

SECTION 02710**FENCES****02710.01 GENERAL****A. Description**

This work will include, but not necessarily be limited to, the construction of fence and gates in accordance with, and in reasonably close conformance to, the lines and grades shown on the Contract Documents or as directed by the Engineer.

B. Related Work Included Elsewhere

1. Clearing and grubbing; Section 02110.
2. Adjusting and replacing fences; Section 02130.

C. Quality Assurance

1. The Engineer will inspect all materials and work to ensure compliance with the Contract Documents.
2. Quality assurance requirements for Portland cement concrete shall be as specified in Section 03310.01.

D. Submittals

1. Shop Drawings

Shop drawings shall be submitted as specified in the "General Provisions" for all fence components. The shop drawings shall include dimensional information, coating details, and such other information as may be required to verify compliance with these Specifications.

2. Certificates of Compliance

Certificates of compliance shall be submitted in accordance with the "General Provisions" for fencing materials stating that the materials furnished meet the requirements specified in Section 02710.02.

02710.02 MATERIALS**A. Materials Furnished by the County**

The County will not furnish any materials for fence installation.

B. Contractor's Options

None.

C. Detailed Material Requirements

1. Barbed Wire

Barbed wire shall meet the requirements of ASTM A 121. The barbed wire shall be 12 1/2 gage with four-point, round barbs at 5-inch spacings and meet Class 3 coating requirements.

2. Chain Link Fabric

Chain link fabric shall be 2-inch mesh woven from coated wire gage No. 6 for 6 foot and 8 foot fence and No. 9 for 5 foot fence. Fence height shall be as noted in the Contract Documents. The ends shall have a knuckled selvage at the bottom and barbed selvage at the top except in yards where fabric shall have knuckled selvage top and bottom. The fabric shall meet the requirements of AASHTO M 181. The weight of zinc coating for galvanized fabric shall be Class B. Vinyl coated steel fabric shall meet the requirements of AASHTO M 181 Type IV, bonded. Vinyl shall be warm grey, green, or black color, or as specified on the Plans. Fabric shall be one piece for the height specified.

3. Portland Cement Concrete

Portland cement concrete for fence post encasement shall be Mix No. 2 as specified in Section 03310.

4. Fence Fittings and Hardware

a. Posts, Rails, Braces, Fittings, and Hardware

All posts, rails, braces, fittings and hardware shall be of the size and shape shown on the Standard Details.

Bonded vinyl coatings shall have a furnished thickness of 10 to 15 mils except that bolts, nuts, and washers shall be galvanized only.

Aluminum posts, rails, gate frames, and expansion sleeves shall conform to the requirements of ASTM B241, for aluminum-alloy seamless pipe, Alloy 6063, T6 or ASTM B 221 for extruded aluminum-Alloy 6063, T6. The finished members shall be of uniform quality straight and true to section.

Zinc coated (galvanized) steel posts, rails, gate frames and hardware shall conform to the requirements of AASHTO M 181. Round posts and rails shall be straight, true to section, and conform to the following weights:

Fence Industry O.D. (inch)	Nominal Pipe Size I.D. (inch)	Decimal Equiv. (inch)	Class 1 Weight Lbs./Ft.	Class 2 Weight Lbs./Ft.
1 5/8	1 1/4	1.660	2.27	1.84
2	1 1/2	1.900	2.72	2.28
2 1/2	2	2.375	3.65	3.12
3	2 1/2	2.875	5.79	4.64
3 1/2	3	3.500	7.58	5.71

Top rails, when specified, shall be fitted with outside expansion sleeves for connecting the lengths into a continuous run. Expansion sleeves shall be at least six (6) inches long, provide a substantial connection, and allow for expansion and contraction of the rail. Top rails shall be securely fastened to terminal gate, corner or pull posts using rail ends and brace bands.

b. Tie Wires, Line Post Clips, Tension Wires, and Tension Wire Clips

Tie wires, line post clips, and tension wire clips shall be galvanized by either Electrolytic or Hot-dip method. The galvanized coating shall weigh a minimum of 1.2 ounces per square foot when tested in accordance with ASTM A 90. These items when used with aluminum coated steel fabric shall be coated with aluminum at a minimum weight of 0.40 ounce per square foot when tested in accordance with AASHTO T 213. The wires shall be the same gauge as the fence fabric, or greater.

