are taken to measure thickness. No price adjustment for thickness is applied to the pavement unit.

   b. Initial Core B-Thickness deviates from design thickness as shown in Table 602-2

      • Take two additional cores and measure thickness.

      • Calculate the average thickness for the pavement unit. In determining the average thickness, measurements of individual cores which exceed the specified pavement thickness by more than 0.25 inch will be recorded as the specified thickness plus 0.25 inch.

      • Use the average thickness, rounded to the nearest 0.1 inch, and Table 602-2 to determine the price adjustment.
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c. Initial Core C-Thickness deviates from design thickness by more than 1.1 inches.
   • Take straddler cores to determine the area of deficiency.
   • Establish a new initial core for the pavement unit excluding the deficient area and repeat the evaluation of pavement thickness.
   • Refer to subsection 602.04.H.5 for removal and replacement of the deficient area.

4. Price adjustments for location of steel within the pavement structure. Price adjustments for depth of steel considers two aspects of the specification—location of steel from the pavement surface and the deviation of the steel location from the allowable depth range. Calculate both and apply only the larger of the two.

   a. Initial Core X-Placement of reinforcement is within allowable tolerance for depth from surface of pavement. No additional cores are taken. No price adjustment for placement of reinforcement is applied to the pavement unit.

   b. Initial core Y
      • Take two additional cores and measure the depth of steel from pavement surface for each core.
      • Calculate the average reinforcement depth.
      • Use the average reinforcement depth and Table 602-3A to determine the price adjustment based on location of steel from the pavement surface.
      • Calculate the absolute deviation from the limits of the design depth range for each core.
      • Calculate the average absolute deviation from the allowable depth range.
      • Use the average absolute deviation and Table 602-3B to determine the contract price decrease based on deviation from allowable depth of steel range.
c. Initial Core Z-Location of reinforcement deviates from design depth by more than allowable tolerance.

- Take straddler cores to determine the area of deficiency.
- Establish a new initial core for the pavement unit excluding the deficient area and repeat the evaluation of placement of reinforcement.
- Refer to subsection 602.04.H.5 for removal and replacement of the deficient area.

5. **Remove and Replace.** If an initial core falls into either the C (thickness) or Z (location of steel within pavement structure) category, the deficient area will be delineated by taking straddler cores at 5-foot intervals, longitudinally, in both directions from the initial C or Z core. Defective areas will be considered separately from the remainder of the pavement unit. The Contractor will remove and replace C and Z range areas as directed by the Engineer. Any area of pavement removed will be at least 10 feet in length. If the area to be removed is within 15 feet of a transverse joint, removal will extend to the joint. The areas replaced will be cored and evaluated according to subsection 602.04.H and provided the concrete pavement meets specifications this work will be paid for at the contract unit price.

<table>
<thead>
<tr>
<th>Table 602-2 Price Adjustment for Concrete Thickness Deficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Initial Core Type</strong></td>
</tr>
<tr>
<td>A</td>
</tr>
<tr>
<td>B</td>
</tr>
<tr>
<td>B</td>
</tr>
<tr>
<td>B</td>
</tr>
<tr>
<td>B</td>
</tr>
<tr>
<td>C</td>
</tr>
</tbody>
</table>

a. Corrective action up to and including remove and replace pavement.
Table 602-3A Price Adjustment for Depth of Steel
From Pavement Surface

<table>
<thead>
<tr>
<th>Initial Core Type</th>
<th>Tolerance on Depth of Reinforcement, in (a) (e)</th>
<th>Price Adjustment, %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>For Uniform Plan Thickness, in (c)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>7.75 to 8.50</td>
<td>8.75 to 9.50</td>
</tr>
<tr>
<td>Z</td>
<td>0.0-0.9</td>
<td>0.0-0.9</td>
</tr>
<tr>
<td>Y</td>
<td>1.0-1.9</td>
<td>1.0-1.9</td>
</tr>
<tr>
<td>X (b)</td>
<td>2.0-4.0</td>
<td>2.0-4.5</td>
</tr>
<tr>
<td>Y (b)</td>
<td>4.1-4.8</td>
<td>4.6-5.4</td>
</tr>
<tr>
<td>Z (b)</td>
<td>6.5 and over 7.3 and over 8.1 and over 8.9 and over</td>
<td>-100 (d)</td>
</tr>
</tbody>
</table>

a. When a pavement is specified to be reinforced with two layers of reinforcement, only the top layer of steel will be measured for proper depth.
b. When a core length measures 0.2 inches or more over the plan thickness, the maximum depth range will be increased by one-half of the excess core length over the plan thickness. For each core, the increase will be rounded off to the nearest tenth of an inch according to AASHTO R 11 and then added to the range shown.
c. Pavement or base course.
d. Corrective action up to and including remove and replace pavement.
e. Use same depth range used for pavement thickness that the shoulder is tied to. Use average shoulder thickness, if tapered.

Table 602-3B Price Adjustment for Deviation of Depth of Steel from Design Range

<table>
<thead>
<tr>
<th>Initial Core Type</th>
<th>Allowable Average Absolute Deviation from Design Depth of Reinforcement (a) (b)</th>
<th>Price Adjustment, %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>For Uniform Plan Thickness, in (c)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6.5 to 7.5</td>
<td>7.75 to 8.5</td>
</tr>
<tr>
<td>X(d)</td>
<td>0.0-0.5</td>
<td>0.0-0.5</td>
</tr>
<tr>
<td>Y(d)</td>
<td>0.5-1.0</td>
<td>0.5-1.0</td>
</tr>
<tr>
<td>Y(d)</td>
<td>1.0 and over 1.0 and over 1.0 and over 1.0 and over 1.0 and over 1.0 and over</td>
<td>-25</td>
</tr>
<tr>
<td>Design Range</td>
<td>2.0-4.0</td>
<td>2.0-4.0</td>
</tr>
</tbody>
</table>

a. When a pavement is specified to be reinforced with two layers of reinforcement, only the top layer of steel will be measured for proper depth.
b. Use same depth range used for pavement thickness that the shoulder is tied to. Use average shoulder thickness, if tapered.
c. Pavement or base course.
d. When a core length measures 0.2 inches or more over the plan thickness, the maximum depth range will be increased by one-half of the excess core length over the plan thickness. For each core, the increase will be rounded off to the nearest tenth of an inch according to AASHTO R 11 and then added to the range shown.