# SECTION 616 PROPERTY AND RIGHT OF WAY FENCE

## 616.1 Description

(1) This section describes furnishing and erecting woven wire fence, chain link fence, or high tensile wire fence.

## 616.2 Materials

### 616.2.1 General

(1) For the given materials, conform to the following:

Concrete ..... section 501
Preservatives and preservative treatment ..... 507.2
Structural Steel and miscellaneous metals ..... 506.2

(2) Furnish grade A, A-FA, A-S, A-T, A-IS, or A-IP concrete conforming to 501.2 as modified in section 716, except the engineer may waive the requirements for proportioning by weight, and may allow alternate mixers or mixing methods. Provide QMP for class III ancillary concrete as specified in section 716.

### 616.2.2 Woven Wire Fence Materials

#### 616.2.2.1 Woven Wire Fabric

(1) Furnish woven wire fabric composed of 11 gauge line and stay wires, except the top and bottom horizontal wires shall be 9-gauge. This fabric shall have 10 line wires, a nominal height of 47 inches, and conform to the design the plans show. Run the vertical stay wires from top to bottom line wires, at 6 inch nominal spacing.

(2) If the plans or special provisions do not designate a specific type of woven fence fabric, the contractor may use one of the following:

- Zinc-coated steel conforming to AASHTO M279 class 3.
- Aluminum-coated steel conforming to ASTM A584.

(3) Furnish the same type for all fence fabric required under the contract, unless specified otherwise.

#### 616.2.2.2 Barbed Wire

(1) Furnish 15 1/2 gauge or heavier 2-strand coated steel barbed wire with 4-point coated steel barbs spaced not more than 5 inches apart and conforming to AASHTO M280. If the plans or special provisions do not designate a specific type of barbed wire, the contractor may use one of the following:

- Type Z zinc-coated steel.
- Type ZA zinc-5 percent aluminum-mischmetal alloy coated steel.
- Type A aluminum coated steel.

(2) Furnish the same type for all barbed wire required under the contract, unless specified otherwise.

#### 616.2.2.3 Smooth Wire

(1) Furnish 9-gauge smooth zinc-coated steel wire for bracing and guying conforming to AASHTO M279 class 3.

#### 616.2.2.4 Braces

(1) Furnish zinc-coated steel pipe or steel tubing braces conforming to ASTM A53; or steel angle or channel section braces conforming to ASTM A123. Use a type, minimum size, and minimum weight conforming to one of the following:

- Welded or seamless steel pipe, nominal 1.90 inches outside diameter, weighing 2.72 pounds per linear foot.
- Steel tubing, 1.75 inches outside diameter, 3.13 pounds per linear foot.
- Steel angle section, nominal 1 3/4 x 1 3/4 x 1/4 inch, 2.77 pounds per linear foot.
- Steel channel section, nominal 3 inches, 4.1 pounds per linear foot.
- Other engineer-approved steel sections.

(2) Shape brace ends as the plans show, or furnish with other engineer-approved fittings for anchoring to posts. Furnish fittings, bolts, nuts, washers or other hardware conforming to ASTM A123.

#### 616.2.2.5 Staples

(1) Furnish 2-inch resin-coated staples made from 9-gauge zinc coated steel wire.

#### 616.2.2.6 Posts

(1) Furnish round wood posts manufactured from one of the softwood species listed in 614.2.5 for wood posts and offset blocks.

(2) The posts shall conform to the dimensions the plans show with a tolerance of plus 2 inches for length, and a diameter at the top or small end, after peeling, 4 1/2 inches or greater for line posts and 6 inches or greater for corner, bracer, or vertical angle posts.

(3) Use posts free from sap rot, woodpecker holes, plugged holes, pest-eaten areas, and hollow knots. Do not use posts with butt rot exceeding 5 percent of butt area. Ensure post tops are sound, except a 7 inch cedar post may have one pipe or heart rot 3/8 inch or smaller in diameter. Posts shall not have excessive checking or a one-way sweep greater than 3 inches, or short kinks. Posts may have a winding twist unless unsightly and excessive. All knots shall be sound.

