

**2531 CONCRETE CURBING****2531.1 DESCRIPTION**

This Work consists of constructing cast-in-place concrete curbs, curb and gutter, solid medians, driveway pavement, and other similar traffic delineation or service items.

**2531.2 MATERIALS**

<b>A</b>	<b>Concrete .....</b>	<b>2461</b>
For each method of placement, use the following mix designations:		
<b>A.1</b>	<b>Manual Placement .....</b>	<b>Mix No. 3F32 or 3F52</b>
<b>A.2</b>	<b>Slip-form Placement .....</b>	<b>Mix No. 3F32</b>
<b>B</b>	<b>Reinforcement Bars .....</b>	<b>3301</b>
<b>C</b>	<b>Welded Wire Reinforcing .....</b>	<b>3303</b>
<b>D</b>	<b>Preformed Joint Filler .....</b>	<b>3702</b>
<b>E</b>	<b>Curing Materials</b>	
<b>E.1</b>	<b>Burlap Curing Blankets .....</b>	<b>3751</b>
<b>E.2</b>	<b>Poly-Alpha Methyl Styrene (AMS) Membrane Curing Compound .....</b>	<b>3754</b>
<b>E.3</b>	<b>Linseed Oil Membrane Curing Compound .....</b>	<b>3755</b>
<b>E.4</b>	<b>Plastic Curing Blankets .....</b>	<b>3756</b>
<b>F</b>	<b>Granular Materials .....</b>	<b>3149</b>

**2531.3 CONSTRUCTION REQUIREMENTS****A Foundation Preparations**

Excavate, shape, and compact the foundation to a firm, uniform bearing surface that conforms to the dimensions and grade shown on the Plans and in accordance with 2106, "Excavation and Embankment – Compacted Volume Method," 2112, "Subgrade Preparation," and 2211, "Aggregate Base."

**B Forms**

Provide forms, made of metal, wood, or other Materials in accordance with 1805, "Methods and Equipment," capable of maintaining the concrete until the concrete can retain its molded shape. Provide side forms with a depth at least equal to the edge thickness of the concrete being formed. Support the forms on the foundation and restrain at the line and grade as shown on the Plans. For radii less than 100 feet, use flexible or curved forms approved by the Engineer.

Before placing concrete, coat the contact surfaces of forms with an approved form treating Material in accordance with 3902, "Form Coating Material." Keep side forms in place for at least 12 hours after casting the concrete.

**C Placing and Finishing Concrete**

The concrete Contractor, or Subcontractor, shall have at least two people with a current ACI concrete flatwork associate, concrete flatwork finisher, or advanced concrete flatwork finisher certification, and at least one of them must be onsite for every concrete pour.

Immediately before placing the concrete wet the foundation and the forms.

Place the concrete in a manner that will prevent segregation. Consolidate the concrete to fill voids using internal vibration. The Engineer will allow hand tamping of stacked concrete during forming of the curb. Strike-off the concrete to the grade shown on the Plans, and float the surface smooth.

After the water sheen has disappeared, round joints and edges to the radii shown on the Plans. Lightly brush concrete surfaces exposed to view to a uniform texture.

**D Slipform Machine Placement**

Instead of using fixed forms, the Contractor may use a slipform machine capable of placing and forming concrete to the dimensions, quality, workmanship, and appearance as required by the Contract. Hand finish the surface to the finish and texture as required by the Contract.

**E Joint Construction**

Place transverse expansion joints, filled with 1/2 inch preformed joint filler Material, at the ends of curved sections and at the ends of the curved portions of entrance and Street returns. Place longitudinal expansion joints as shown on the Plans. Place expansion joints with preformed joint filler Material at locations where the concrete surrounds or adjoins an existing fixed object, such as a fire hydrant, building foundation, or other rigid Structure.

Provide contraction joints at the following intervals, except as otherwise shown on the Plans:

- (1) Adjacent to bituminous mainline, every 10 feet maximum
- (2) Adjacent to concrete mainline, match the adjacent concrete pavement joints
- (3) In solid median construction where the width is at least 10 feet wide, install joints not to exceed a maximum of 150 square feet

Form or saw the contraction joints to a depth to prevent random/uncontrolled cracking.

Construct joints perpendicular to the Subgrade. Align joints with joints in adjoining Work unless a 1/2 inch preformed joint filler isolates the Work. Place transverse joints at right angles to the longitudinal axis of the Work, unless otherwise required by the Contract.

Use an edging tool with a radius no greater than 1/2 inch to round edges of longitudinal construction joints between a concrete median or gutter section and a concrete pavement.

