

02400 - CURB & GUTTER, DRIVEWAYS, AND SIDEWALKS

(Revised 4/13/20)

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PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this specification.
- B. Section 01000 – GENERAL REQUIREMENTS.
- C. [Section 02200](#) – EARTHWORK.
- D. Any Specifications or details not covered herein shall be per Virginia Department of Transportation, *Road and Bridge Specifications*, latest revision.

1.2 SUMMARY

This section includes concrete curbs, combination curb and gutters, ramps, sidewalks, driveways, flumes, valley gutters, median strips, islands, retaining walls, steps, and headwalls on municipal roadways and its appurtenances.

1.3 DEFINITIONS

For the purposes of this specification, the following definitions refer to the streets and roadway system that comes under the authority of the City of Lynchburg, Virginia as specified within this section and other sections of this manual.

Street or Roadway: A publicly dedicated street or roadway right-of-way maintained by the City of Lynchburg Virginia

1.4 SUBMITTALS

Submit product data and shop drawings for the following in accordance with Section 01000, *General Requirements*:

- A. Air Entrainment
- B. Concrete cylinder break tests.
- C. Concrete admixtures
- D. Joint Sealants and expansion joint material
- E. Job mix formula
- F. Other embedded items

1.5 QUALITY ASSURANCE

Materials and operations shall comply with the latest revision of all applicable Codes and Standards.

1.6 STANDARD ABBREVIATIONS

AASHTO	American Association of State Highway Transportation Officials
ACI	American Concrete Institute
ANSI	American National Standards Institute
ASCE	American Society of Civil Engineers
ASTM	American Society for Testing and Materials
C&G	Concrete Curb and Gutter
CRSI	Concrete Reinforcing Steel Institute
FS	Federal Specifications
MSDS	Material Safety Data Sheets
VDOT	Virginia Department of Transportation
WWF	Welded Wire Fabric

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Concrete Handling/Transportation

- 1) Hydraulic cement concrete plant operations shall comply with the latest revision of VDOT *Road and Bridge Specifications*.
- 2) Time limitations and intervals between deliveries shall be in accordance with Section 217.09 of the VDOT *Road and Bridge Specifications* or latest revision.
- 3) Forms required to be accompanied with delivery shall be in accordance with Section 217.09 of VDOT *Road and Bridge Specifications*.
- 4) See Part 3 - EXECUTION of these specifications for handling of materials during placement of hydraulic cement concrete.

B. Steel Handling/Examination**1) Steel Reinforcing Storage:**

Reinforcing steel shall be stored on platforms, skids, or other supports that will keep the steel above ground, well drained, and protected against deformation. Upon deliver to site, epoxy coated steel shall be covered with an opaque covering. Coverings shall be placed to provide air circulation and prevent condensation.

2) Steel Reinforcing Inspection

a. **Plain Steel Reinforcing:** The Contractor shall be responsible for inspecting materials thoroughly upon arrival. Examine materials for damage or excessive rust. Remove damaged or rejected materials from site. A light coat of rust is permitted to develop on steel bars and fabric; however, rust scaling and flaking is not permitted.

b. **Coated Steel Reinforcing:** Handling and storage of coated bars shall conform to the requirements of AASHTO M284. Visible damage to the coating shall be patched or repaired with materials compatible to the existing coating in accordance with AASHTO M284.

3) **Pre-Installation Inspection:** Prior to being installed, inspect each bar of steel reinforcing for the presence of dirt, paint, oil, rust scaling, flaking or other foreign matter. Remove such matter with appropriate methods and to the satisfaction of the City Engineer.

C. Observe manufacturer's directions for delivery and storage of materials and accessories.

D. Hydraulic cement concrete plant shall be certified by Virginia Department of Transportation.

1.8 PROJECT CONDITIONS**1.8.1 PROTECTION OF STREAMS**

Do not discharge excess concrete into a drainage pipe, catchbasin, ditch, stream, river, pond, lake, or on City property without the approval of the City Construction Engineer.