(4) Do not use posts with both the maximum crook and maximum butt rot. Not more than 10 percent of the posts required under the contract may have the maximum crook or the maximum butt rot. The engineer will have sufficient grounds to reject posts that contain other defects of any kind that give a post an unsightly appearance.

(5) Use posts seasoned in a department-approved manner and peeled for their entire length, with all outer and inner bark to the white wood completely removed by shaving or by other effective means. Trim knots closely and saw both ends of the post square. If setting the posts by driving, then the larger end may have a blunt point. After peeling, trimming, and cutting to required length, preservative treat the posts by the pressure process specified in 507.2.2.6, except the preservative minimum retention is 6 pounds per cubic foot of wood for creosote-coal tar solution or pentachlorophenol solution.

### 616.2.3 Chain Link Fence Materials

#### 616.2.3.1 General

(1) Furnish new material for all parts. The department will not allow used, re-rolled, or open seam material in posts, rails, and braces.

(2) All metal materials, except high strength steel posts, rails and braces, and ground rods must comply with AASHTO M181, and the following:

- Use type I zinc-coated steel or type II aluminum-coated steel tension wire.
- Use type II aluminum-coated steel fence fabric.
- Use type I zinc-coated steel posts, rails, and frames.
- Use type I zinc-coated steel, cast iron, or malleable iron hardware and fittings.
- Do not use AASHTO grade 2 steel posts, rails, or frames.

(3) Ensure that hot-dipped coatings are applied to rolled sections after rolling. The contractor may substitute zinc-5 percent aluminum-mischmetal alloy for hot-dipped zinc as allowed under AASHTO M181.

(4) Unless specified otherwise, furnish the same type of material for all fence fabric required under the contract. Make all posts, hardware, and fittings used on the contract the same kind, unless specified otherwise.

#### 616.2.3.2 Fence Fabric

(1) Use fence fabric woven of 9-gauge wire in 2-inch diamond pattern mesh with both the top and bottom selvages knuckled. Ensure the furnished fence fabric is the same nominal height as the designated fence height.

#### 616.2.3.3 Posts

(1) Use posts of the type, size, and length the plans show. Conform to ASTM F1043 and use one of the following:

- Group IA or group IC round steel pipe with a type A coating.
- Group IIA roll-formed steel C-sections with a type A coating.
- Group III hot rolled H beams with a type A coating.

#### 616.2.3.4 Post Tops

(1) Fit all posts, except roll formed terminal posts, with ornamental tops of the type the plans show. Ensure ornamental tops are of department-approved design, made of metal, have a flanged base that fits snugly over top and around outside of post, and is securely fastened in place. Provide the base of each line post top with an opening for passage and support of the top tension wire.

(2) For roll-formed line posts, the contractor may use the notched alternate post top the plans show instead of and ornamental post top.

#### 616.2.3.5 Bracing

(1) Use brace rail of the type, size, and weight the plans show for horizontal and diagonal bracing. Conform to ASTM F1043 and use one of the following:

- Group IA round steel pipe with a type A coating.
- Group IIA roll-formed steel C-sections with a type A or C coating.

(2) Make horizontal and diagonal pipe, or roll formed braces and diagonal truss rods extend from all terminal, corner, intersection, or intermediate braced posts to the first adjacent line post, and fasten them securely to the posts with suitable connectors. Use zinc coated 3/8 inch round steel rods equipped with a threaded take-up adapter for diagonal truss rods.

#### 616.2.3.6 Pipe Fittings

(1) Use malleable iron, cast iron, or pressed steel pipe fittings.

#### 616.2.3.7 Fabric Fasteners

(1) Use clips made of 9-gauge zinc coated steel or 0.179-inch diameter aluminum tie wires as fasteners for securing the fence fabric to H column line posts. User 9-gauge zinc coated steel or 0.179-inch diameter aluminum tie wires as fasteners for securing the fence to posts or top tension wires and braces. Use tie wires not smaller than 12-gauge zinc coated steel, or 0.149-inch diameter aluminum wire, as fasteners for securing to bottom tension wires.

