

501.04—Measurement and Payment.

Underdrains and combination underdrains will be measured in linear feet, complete-in-place, and will be paid for at the contract unit price per linear foot. The contract unit price for underdrains installed at depths greater than that shown in the standard drawings will be increased 20 percent for each 1-foot increment of increased depth. No adjustment in the contract unit price will be made for an increment of depth less than 6 inches. When drains are to be placed under pavement that was not constructed under the Contract, the contract unit price shall include removing and replacing pavement.

Geotextile drainage fabric, when a pay item, will be measured and paid for in accordance with the requirements of Section 504.

These prices shall include geotextile drainage fabric when not a pay item, excavating, backfilling, disposing of surplus and unsuitable material, and installing outlet markers.

Outlet pipe for underdrains will be measured in linear feet, complete-in-place, and will be paid for at the contract unit price per linear foot.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
Underdrain (Standard)	Linear foot
Combination underdrain (Standard)	Linear foot
Outlet pipe	Linear foot

SECTION 502—INCIDENTAL CONCRETE ITEMS**502.01—Description.**

This work shall consist of constructing curbs, gutters, combination curbs and gutters, paved ditches, paved flumes, bridge drainage aprons and chutes, concrete median barriers, median strips, sign islands, and directional island curbs in accordance with these specifications and in reasonably close conformity to the lines and grades shown on the plans or as established by the Engineer.

502.02—Materials.

- (a) **Hydraulic cement concrete** shall conform to the requirements of Section 217. With the approval of the Engineer, the design of the mixture may be modified to accommodate the placement equipment to be used.

- (b) **Asphalt concrete** shall conform to the requirements of Section 211.
- (c) **Preformed joint filler** shall conform to the requirements of Section 212. Material shall be approximately 1/2 inch in thickness and shall have a width and depth equal to those of the incidental structure.
- (d) **Curing materials** shall conform to the requirements of Section 220.
- (e) **Reinforcing steel** shall conform to the requirements of Section 223, Grade 40 or 60.
- (f) **Rubble stone** shall conform to the requirements of Section 205.
- (g) **Grout** shall conform to the requirements of Section 218.
- (h) **Foundation course** shall be aggregate No. 68 conforming to the requirements of Section 203.
- (i) **Dry filler** shall consist of aggregate conforming to the requirements of Section 202 or 203, as applicable.
- (j) **Seed** shall conform to the requirements of Section 244.
- (k) **Topsoil** shall conform to the requirements of Section 244.

502.03—Procedures.

The foundation shall be constructed to the required elevation. Unsuitable material shall be removed and replaced as directed by the Engineer. The subgrade shall be thoroughly compacted and shaped to provide a uniform, smooth surface. The foundation for hydraulic cement concrete items shall conform to the specified density of the course and shall be moist when concrete is placed.

Immediately following finishing operations, hydraulic cement concrete shall be cured and protected in accordance with the requirements of Section 316.04.

(a) **Fixed Forms Requirements**

Fixed forms shall be straight, free from warp, and of such construction that there will be no interference with the inspection of grade and alignment. Forms shall extend the entire depth of the item and shall be braced and secured so that no deflection from alignment or grade will occur during concrete placement. Radial forms shall be sufficiently flexible or otherwise designed to provide a smooth, uniform, curved surface of the required radius. Face forms shall be removed as soon as concrete has attained sufficient set for the curb to stand without slumping. The exposed surface shall then be smoothed by the use of a suitable finishing tool.

Transverse joints for crack control for fixed forms shall be provided at the following locations:

1. at approximately 20 foot intervals;
2. at the gutter where the curb and gutter tie to the gutter apron of drop inlets;
3. when time elapsing between consecutive concrete placements exceeds 45 minutes.
4. where no section shall be less than 6 feet in length.

Crack control joints may be formed by using one of the following methods:

- a. removable 1/8 inch thick templates
- b. scoring or sawing for a depth of not less than 3/4 inch when using curb machine
- c. approved "leave-in" type insert or may be formed or created using other approved methods which will successfully induce and control the location and shape of the transverse cracks.