1.8.2 PROTECTION OF ROADWAYS

Do not discharge or allow concrete to spill onto any roadway or appurtenances either during placement or while in transit. Remove spills immediately or otherwise repair street as directed by the City Engineer. The contractor shall be responsible for cleanup of all waste/excess of concrete.

1.8.3 PROTECTION OF PROPERTY

Do not discharge excess concrete without written permission of the property owner.

1.9 COORDINATION

Coordinate placement of sidewalk and driveway connections to municipal streets and roadways with the City Engineer.

PART 2 – PRODUCTS

2.1 HYDRAULIC CEMENT CONCRETE

Ready mixed concrete shall comply with ASTM C94, *Standard Specification for Ready-Mixed Concrete*. Cement concrete shall meet the requirements of Section 217, VDOT *Road and Bridge Specifications* or latest revision. Concrete strength shall be as specified on Standard Details and drawings. Concrete class for combined curb and gutter, curbs, sidewalks, driveways, flumes, ditches, steps, headwalls, and islands shall be a minimum of A3, 3000 psi or as designated in the specifications or drawings. Unless otherwise specified, all concrete shall be Class A3, minimum.

All exposed concrete shall be air entrained with an air content conforming to the requirements of Table II-17, Section 217 of the VDOT *Road and Bridge Specifications*, latest revision. Air entrained admixtures for use in portland cement concrete shall meet the requirements of AASHTO designation M154. Only those admixtures shall be used which have been approved by the City Engineer.

Calcium chloride may be used as an admixture if approved by the City Engineer. Calcium chloride shall conform to AASHTO M144, type 2. The use of calcium chloride is not permitted in reinforced concrete construction.

Concrete admixtures, when specified, shall conform to Section 215 of VDOT *Road and Bridge Specifications*.

Concrete Classes (VDOT) to Design Compressive Strength at 28 days (f'c):

Class A4.5	General	4,500-psi
Class A4	General	4,000-psi
Class A3	General	3,000-psi
Class B2	Massive or Lightly Reinforced	2,200-psi

2.2 MISCELLANEOUS

2.2.1 HANDRAILS

Handrails shall conform to requirements of Section 410 of the VDOT *Road and Bridge Specifications*.

2.2.2 PREFORMED (ASPHALT) EXPANSION JOINT FILLER

Prefomed (Asphalt) expansion joint filler material shall be in accordance with Section 212.02(c) of the VDOT *Road and Bridge Specifications*, latest revision. Material shall be approximately ½ inch in thickness and a width and depth equal to those of the incidental structure.

2.2.3 CURING MATERIALS

White pigmented liquid membrane curing compound, PE film, or water for curing shall meet the requirements of Section 220 of the VDOT *Road and Bridge Specifications*.

2.2.4 INSULATION BLANKET

In cold weather operations, insulated blankets must retain or supply moisture and maintain the temperature at the outermost surfaces of concrete above 50° F for at least 72 hours and above 32° F for at least an additional 48 hours.

2.2.5 POROUS BACKFILL AND WEEP HOLES

Porous backfill material and drain pipes for weep holes for retaining walls shall conform to requirements of Section 506 of the VDOT *Road and Bridge Specifications*.

2.2.6 PORTLAND CEMENT

Type I, CSA normal, ASTM C150 *Standard Specification for Portland Cement*.

2.2.7 REINFORCEMENT

A. Reinforcing Bars

Reinforcing bars shall conform to the requirements Section 223, Grade 40 or 60 of the VDOT *Road and Bridge Specifications*, latest revision.

B. Welded Wire Fabric

Wire mesh reinforcement shall be minimum 6 x 6, 10 Ga. shall conform to the requirements of Section 223 of VDOT *Road and Bridge Specifications*, latest revision.

2.2.8 AGGREGATE BASE MATERIAL

Aggregate base materials for foundation support shall be VDOT 21A, compacted, and in compliance with Section 208 of the VDOT *Road and Bridge Specifications*, latest revision.