#### 616.2.3.8 Tension Bars

(1) Use zinc-coated flat mild or rail steel of the required length.

#### 616.2.3.9 Gates

(1) Conform to the material, design, and dimensional requirements the plans show for chain link fence gates.

### 616.3 Construction

#### 616.3.1 General

(1) If an area of right of way is subject to ingress of cattle or other farm animals, erect the right of way fencing before starting other items of work under contract for these areas, or provide a temporary fence to exclude the livestock.

(2) Remove and dispose of all trees, brush, logs, stumps, or other debris that might interfere with fence construction, within approximately 12 inches along each side of the fence line, as specified for clearing and grubbing in 201.3. If the contractor cuts trees or stumps close enough to the ground to prevent interference with correct fence erection, the engineer will not require grubbing of the stumps.

(3) Excavate minor ridges and humps in the ground surface, necessary to correctly erect the fence.

(4) Erect the fence on the right of way, parallel to, and 3 feet from the right of way line, unless the plans show or the engineer directs otherwise. Where the engineer directs or allows the contractor to leave trees on the fence line, deviate the fence line past the tree as the plans show.

(5) Erect the wire on the far side of the posts with respect to the proposed roadway.

(6) Before final acceptance, remove and dispose of all excess excavation and surplus materials from the fence site.

#### 616.3.2 Woven Wire Fence

#### 616.3.2.1 General

(1) Erect woven wire fencing fabric and one line of barbed wire on preservative treated wood posts. Place all end, corner, pull, and vertical angle posts at the locations staked or where the engineer designates.

#### 616.3.2.2 Placing Posts

(1) Set all posts with the large end down to the depth the plans show and make plumb and true to line on the wire side. Unless the plans show otherwise, set line posts at as uniform spacing as possible under local conditions, but the spacing shall not exceed 16 feet center to center of posts. Set additional posts, as required, at abrupt changes in grade. Excavate post holes to the required depth. If the contractor encounters rock, employ necessary drilling, blasting, or other means of excavation. Use suitable material for backfill, and place and compact in layers around the post until firmly embedded, plumb, and true to alignment.

(2) Set all corner, end, pull, vertical angle posts, and posts at stream crossings in concrete. Brace and guy as the plan details show. Use a double strand of 9-gauge zinc-coated, smooth wire for wire guying and stretch between posts as the plans show. Wrap the wire around the posts and staple. Twist the strands of wire taut. Place vertical angle post assemblies at grade change points of more than 2 feet between consecutive posts that result in a wire uplift on the posts.

(3) The contractor may drive posts instead of setting posts in previously dug holes and backfilling, except if placing in concrete. If driving posts, drive them plumb, to the required depth and alignment, and with adequate lateral stability. Remove and replace with a sound post any post not conforming to the above requirements, or damaged below cut-off during driving.

#### 616.3.2.3 Placing Wire

(1) Attach the woven wire to the posts so that the bottom wire is approximately 2 inches above the ground, but not more than 4 inches above the ground at the posts, except on abrupt grade changes as the plans show. Place one line of barbed wire above the woven wire, as the plans show, and staple the wire at each post.

(2) Secure the woven wire and the barbed wire to all end and corner posts by wrapping each line of wire around the post and tying the wire back on itself with not less than 1 1/2 twists tightly wrapped with tools designed for the purpose, and supplement with staples driven into the posts. Stretch the wire until no slack exists, longitudinal wires are tight, and approximately 50 percent of the factory fabricated fence crimp is removed. Apply tension with an engineer-approved stretcher designed to produce a uniform amount of tension in each wire.