The joint at the gutter where the curb and gutter ties to the apron gutter of the drop inlet shall be formed by scoring or sawing.

Expansion joints shall be formed at intervals of approximately 100 feet, at all radii points at concrete entrances and curb returns and at locations no less than 6 feet and no more than 10 feet from drop inlets.

Hydraulic cement concrete shall be sufficiently consolidated to produce a uniform, closed surface. Edges shall be rounded to a 1/4-inch radius.

Exposed surfaces immediately adjacent to the roadway, except concrete median barrier, shall be given a light broom finish. Concrete median barrier shall be given a Class 1 finish in accordance with the requirements of Section 404.07(a). Paved ditches and paved flumes shall be given a coarse or roughened texture. Other exposed surfaces shall be given a rough wood float finish. Mortar used in the removal of surface irregularities shall be in accordance with the requirements of Section 218.

(b) **Slipform Requirements**

The Contractor will be permitted to slipform incidental concrete items provided the following conditions contained herein are met. Approval by the Department to allow the Contractor the option of slipforming concrete

items is permissive only and in no way relieves the Contractor from his responsibility to meet the contract requirements and conditions.

Slipform equipment shall produce a product equal to or better than that produced by fixed form construction. Equipment for slipforming operations shall be designed or engineered to form the type of construction design for which its use is intended. Where equipment has been modified to such an extent that its use is questionable, the Contractor may be required at his expense to demonstrate to the Engineer's satisfaction that the equipment can consistently produce the desired type of construction. The slipform equipment shall be self-propelled and shall be equipped to consolidate, form, extrude, and finish the freshly placed concrete in such a manner that a minimum of hand finishing is required to produce a dense, consolidated, homogenous product. Slipform equipment shall be controlled to line and grade by automatic sensing, guidance and control devices such that the machine automatically senses and follows taut guidelines or other stable reference, performing any necessary corrective action to ensure the correct grade and alignment is achieved. The Contractor shall ensure the slipform operation is planned to result in the full cross section and grade of the desired design at the beginning and end of the placement. Slipform equipment shall operate with a continuous forward movement. The Contractor shall plan and stage the work to eliminate the need for the slipform machine to be stopped during placement operations. If for any reason it is absolutely necessary to stop the forward progress of the machine; operation of the vibrating and tamping elements shall be stopped immediately. Equipment used for slipforming shall conform to the general requirements of Section 108.07. If the results of the slipform operation are not satisfactory to the Engineer in accordance with the requirements stated herein, the continued use of the equipment will not be permitted.

Concrete for use in slipform operations may be manufactured with a slump as low as zero. The top of the slump range shall conform to the class of concrete specified on the plans or special provisions in accordance with Section 217. The concrete shall have properties that consistently maintain workability and the cross section, line, and grade of the proposed product. Concrete shall be finished to a light broom finish. If water is held back to maintain the desired slump, it may be added in increments provided the maximum water per cubic yard has not been exceeded and a minimum of 30 revolutions at mixing speed is used for complete mixing.

Where reinforcing steel is incorporated into the proposed design, it shall be uncoated steel conforming to Section 223. Reinforcing steel shall be tied at 100 percent of the bar intersections and shall be sufficiently strengthened with braces, additional reinforcement, or chairs to make the reinforcement cage rigid so as to prevent any movement during concrete placement. If the reinforcing steel exhibits any movement during concrete

placement using slipforming methods, the work shall be suspended until the reinforcing steel has been sufficiently tied and stabilized to the satisfaction of the Engineer. The reinforcing steel shall be continuous from fixed object to fixed object. All reinforcing steel shall have the appropriate amount of concrete cover for the particular design with a tolerance of $-0 +1/2$ inch; however, in no case shall the amount of cover be less than $1 \frac{1}{2}$ inches. Reinforcing steel inserted in the freshly placed concrete shall be inserted with the use of vibration to achieve adequate bond of the reinforcing steel. Where bonding is suspect, the Engineer may require pull out tests be performed by the Contractor at his expense. If such tests confirm the presence of adequate bond, the Department will reimburse the Contractor the cost of such testing.