Do not saw or seal longitudinal construction joints between a concrete median and concrete pavement, or between a gutter section and concrete pavement, unless specified otherwise in the Plans.

**F Metal Reinforcement**

Provide and place metal reinforcement as shown on the Plans and in accordance with 2472, "Metal Reinforcement."

**G Concrete Curing and Protection**

After completing final finishing operations, cure exposed concrete surfaces. Use one of the following curing methods:

- (1) In accordance with 2531.3G.1.a, "Membrane Curing Method," place the membrane curing compound conforming to 3754, "Poly-Alpha Methyl Styrene (AMS) Membrane Curing Compound," or 3755, "Linseed Oil Membrane Curing Compound," within 30 minutes of concrete placement or once the bleed water has dissipated, unless the Engineer directs otherwise. Place the membrane curing compound on the edges within

30 minutes after permanent removal of the forms or curing blankets, unless the Contract requires otherwise.

- (2) Place plastic curing blankets or completely saturated burlap curing blankets as soon as practical without marring the surface in accordance with 2531.3G.1.b, "Curing Blanket Method."

Whenever weather conditions are such as to cause unusual or adverse placing and finishing conditions, expedite the application of a curing method or temporarily suspend the mixing and placing operations, as the conditions require.

If necessary to remove the coverings to saw joints or perform other required Work, and if the Engineer approves, remove the covering for the minimum time required to complete that Work.

## **G.1 Curing Methods**

### **G.1.a Membrane Curing Method**

Before application, agitate the curing compound as received in the shipping container to obtain a homogenous mixture. Protect membrane curing compounds from freezing before application. Handle and apply the membrane curing compound in accordance with the manufacturer's recommendations.

The Engineer will only approve airless spraying machines equipped with a recirculating bypass system that provides for continuous agitation of the reservoir Material, separate filters for the hose and nozzle, and multiple or adjustable nozzle system that provides for variable spray patterns.

Apply the curing compound with an Engineer approved airless spraying machine in accordance with the following:

- (1) At a minimum rate of 1 gallon per 150 square feet of surface curing area.
- (2) Apply homogeneously to provide a uniform, solid, white, opaque coverage on exposed concrete surfaces (equal to a white sheet of typing paper) at the time of application. Some Department approved curing compounds may have a base color (i.e. yellow) that cannot comply with the above requirement. In this case, provide a uniform, solid, opaque consistency meeting the intent of the above requirement.
- (3) If the curing compound is damaged during the curing period, immediately repair the damaged area by respraying. If the Engineer determines that the initial or corrective spraying result in unsatisfactory curing, the Engineer may require the Contractor to use the blanket curing method at no additional cost to the Department.

### **G.1.b Curing Blanket Method**

After completion of the finishing operations and without marring the concrete, cover the concrete with curing blankets. Install in a manner that envelops the exposed concrete and prevents loss of water vapor. After the concrete has cured, apply membrane curing compound to the concrete surfaces that will remain exposed in the completed Work.

**G.2 Protection Against Rain**

Protect the concrete from damage due to rain. Have available, near the site of the Work, Materials for protection of the edges and surface of concrete. Should any damage result, the Engineer will suspend operations until the Contractor takes corrective action, and may subject the rain-damaged concrete to 1503, "Conformity with Contract Documents," and 1512, "Unacceptable and Unauthorized Work."

**G.3 Protection Against Cold Weather**

If the National Weather Service forecast for the construction area predicts air temperatures of 36°F or less within the next 24 hours and the Contractor wishes to place concrete, submit a cold weather protection Plan.

Protect the concrete from damage including freezing due to cold weather. Should any damage result, the Engineer will suspend operations until the Contractor takes corrective action, and may subject the damaged concrete to 1503, "Conformity with Contract Documents," and 1512, "Unacceptable and Unauthorized Work."

**G.3.a Cold Weather Protection Plan**

Submit a proposed time schedule and Plans for cold weather protection of concrete in writing to the Engineer for acceptance that provides provisions for adequately protecting the concrete during placement and curing. Do not place concrete until the Engineer accepts the cold weather protection Plan.

**H Backfill Construction**

Protect newly placed concrete from damage by adjacent vibratory or backfilling operations for a minimum of 24 hours. Perform vibratory operations and backfilling at least 72 hours after placing the concrete or after the concrete reaches a compressive strength of at least 2,000 psi. The Engineer will cast, cure, and test the concrete field control specimens in accordance with 2461.3G.5.c, "Field Control Strength Cylinders." If damage results from any of these operations, the Engineer will suspend operations until the Contractor takes corrective action and obtains the Engineer's approval of a new method. The Engineer may require removal and replacement of the damaged concrete in accordance with 1503, "Conformity with Contract Documents," and 1512, "Unacceptable and Unauthorized Work."