PART 3 – EXECUTION

3.1 CONSTRUCTION – ALL CONCRETE ITEMS

3.1.1 CONSTRUCTION OF SUBGRADE

- A. **Subgrade Preparation:** Excavation and subgrade preparation shall be in strict compliance with Section 02200, *Earthwork*. The subgrade upon which this work is to be placed shall be shaped and compacted to a firm, even surface conforming to the elevation and cross-sections shown on the plans, the Standard Details or as directed by the Engineer. All soft, frozen, and unsuitable material shall be removed and replaced with approved material. The subgrade shall be moist when the concrete is placed.
- B. **Subgrade Fine Grading (Trimming):** When forms have been set to exact grade and secured, fine grading to exact sub-grade elevation shall be completed by hand. Before pouring operations begin, the Contractor shall have forms set and grade tested and approved by the Construction Coordinator ahead of pouring operations. Subgrade fine grading shall be the responsibility of the Contractor to insure that the subgrade conforms to the Standard Details.

3.1.2 FORMS

Forms for this work shall be of wood, metal, or other approved material, shall extend to the full depth of the concrete and shall be straight, free from warps and of sufficient strength to withstand the pressure of the concrete without springing. Bracing and staking of the forms shall be such that the forms will remain in both horizontal and vertical alignment until their removal. Forms shall be cleaned of foreign matter and oiled before concrete is placed. No concrete shall be poured into forms that have not been checked and approved by the City Construction Coordinator.

3.1.3 CURING

A. Curing – Year Round

The following method of curing is required year round:

- 1) **Liquid Membrane Compound:** Apply membrane-curing compound for curing, sealing, and moisture retention. The entire surface of the concrete shall be sprayed uniformly with a white pigmented membrane-forming compound immediately following the texturing operation.

Perform application in accordance with manufacturer's directions but at a minimum rate of 100 to 150 square feet per gallon and not more than 350 square feet per gallon. Application shall be by a sprayer or long-nap roller and shall be an even, continuous membrane produced on the concrete surface. No puddling shall be produced. At the time of use, the compound shall be in a thoroughly mixed condition, with pigment uniformly dispersed through the vehicle.

The membrane shall harden 30 minutes after application. Personnel and equipment shall be kept off the freshly applied material to prevent damage to the seal for a minimum of 72 hours. If the membrane becomes damaged within the initial 72 hours, damaged portions shall be repaired immediately with additional compound. Other requirements for protection of the structural integrity of concrete from pedestrians, vehicular traffic, and equipment shall be per these specifications as stated in applicable sections.

If removal of forms is required, exposed sections shall be protected immediately to provide a curing treatment equal to that provided for the surface.

- 2) **PE Film:** Concrete shall be covered with PE film. Color of film shall be white. However, from November 1 to April 1, clear or opaque PE film will be permitted. Film shall be installed immediately after liquid membrane compound has obtained a sufficient set so that it is not damaged. Apply film so that marks from application are not produced.
- 3) No extra compensation will be made for curing of any type.

B. Cold Weather Curing – Additional Requirements

No concrete is to be poured when the outside ambient temperature is 40 degrees and falling. Cold weather curing shall be applied when the outside temperature is 50 degrees and falling.

- 1) **Concrete Temperature:** Conform to the requirements of paragraph 217.10 *Placement Limitation* of the *VDOT Road and Bridge Specifications*, latest revision for the required temperatures of concrete.
- 2) **Cold Subgrade:** No concrete is to be placed on a frozen subgrade.
- 3) In addition to year round curing, install insulated blankets that will retain or supply moisture and maintain the temperature of concrete at the outermost surfaces above 50° F for at least 72 hours and above 32° F for at least an additional 48 hours. Blankets shall be left in place for a minimum of 7 days.
- 4) In cold weather applications, calcium chloride may be used as an admixture, if approved by the City Engineer

C. Hot Weather Curing – Additional Requirements

Hot weather curing shall be applied when the outside temperature is 75 degrees and rising. Care shall be taken in hot, dry, or windy weather to protect the concrete from shrinkage cracking by applying at a minimum, liquid membrane compound and PE film as described in Section 3.1.3 A, above.

Routine hot weather measures shall include cooling forms and wetting subgrade in addition to any other measures as required by the City Engineer.