The maximum height of any extrusion shall be limited such that the alignment and cross sectional shape of the design is maintained within the construction tolerances. If the Contractor elects to use or is required to use multiple placements to achieve a particular design, the Contractor shall submit a plan outlining the details of each placement for approval by the Engineer prior to beginning placement operations. Where multiple placements are permitted for installation of a particular design, the separate placements shall be staged so that any horizontal joints incorporated in the phased construction shall be arranged in such a manner as to prevent water infiltration in the final design and water flowing through any longitudinal joint.

Where weep holes are part of the proposed median barrier design, the Contractor shall use 6-inch diameter underdrain pipe in lieu of weep holes. Underdrain pipe conforming to Section 232 shall be installed at the grade at the bottom of the footing and shall terminate in catch basins or drop inlets.

Where naturally occurring vertical contraction cracking occurs and where there exists a grade separation on each side of the barrier, the Contractor shall install a waterproofing membrane conforming to Section 213, spanning $1 \frac{1}{2}$ feet on each side of the contraction crack at the back surface of the higher grade side of the barrier to prevent water from passing through the barrier.

Expansion joint material $1 \frac{1}{2}$ -inch thick shall be installed adjacent to each fixed object. Expansion material shall be placed against each fixed object prior to placement of the slipformed concrete. Contraction joints will not be required with slipformed operations provided the reinforcing steel is continuous from fixed object to fixed object.

(c) **Individual Item Requirements**

1. **Hydraulic Cement Concrete Curbs, Gutters, Combination Curbs and Gutters, Paved Ditches, and Paved Flumes:** Where

standard mountable curb or combination curb and gutter with mountable curb is specified, adjacent curbs of standard entrance gutter and standard connection for streets shall be modified to provide a mountable shape corresponding to the standard mountable shape.

Where integral curb is specified, the curb shall be placed simultaneously with or immediately after placement of the slab. The time period between slab and curb placement shall be not more than 45 minutes except as hereinafter specified. The surface of the slab on which the curb is to be placed shall be roughened, and the concrete shall be placed so as to secure a bond between the slab and curb.

When authorized by the Engineer, the Contractor may construct the integral curb by providing steel dowels 5/8 inch in diameter, 7 inches in length, to be embedded in the slab at 1-foot intervals. Dowels shall be placed so as to extend at least 2 inches into the curb. While the slab is still plastic, it shall be roughened to a depth of approximately 1/2 inch below the screeded surface for the full width of the curb.

Local irregularities in the face and top of curbs shall be not more than 3/8 inch in 10 feet. Vertical alignment shall be sufficiently uniform and regular to ensure complete drainage.

Any curb, gutter or combination curb and gutter, except those on structures, may be placed by the slipform method provided the finished product is true to line, cross section and grade and the concrete is dense and has the required surface texture. The concrete shall be of such consistency that it will maintain the desired shape or cross section of the design without support.

Where concrete curb or curb and gutter is placed over existing pavement, it shall be anchored to the existing pavement either by placing steel dowels and reinforcing steel or by using an approved adhesive. Steel dowels shall be firmly mortared with 1:1 Portland cement and sand mortar in holes drilled in the pavement. If an adhesive is used, the surface of the pavement shall be thoroughly cleaned before the adhesive is applied. Adhesive shall be EP-4 epoxy resin, a two component system conforming to Section 243. The pavement shall be cleaned either by blast cleaning or by wire brushing so that the prepared surface is free of dust, loose material, oil, or any other material that may prove deleterious to bonding.

The grade for the top of the extruded curb shall be indicated by an offset guideline set by the Contractor from survey information supplied by the Department. The forming tube portion of the extrusion machine shall be readily adjustable vertically to accommodate, when necessary, a variable height of curb conforming to the predetermined curb grade line. A grade line gage or pointer shall be attached to the

machine to monitor the elevation of the curb being placed against the established grade line so as to make corrective adjustment as necessary. In lieu of a grade line gage or pointer the extrusion machine may be operated on rails or forms set to produce the predetermined finished grade line for the curbing.