(3) Secure the woven wire to each post with staples at the top and bottom wires and, at least, at 3 intermediate wires. Use additional staples if necessary. Stagger the vertical alignment of staples slightly and do not place parallel with the wood grain. Drive the staples tight at all pull, angle, end, and corner posts, and double staple the wire if required. Drive the staples firmly at other line posts but loose enough to allow lateral movement of the wire. Make splices in the fencing at posts or between posts to the engineer's satisfaction.

(4) Ground the fence as specified in 616.3.3.

### 616.3.3 Chain Link Fence

#### 616.3.3.1 General

(1) Erect chain link fencing fabric, of the required height, attached at the top and bottom to a tension wire, on driven unbraced metal line posts.

#### 616.3.3.2 Setting Posts

(1) Set or drive posts, in a vertical position, at the required location and alignment, and at as uniform a spacing as local conditions allow. Space posts, center to center, according to the following situations as follows:

- On a tangent or on a curve of 500 feet or more radius; space posts at no more than 10 feet.
- On a curve of from 200 feet to 500 feet radius, space posts at no more than 8 feet.
- On a curve of from 100 feet to 200 feet radius, space posts at no more than 6 feet.
- On a curve of less than 100 feet radius, space posts at no more than 5 feet.

(2) Set or drive posts, with their tops at the required elevation to provide a smooth profile at the top wire without abrupt changes. Conform to the general contour of the terrain.

(3) Place an end post at each end of each run of fence. Place a corner post at breaks of 30 degrees or more in the horizontal alignment. Set an intersection post in line with an intersecting chain link fence, and brace with the adjacent post of the intersecting fence.

(4) Place an intermediate braced post if there is over a 5 degrees change in the vertical alignment or a change in the fence line grade of greater than 9 percent that results in wire uplift on the post.

(5) If placing posts on concrete walls, curbs, or other concrete structures, place them in sleeve anchors and grout as the plan details show. Use a non-shrink grout conforming to 506.3.30 for bearings and anchorages. Thoroughly ram the grout into the sleeve anchor while the post is in place. Allow the grout to cure at least 48 hours before stretching the chain link fabric.

(6) Coat the portion of aluminum-coated posts to be set in concrete with a uniform, thin application of asphaltic or other engineer-approved material. Ensure this coating is firmly set before placing the posts.

(7) Set the end, corner, angle, intersection, and intermediate braced posts in concrete footings.

(8) Ensure the top of the concrete footing is approximately 6 inches below the ground line and slopes slightly away from the post. Locate the footing to allow centering of the post. Backfill the top of the footing with topsoil or other suitable material.

(9) In firm ground, excavate holes for the footings to the neat dimensions and place concrete directly in the excavation. Remove rock or other obstructions encountered in the excavation to the required depth.

(10) If unstable soils or other areas prevent making footing excavations to neat dimensions, use forms. Keep the form in place until the concrete cures for at least 24 hours. After removing the form, backfill the footing with suitable material. Ensure the backfill material has the correct moisture content for compacting and place and compact in layers.

(11) Set the posts, anchor the braces in place, and wait at least 7 days before placing the top and bottom tension wires.

(12) Place an intermediate braced post midway between end posts and corner posts if the fence run is more than 1000 feet, but not more than 2000 feet. For fence runs greater than 2000 feet, make the maximum spacing of intermediate braced posts 1000 feet.

(13) Set in concrete or drive unbraced line posts, provided the contractor drives them plumb, to the required depth and alignment, and with adequate lateral stability. Remove and replace any post that fails to conform to the above requirements, or that the contractor damages during driving, with an undamaged post. In unstable soils, increase the length of driven posts by multiples of 2 feet, as the engineer directs, to increase the stability of the post.

#### 616.3.3.3 Erecting Fence Fabric

(1) Place, tension, and secure the top and bottom tension wires before erecting the fence fabric. Anchor the tension wires securely to each end, corner, intersection, or intermediate braced post. Fasten the tension wires to each line post.