Other measures for curing may be required by the City Engineer, such as: fog spraying, sprinkling, ponding, windbreaks, shading, or wet covering with an approved light colored material.

Hot weather curing shall remain in place for a minimum of 7 days.

D. Improper Curing

Any work damaged due to improper curing, freezing, or rain, shall be replaced at the Contractor's expense.

3.1.4 PROTECTION OF CONCRETE

- A. Protect new concrete sidewalks and appurtenances from pedestrian traffic for a minimum of 24 hours and driveway surfaces and curb and gutter from vehicular traffic for minimum of 7 days, unless otherwise approved by the City Engineer. Erect and maintain warning signs, lights, and watchmen to protect pedestrians and to direct traffic as needed.
- B. No equipment shall be driven or moved across newly concreted surfaces unless such equipment is rubber-tired and only if concrete surface is designed for and capable of sustaining loads imposed by the equipment.
- C. Protect new concrete from graffiti.
- D. Protection of concrete shall meet requirements of Section 404.03 of the VDOT *Road and Bridge Specifications*, latest revision.

3.1.5 TESTING

Testing shall be in accordance with the requirements of Section 217.08 – *Acceptance* of the VDOT *Road and Bridge Specifications*, latest revision.

3.1.6 COORDINATION OF POURS

It will be the responsibility of the Contractor to coordinate the times of pours with the City Construction Coordinator. For miscellaneous concrete pours (i.e. sidewalk, curb & gutter, collars, etc), a minimum of 24 hours notice shall be given to the City Construction Coordinator so that he/she can check all aspects of the work before the pouring operations begin. For structural pours (i.e. retaining walls, bridge decks, box culverts, etc.), a minimum of 48 hours notice shall be given to the City Construction Coordinator. Under no circumstances shall the Contractor pour concrete until the Construction Coordinator has had time to make checks of the work.

3.1.7 PLACING AND FINISHING – ALL CONCRETE ITEMS

The concrete shall be placed in the forms in such a manner as to prevent the segregation of the mortar and the aggregate. The concrete shall be spaded, tamped, or vibrated sufficiently to bring the mortar to the surface.

Prior to and during pouring operations, the Contractor's foreman or formsetter shall carefully watch all alignment and grades to detect any errors in grade or misalignment. In the event any of the work is damaged from any cause or proves defective in any way, or is out of alignment or grade, the Contractor shall remove such work and replace at his own expense. The detection of poor subgrade shall also be his responsibility.

When sufficient concrete has been placed in the forms, it shall be well spaded along all areas in contact with the forms in order to eliminate all honeycombing. Concrete shall be floated to the proper grade and alignment, free from depressions or other irregularities, after which the exposed surfaces shall then be screeded with a straight edge and finished with a steel or wooden trowel. No additional water shall be added during placement of concrete.

The concrete shall be troweled smooth and, before the concrete obtains full set, very lightly brushed with a brush moistened with clear water. No mortar shall be used in the finishing. Immediately following finishing operations, the finished concrete shall be cured and protected in accordance with these specifications.

3.1.8 DEFECTIVE WORK

The City will require the removal and replacement of any concrete items where they have been broken, cracked, chipped, have become misaligned, grades are incorrect, does not meet dimensions as shown in the Standard Details, improperly cured, or of a substandard or non-approved product. Such areas designated by the City Engineer shall be replaced at no cost to the City. Items replaced shall conform to the requirements for new work as to strength and construction. During removal of defective work, an amount equal to the required lengths of construction joints for each item or the amount as directed by the City Engineer must be removed and replaced.

The Engineer may drill cores from the completed slab to make depth measurements. Sections showing a deficiency of more than 3/8 inch shall be removed and replaced to the specified depth at the Contractor's expense.

3.1.9 PLACEMENT LIMITATIONS

Conform to the requirements of paragraph 217.10 of the VDOT *Road and Bridge Specifications*, latest revision for concrete temperature.

3.1.10 REINFORCING STEEL OR WIRE MESH

Wire mesh or reinforcing steel will be used if recommended by the City Engineer, stated in the specifications, shown on plans, or Standard Details. For installation of mesh or steel, see the applicable Sections of the VDOT *Road and Bridge Specifications or Standards*. All wire mesh or steel shall be properly spaced and thoroughly tied, and approved by the City Construction Coordinator before concrete is placed.