Concrete shall be continuously fed to the slipforming machine at a uniform rate. The machine shall be operated under sufficient uniform restraint of forward motion so as to produce a well compacted homogenous mass of concrete free from surface pits larger than 1/4 inch in diameter and requiring no further finishing other than light brushing with a broom. Finishing with a brush application of grout will not be permitted.

Expansion joints shall be constructed as specified for fixed formed curbing or shall be constructed by sawing through the curb section to its full depth. The width of the cut shall be such to allow the insertion of the joint filler with a snug fit. If sawing is performed before the concrete has hardened, the adjacent portions of the curb shall be supported firmly with close fitting shields. The operations of sawing and inserting the joint filler shall be completed before curing the concrete.

If sawing is performed after the concrete has hardened, the joint filler shall be mortared in place with heavy trowel pressure. After sawing is performed, all exposed portions of the curb in the vicinity of the joint shall be covered with another application of curing compound. At the conclusion of the curing period, the filler in each sawn joint shall be checked for tightness of fit. Any loose filler shall be mortared in place again and cured.

Within 3 to 7 days, the Contractor shall backfill curb; gutter and combination curb and gutter to the required elevation with approved material. Backfill material shall be compacted with curbs and gutters remaining plumb.

2. **Asphalt Concrete Curbs and Paved Ditches:** The curb shall be placed on a clean dry surface. Immediately prior to placement of the asphalt mixture, a tack coat of asphalt shall be applied to the surface at a rate between 0.05 and 0.15 gallon per square yard of surface. Asphalt shall be prevented from spreading outside the area to be occupied by the curb.

Asphalt concrete curb shall be placed by a self-propelled automatic curb machine or a paver having curbing attachments to form a satisfactorily compacted curb of a uniform texture, shape, and density. The Engineer may permit construction of curbs by other means when short sections or sections with short radii are required. The resulting

curbs shall conform in all respects to curbs produced by a curb machine.

Sealing or painting shall be performed only on curbs that are clean, dry, and cooled to ambient temperature.

Asphalt concrete paved ditches shall be placed and compacted so as to provide a smooth, uniform, and dense texture.

3. **Grouted Rubble Gutter:** Aggregate for the foundation course shall be spread on the subgrade to a depth of at least 4 inches.

Gutter stones shall be bedded in the foundation course perpendicular to the finished surface, flat side up, in straight rows, with the longest dimension perpendicular to the centerline of the gutter. Joints shall be broken in a satisfactory manner, and the width of interstices in the dry gutter shall be not more than 1 inch.

Stones shall be rammed until the surface is firm and conforms to the finished grade and cross section. Joints shall then be filled with dry filler to within 4 inches of the top of stones, and the surface shall be rammed to ensure proper compaction of filler. After irregularities have been corrected, cement grout shall be poured and broomed into joints and over stones. Additional grout shall be applied and brooming shall be continued until grout remains flush with the top of stones.

4. **Concrete Median Barriers:** Concrete median barriers shall be constructed in accordance with the requirements specified herein and in Sections 512, 404, and 410.

Concrete median barriers shall be constructed within an allowable tolerance of 1/2 inch for overall depth and overall width, 1/4 inch for the width of the upper portion of the barrier, and 1/4 inch per 10 feet for horizontal alignment.

After the specified curing time has elapsed, concrete median barriers for roadways shall be backfilled to the required elevation with approved material. Material shall be thoroughly tamped in layers not more than 6 inches in depth before compaction. Delineators shall be installed on median barriers in accordance with the requirements of Section 702.03.

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Standard concrete curbs, radial curbs, standard combination curb and gutter, radial combination curb and gutter, and asphalt concrete curbs will be meas-

ured in linear feet along the face of the curb, complete-in-place, and will be paid for at the contract unit price per linear foot. The price shall include modifying curbs for standard entrance gutters, standard street connection pavement, and standard median strips. Where the curb or curb and gutter is adjacent to drop inlets, the contract unit price for the drop inlets shall include that part of the curb or curb and gutter within the limits of the structure.