(2) Attach the end of the fabric to the post with a tension bar threaded through the end loops of the fabric and secured to the post with clamps and bolt. Stretch the fabric with engineer-approved stretching equipment to remove all slack. Secure the stretched fabric to line posts, braces, and tension wires with specified fabric fasteners. Place fabric fasteners on line posts at no greater than 14 inch centers; and on braces and tension wires at no greater than 18 inch centers. Repeat stretching operations at approximately every 100 feet for each run of fence.

(3) Splice fabric by interweaving a wire picket through each end loop of each piece of fabric. Ensure that the splice is neat and secure.

#### 616.3.3.4 Gates

(1) Erect chain-link fence gates as the plans show.

#### 616.3.3.5 Salvaged Chain Link Fence

(1) Remove, handle, store, and re-erect the fence, gates, and all posts, fittings, bases and appurtenant hardware without damaging the parts. Replace contractor-damaged parts and provide all other materials, including concrete, required to re-erect the fence. Dispose of all surplus materials.

(2) Re-erect salvaged chain link fence as specified for chain link fence under 616.3.3.

### 616.3.4 High Tensile Wire Fence

(1) Construct tensioned wire strands on preservative treated wood posts as the plan details show. Furnish bracing materials as specified in 616.2.2.4. Use wood posts of the size the plans show and otherwise conforming to 616.2.2.6.

### 616.3.5 Electrical Grounds

(1) Ground woven and high tensile wire fence. Use 1/2 inch minimum diameter zinc coated or copper clad steel rod at least 8 feet long, driven vertically into the ground along the fence line, near a post, until approximately 6 inches extends above the ground. Securely clamp, bolt, or braze at least 3 fence wires to the ground rod. Electrically ground barbed wire as the plans show.

(2) Install electrical grounds at locations where primary electrical transmission or distribution lines, other than secondary feeder lines for individual service, cross the fence. Install one ground rod along the fence at the point of crossing and one 25 to 50 feet in each direction from the crossing.

(3) Install additional ground rods in each fence spaced approximately every 500 feet. Install at least one ground rod on each electrically isolated section of fence, defined as a run with no interruptions in electrical continuity.

## 616.4 Measurement

(1) The department will measure the Fence Woven Wire and Fence High Tensile Wire bid items by the linear foot acceptably completed, measured from center to center of end posts, along the fence line at the ground line. The department will deduct for openings.

(2) The department will measure the Fence Chain Link bid items by the linear foot acceptably completed, measured from center to center of end posts, along the top tension wire. The department will deduct for gates and other openings.

(3) The department will measure the Gates Chain Link bid items as each individual unit acceptably completed.

(4) The department will measure the Fence Chain Link Salvaged bid items by the linear foot acceptably completed, measured from center to center of end posts, including gates, along the top rail or tension wire.

## 616.5 Payment

(1) The department will pay for measured quantities at the contract unit price under the following bid items:

| ITEM NUMBER | DESCRIPTION | UNIT |
|---|---|---|
| 616.0100 | Fence Woven Wire (height) | LF |
| 616.0200 - 0299 | Fence Chain Link (height) | LF |
| 616.0329 | Gates Chain Link (width) | EACH |
| 616.0400 - 0499 | Fence Chain Link Salvaged (height) | LF |
| 616.0500 | Fence High Tensile Wire (height) | LF |

(2) Payment for all bid items under this section includes erecting temporary fence to keep farm animals off the right of way.

(3) Payment for all the fence bid items under this section is full compensation for clearing and grubbing the fence line; for excavating; for setting posts including placing concrete; for erecting and tensioning all fencing components; for installing grounds; and for removing and disposing of all debris, excess excavation, and surplus materials.

(4) Payment for the Fence Chain Link bid items also includes providing longer posts driven in unstable soils at no additional cost to the department.

(5) Payment for the Fence Chain Link Salvaged bid items also includes removing, handling, and storing existing fence materials; for re-erecting gates; for replacing all contractor-damaged parts; and for providing all other materials required to re-erect the fence.

(6) Payment for the Gates Chain Link bid items is full compensation for providing the gate.