3.2 STANDARD CONCRETE CURB AND COMBINED CURB AND GUTTER

3.2.1 GENERAL REQUIREMENTS – COMBINED CURB & GUTTER

This work shall consist of a single course of portland cement concrete, constructed on a prepared subgrade in accordance with these specifications. It shall have the dimensions, cross-section, and location as shown on the plans or as directed by the City Engineer. See **Standard Detail 25.04** for standard concrete curb, combined curb and gutter, and valley gutter sections.

Horizontal alignment of curbs and combined curb and gutter shall be in reasonably close conformity to the lines shown on the plans. Vertical alignment shall not exceed +/- 3/8 inch in 10 feet from plan grade.

Before concrete obtains full set, all exposed surfaces shall be finished with a brush moistened with clear water.

When constructing curb and gutter, the Contractor will be responsible for filling and compacting material in the space left behind the curb and gutter after the forms are removed. This shall take place within 3 to 7 days from pour and the material shall be compacted to the grade of the back of the curb. No extra compensation shall be made for this work.

When tying curb and gutter into inlets, dowels shall be placed in the throat plate, to tie gutter to plate as required in the use of conventional forms.

3.2.2 JOINTS FOR CURB AND GUTTER

A. Transverse Joints

- 1) Transverse joints for crack control for fixed forms shall be provided at the following locations:
 - a. At approximately 10 foot intervals;
 - b. At the gutter where the curb and gutter ties to the gutter apron of drop inlets;
 - c. When time elapsing between consecutive concrete placements exceeds 45 minutes; and
 - d. Where no section shall be less than 6 feet in length.

- 2) Transverse joints for crack control 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; or
 - 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. Approval by the City Engineer is required.

If templates are used for transverse joints, templates shall be removed by stages, but not entirely until the concrete has become thoroughly hard. After removal of the templates, there must be a clear division throughout between these sections. Edging tools will be used to form an edge along the back and front form and at each template.

- B. **Expansion Joints:** See PRODUCTS, Section 2.2.3 of these specifications for approved expansion materials.

Expansion joints shall be formed at intervals of approximately 90 feet, at all radii points at concrete entrances and curb returns, at locations no less than 6 feet and no more than 10 feet from drop inlets, at the end of days work, and or all cold joints.

3.2.3 FORMS – COMBINED CURB & GUTTER

A. **Fixed Forms**

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. When sufficient concrete has been placed in the forms, it shall be well spaded along all areas in contact with the forms in order to eliminate all honeycombing. 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.

B. **Slip Forms**

The contractor will be permitted to slipform combined curb & gutter provided that he has obtained approval by the City Engineer and that all slipform requirements stated in the VDOT, *Road and Bridge Specifications*, Section 502.03 (b), or latest revision are adhered to.

3.3 STANDARD PORTLAND CEMENT CONCRETE SIDEWALK AND DRIVEWAY ENTRANCES

3.3.1 GENERAL REQUIREMENTS

This work shall consist of the construction of portland cement concrete sidewalk 4 inches thick and in accordance with these specifications. Sidewalks crossing driveways entrances and the driveway entrances shall be constructed 7 inches thick. See **Standard Details 25.05** and **25.06** for sidewalk and **Standard Details 25.10, 25.11,** and **25.12** for driveway entrance openings.

Curb cuts for driveways and handicap ramps shall be constructed as shown on the Standard Details for the type driveway or ramp specified on the plans or as directed by the City Engineer.

Handicap ramps shall be constructed at all street intersection corners. The ramps shall be constructed as shown on the Standard Details for the type shown on the plans or as directed by the City Engineer.

Sidewalks shall not be opened to pedestrian traffic for the first 24 hours. Vehicular traffic shall be excluded for the first 7 days or until the minimum design compressive strength is attained, whichever is the lesser time.