Where there is no excavation within the limits of the curb, gutter, combination curb and gutter, or median barrier other than that necessary for its construction, the contract unit price shall include excavating, backfilling, compacting, and disposing of surplus and unsuitable material. Where excavation is necessary for the roadway, the part within the limits of the curb, gutter, combination curb and gutter, or median barrier section will be paid for as regular excavation in accordance with the requirements of Section 303.06.

Standard, radial, entrance, and grouted rubble gutters; paved ditches; paved flumes; street connection pavement; and bridge drainage aprons and chutes will be measured in square yards of surface area, complete-in-place, and will be paid for at the contract unit price per square yard. The price for grouted rubble gutter shall include rubble stone, grout, foundation course, and filler. When pipe drain ditch liner is substituted for standard paved ditch at the Contractor's option, payment will be made at the contract unit price for the standard paved ditch specified. When pipe drain ditch liner is specified on the plans, payment will be made at the contract unit price per linear foot, complete-in-place.

The cost of excavation below the finished grade or below the slope surface of cut or fill sections that is necessary for installing and backfilling paved ditches and flumes shall be included in the contract unit price for the paved ditch or flume. Undercut excavation below the neat lines of paved ditches in cut sections, including replacement backfill for undercut excavation and excavation above the upper lateral limits of paved ditches and paved flumes that are outside the normal plan earthwork limits, will be measured and paid for in accordance with the requirements of Section 303.06.

Cattle guards will be measured in units of each, complete-in-place, and will be paid for at the contract unit price per each.

Energy dissipators will be measured in units of each, complete-in-place, and will be paid for at the contract unit price per each.

Median barriers will be measured in linear feet along the centerline of barriers complete in place and will be paid for at the contract unit price per linear foot. Unless otherwise specified, this price shall include furnishing and placing delineators, aggregate, excavation, backfill, weep hole covering, concrete cap, dowels and joint sealer.

Curb-cut ramps will not be measured for separate payment but will be measured in the units specified for their components.

Median strips will be measured in square yards or linear feet as specified and will be paid for at the contract unit price per square yard or linear foot.

Sign islands will be measured in units of each or square yards, complete-in-place, exclusive of posts and signs, and will be paid for at the contract unit price per each or per square yard.

Directional island curbs will be measured in linear feet along the face of the curb and will be paid for at the contract unit price per linear foot.

Embankment material between curb lines will be measured and paid for in accordance with the requirements of Section 303.06 except as specified below.

When there is no excavation or construction other than that necessary for constructing median strips, sign islands, or directional island curbs, the contract unit price shall include excavating, removing existing pavement, disposing of surplus and unsuitable material, backfilling, and compacting. When excavation or demolition of pavement is necessary for the adjoining roadway, that portion within the limits of the median strip, sign island, or directional island curb will be paid for as regular excavation or demolition of pavement in accordance with the requirements of Sections 303.06 and 508.03, respectively.

These prices shall include applying topsoil and seed.

Ditch Flume Connector will be measured in units of each, complete in place, and will be paid for at the contract unit price per each. This price shall include excavation when required, dowels, welded wire fabric, reinforcing steel, anchor lugs, curtain walls and concrete.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
Curb (Type and standard)	Linear foot
Combination curb and gutter (Type and standard)	Linear foot
Gutter (Type and standard)	Square yard
Paved ditch (Standard)	Square yard
Pipe drain ditch liner (Standard)	Linear foot
Paved flume (Standard)	Square yard
Energy dissipator (Standard)	Each
Entrance gutter (Standard)	Square yard
Street connection pavement (Standard)	Square yard
Median barrier (Standard)	Linear foot
Bridge drainage apron and chute (Standard)	Square yard
Median strip (Standard width)	Square yard or Linear foot
Sign island (Standard)	Each or square yard
Directional island curb (Standard)	Linear foot
Cattle guard (Standard)	Each
Ditch Flume Connector (Standard)	Each