The tension wire shall meet the requirements of AASHTO M 181 except when zinc coated. The coating shall be 1.2 ounces per square foot minimum. When used with vinyl coated steel fabric, the wire shall have a minimum bonded vinyl coating of 7 mils and shall be the same color as the fence fabric.

c. Gates

The fabric used for gates shall be identical to the fencing fabric. Vinyl coated, movable fittings, such as hinges and latches, shall be field coated with a vinyl coating specifically prepared for this purpose. Gates may be fabricated using welded construction or heavy pressed steel or malleable corner fittings securely riveted. Gates shall be properly braced to eliminate sagging or twisting and shall be equipped with a positive latching type device with means for padlocking.

5. Mowing Strip

Where specified, a mowing strip shall be provided at the base of the fence in accordance with the Contract Documents.

6. Type of Fence

The type of fence shall be the specified height and constructed of one of the seven alternates as herein listed, unless specified as a single type. Replacement fence shall match existing fence as to size, type, coating, and color.

- a. Fence composed of galvanized coated steel fabric and malleable iron posts and fittings.
- b. Fence composed of galvanized coated steel fabric, galvanized steel corner and brace posts, and aluminum line posts.
- c. Fence composed of aluminum coated steel fabric and galvanized steel posts.
- d. Fence composed of aluminum coated steel fabric; galvanized steel terminal, corner, and brace posts; and aluminum line posts.
- e. Fence composed of bonded vinyl coated steel fabric, galvanized steel or galvanized bonded vinyl coated steel posts and fittings.
- f. Fence composed of bonded vinyl coated steel fabric; galvanized steel or galvanized bonded vinyl coated steel terminal, corner, and brace posts; and aluminum line posts.
- g. Fence composed of bonded vinyl coated steel fabric; galvanized bonded vinyl coated steel posts and fittings, including tension wires, truss rods, and the wiring for the barbed wire.

02710.03 EXECUTION**A. General**

1. The Contractor's activities and operations shall be confined to the area immediately adjacent to the right-of-way or property lines and within the right-of-way or site except that permission will be granted by the County for normal construction activities through lands owned by or under the control of the County. The Contractor shall be responsible for satisfactory arrangements for obtaining permission to occupy portions of the lands of adjacent property owners as may be required by his plan for completing the required work.
2. In areas where any privately owned fence or other property is within the County's right-of-way or site, the Engineer will endeavor to arrange for the relocation of such items. When directed by the Engineer, the Contractor shall carefully relocate the items where directed. The Contractor shall be responsible for any damage to privately owned items during handling.
3. In the area of large drainage structures and bridges, the fence may be set on a "Fence Line" for the purpose of avoiding the crossing of inlet and outlet ditches

by placing the fence behind the headwall of the structure or for the purpose of tying the fence into the existing bridge parapet. These "Fence Lines" as shown on the Plans are only a guide and the exact location of the fence shall be determined in the field by the Engineer.

4. The fence shall be erected at locations shown on the Plans, or where directed by the Engineer to grades conforming to existing ground contours with tolerances shown on the Standard Details. The bottom of the fabric shall be placed a normal distance of 1 inch above the ground line, however, over irregular ground, a minimum clearance of 1 inch and a maximum clearance of 6 inches will be permitted for a horizontal distance not to exceed 8 feet.
5. Any excavation or backfill required in order to comply with these provisions shall be made as directed by the Engineer. The fence shall be true to line, taut, and shall comply with the best practice for chain link fence construction. For roadway and site fencing projects, the fence fabric shall be placed on the road or site side of the posts. For stormwater management ponds the fabric shall be placed on the outside of the posts, or the side furthest from the pond. For site fencing, barb wire strands at the top of the fence should project outward.
6. The type of fence to be supplied shall be as indicated in the Contract Documents.
7. All posts shall be plumbed and placed at the specified spacing shown on the Standard Details with a tolerance of minus 2 feet. Spacing of posts shall be as uniform as practicable under local conditions. The distance between line posts shall not exceed 10 feet.
8. Terminal posts shall be installed at all ends, abrupt changes in grade, and at changes in the horizontal alignment greater than 10 degrees. In no case shall the distance between terminal posts exceed 500 feet.
9. Post lengths must be adequate in all cases to accommodate the fabricated width of the fence fabric without stretching or compressing the fabric and to obtain, as a minimum, the distance required below the bottom of the fabric.
10. Post caps are not required for "H" and "C" line posts, but are required for round line posts, and all terminal and corner posts. Post caps shall be watertight with openings for top rail when required.
11. Unless otherwise shown or specified, a tension wire shall be run continuously between terminal posts near the top and bottom of the fabric and attached to the fabric with hog ring fasteners at 18-inch intervals.
12. Horizontal brace rails shall be installed at all gate, pull, and corner posts. Horizontal brace rails with diagonal truss rods and turn buckle shall be installed at all terminal posts. Sufficient braces shall be supplied to allow complete bracing from each terminal post to all adjacent line posts.