Tolerances: Horizontal alignment of sidewalks shall be to the lines and grades as shown on the plans and details. Vertical alignment shall not exceed +/- 3/8 inch in 10 feet from the plan grade.

3.3.2 JOINTS FOR CONCRETE SIDEWALK AND DRIVEWAY ENTRANCES

Transverse expansion joints shall be constructed at intervals of approximately 30 feet. Slabs shall be separated by transverse preformed joint filler, 1/2 inch in thickness, that extends from the bottom of the slab to approximately 1/4 inch below the top surface.

The slab between expansion joints shall be divided into sections approximately 5 feet in length by transverse score joints formed by a jointing tool, trowel, or other approved means. Transverse control joints shall also be provided when the time period between consecutive concrete placements is more than 45 minutes. Control joints shall extend into concrete for at least 1/4 of the depth and shall be approximately 1/8 inch in width. Where slabs are more than 7 feet in width, control joints shall be formed longitudinally to obtain secure uniform blocks that are approximately square. Transverse control joints shall also be installed where the corners of the drop inlets project into the sidewalk.

Construction joints shall be formed around appurtenances extending into and through the sidewalk. Preformed joint filler 1/4-inch thick shall be installed in these joints except that joint filler shall not be used adjacent to drop inlets. Preformed joint filler shall be securely fastened. An expansion joint shall be formed and filled with 1/4 inch preformed joint filler no less than 6 feet and no more than 10 feet from drop inlets. Preformed joint filler shall also be installed

between concrete sidewalk and any adjacent fixed structure which is not tied to the sidewalk with steel dowels.

3.3.3 PLACING AND FINISHING CONCRETE

The foundation shall be thoroughly moistened immediately prior to concrete placement. Concrete shall be placed in forms by methods that will prevent segregation. Concrete shall be spread to the full depth and brought to grade by screeding and straightedging. Concrete shall be spaded adjacent to forms to prevent a honeycomb appearance, and the surface shall be floated with a wooden float to produce a surface free from irregularities. The final finish shall be obtained with an approved hand float that will produce a uniform surface texture. Light brooming shall be used to hide trowel marks. Outside edges of the sidewalk slab and joints shall be edged with an edging tool having a radius of 1/4 inch.

See paragraph 3.1.3 *Curing* for requirements for curing concrete.

3.3.4 FORMS

A. Fixed Forms

See paragraph 3.2.3 A *Fixed Forms*, of these specifications.

B. Slip Forms

Slip form pouring shall be allowed with approval of the City Engineer. All portions of paragraph 3.2.3 B, *Slip Forms*, of these specifications, concerning pouring operations with slip forms shall apply.

3.4 FACEDOWN PORTLAND CEMENT CONCRETE SIDEWALK

This type of sidewalk construction shall consist of standard sidewalk as specified in above paragraph 3.3 - *Standard Portland Cement Concrete Sidewalk and Driveway Entrances*, of these specifications, poured monolithically with a 12-inch curb as shown on **Standard Detail 25.06**. See also **Standard Details 25.10, 25.11, and 25.12** for driveway entrance openings.

The methods of construction for facedown sidewalk shall be the same specified in paragraph 3.3 - *Standard Portland Cement Concrete Sidewalk and Driveway Entrances* of these specifications with the following additions:

- A. A joint shall be cut with an approved edging tool 6 inches from the face of the curb and parallel thereto.
- B. All expansion joints in the sidewalk shall extend across the top and face of the curb.
- C. The final finish for the top of the curb shall be made with a brush dampened with water, to match the finish of the adjoining structure.

3.5 MISCELLANEOUS PORTLAND CEMENT CONCRETE STRUCTURES AND APPURTANCES

This work shall consist of portland cement concrete retaining walls, headwalls, steps, piers for stream crossings, flumes and ditches, median barriers, median strips, islands, etc. constructed in accordance with these specifications. Any specifications or details pertaining to these items that are not covered herein shall be per VDOT *Road and Bridge Specifications and Standards*, latest revision. These structures shall be constructed to the dimensions, cross-sections, and locations as shown on the plans, shown on the Standard Details, or as directed by the City Engineer.

END OF SECTION 02400

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