The Contractor may use hand-operated concrete consolidation Equipment and walk behind vibratory plate compactors 24 hours after placing the concrete, and other Equipment as approved by the Engineer, in conjunction with the Concrete Engineer.

After the curing is complete and without subjecting the concrete Work to damaging stresses, perform the backfill or embankment construction to the elevations as shown on the Plans. Use suitable grading Materials from the excavations in accordance with 2106, "Excavation and Embankment – Compacted Volume Method," unless the Contract requires otherwise. Place and compact the backfill Material in accordance 2106, "Excavation and Embankment – Compacted Volume Method."

Dispose of surplus excavated Materials in accordance with 2106, "Excavation and Embankment – Compacted Volume Method."

**I Workmanship and Finish**

Ensure the surface contour and texture of the completed concrete Work is uniform and meets the lines and grades as shown on the Plans. Finish the flow line surface of gutters to eliminate low spots and avoid entrapment of water.

The Engineer will use a 10 foot straightedge to measure the surface.

#### **2531.4 METHOD OF MEASUREMENT**

The Engineer will not make measurement deductions for castings or minor fixtures in the Work.

##### **A Length**

For curbs and curb and gutter, including the curb cuts and curb returns, the Engineer will measure the linear length along the face of the curb at the gutter line. In the case of transitions from one size or design to another, the Engineer will measure the entire transition for payment under the item with the higher Contract Unit Price.

For solid medians and other construction with uniform widths and symmetrical cross sections, the Engineer will measure the length along the center of the longitudinal axis.

##### **B Area**

For solid medians and other construction with non-uniform widths and non-symmetrical cross-sections, the Engineer will measure by the square yard area. The area is based on the width at grade by the exposed length. The Engineer will disregard variations in concrete thickness caused by integral construction. The Engineer will separately measure driveway pavement of each specified thickness.

#### **2531.5 BASIS OF PAYMENT**

Payment for concrete curb and gutter, concrete curb, concrete medians, and concrete driveway pavement at the Contract price per unit of measure is full compensation for cost of providing concrete curb and gutter, concrete curb, concrete medians, and concrete driveway pavement to the specified lines, grade and minimum thickness specified in the Plans, including but not limited to: forming, joint filler Material, furnishing and placing concrete, concrete compaction by vibration, concrete curing, and protecting the completed Work from damage.

##### **A Monetary Adjustments**

The Department must apply Incentives and Disincentives and may apply monetary deductions for Concrete Curbing. The amounts of these adjustments are deemed reasonable.

###### **A.1 Concrete Curing and Protection**

Failure to properly cure and protect the concrete in accordance with 2531.3G, "Concrete Curing and Protection," will result in the Engineer applying a monetary deduction in accordance with 1503, "Conformity with Contract Documents," and 1512, "Unacceptable and Unauthorized Work." If the Contract does not contain a separate Contract Item for structural concrete, the Department will apply a monetary deduction of \$50.00 per cubic yard or 50 percent of the Contractor-provided invoice amount for the concrete in question, whichever is less.

###### **A.2 Workmanship and Finish**

The Engineer will consider concrete Work with deviations 3/8 inch or greater in any 10 feet length of finish curb and gutter, either horizontal or vertical, as unacceptable Work. Remove and replace unacceptable Work as directed by the Engineer.

If the Engineer does not direct the removal and replacement of unacceptable Work, the Engineer will reduce the Contract Unit Price for the unacceptable concrete Work in accordance with the following:

(1) For deviations from 3/8 inch to 9/16 inch, payment at 75 percent of the Contract Unit Price

(2) For deviations greater than 9/16 inch, payment at 50 percent of the Contract Unit Price

Repair or replace concrete with random or uncontrolled cracks as directed by the Engineer. Submit the intended repair technique to the Engineer for approval. Perform repairs at no additional cost to the Department. If the repair fails, replace the concrete at no additional cost to the Department. The Engineer will accept repairs in accordance with 1516.2, "Project Acceptance."

**B Schedule**

The Department will pay for concrete curbing, median, and driveway construction on the basis of the following schedule:

<b>Item No.</b>	<b>Item</b>	<b>Unit</b>
2531.503	Concrete Curb and Gutter Design ____	linear foot
2531.503	Concrete Curb Design ____	linear foot
2531.503	Concrete Median	linear foot
2531.504	Concrete Median	square yard
2531.504	____" Concrete Driveway Pavement	square yard