13. Fabric shall be tied to brace and top rails at 2-foot intervals maximum. Stretcher bars shall be attached to terminal posts by connectors equally spaced at 15-inch centers maximum. Each connector shall be as close as possible to the ends of the fabric.
14. Gates shall be installed so as to be easily opened and closed by one person and shall be arranged to be swung back parallel with the fence unless otherwise noted.

B. Concrete

1. Concrete footings shall be constructed in accordance with dimensions shown on the Standard Details. Posts shall be centered in cylindrical concrete footings. Aluminum parts, where embedded in concrete, shall be coated with zinc chromate. The concrete shall be thoroughly compacted around the post by tamping or vibrating. The finish top surface shall be a troweled smooth finish, slightly above the ground line, and uniformly sloped to drain away from the post. The post shall not be disturbed in any manner within 72 hours after the individual post footing is completed.
2. Hand mixed concrete shall not be used without written permission of the Engineer. If permitted, the hand mixed batch shall not exceed 1/2 cubic yard.

C. Anchorage for Line Posts and Terminal Posts (End, Pull, and Corner Posts).

1. The following alternate will be allowed in case of line posts only. After being driven in the ground, the line post shall be held rigidly upright by means of two galvanized steel angle bar anchors. When utilizing the galvanized steel "H"-Beam the size of the angle bar anchor shall be 1 inch x 1 inch x 30 inches. For all other line posts the size of the angle bar anchor shall be 1-1/2 inch x 1-1/2 inch x 30 inches, or 1-1/4 inch x 1-1/4 inch x 36 inches. These anchors shall be driven diagonally through galvanized steel fittings attached to opposite sides of the post. The approximate spread of the anchor at its full depth shall be 39 inches. The device and procedure shall have prior approval of the Engineer.
2. The following alternate will be allowed for terminal posts (end, pull, and corner posts). After being driven into the ground the terminal post shall be held rigidly upright by means of two anchor units spaced approximately 6 inches apart along the terminal post, and each anchor unit driven in a direction to offset the stresses caused by the tension of the fence wire. Each anchor unit shall be composed of two 1-1/2 inch x 1-1/2 inch x 30 inch galvanized steel angle bar anchors or two 1-1/4 inch x 1-1/4 inch x 36 inch galvanized steel angle bar anchors which are driven through galvanized steel fittings attached to the opposite sides of the post. The approximate spread of the anchor at its full depth shall be 39 inches. The device and procedure shall have prior approval of the Engineer.

02710.04 METHOD OF MEASUREMENT**A. Chain Link Fence**

Measurement for chain link fence will be made of the length of fence of various sizes installed complete and accepted. Measurement will be made to the centers of end posts.

B. Terminal Posts

Measurement for terminal posts (end, pull, and corner) will be made of the number installed.

C. Line Posts

No measurement of line posts will be made.

D. Gates

Measurement for gates will be made of the number of various sizes and types installed.

02710.05 BASIS OF PAYMENT**A. General**

1. Payment will be made at the unit prices bid. The prices bid shall include and cover furnishing all labor, tools, equipment, and materials necessary to complete the work as shown and specified, in strict accordance with the Contract Documents, and accepted by the Engineer.
2. Payment will be made for contingent items when ordered by the Engineer. Payment will be as specified in Section 02951, 02952, 02953, 02954, 02955, 02956, and 02957.

B. Chain Link Fence

Payment for chain link fence will be made at the price bid per linear foot for fence of the size and type specified and shall include the furnishing and installation of all line posts and fittings.

C. Terminal Posts

Payment for terminal posts will be made at the price bid per each for the number, size, and type specified and shall include the furnishing and installation of all fittings.

D. Gates

Payment for gates will be made at the price bid per each for the number, size, and type specified and shall include the furnishing and installation of all fittings.

END OF SECTION