

## **80 FENCES**

### **80-1 GENERAL**

#### **80-1.01 GENERAL**

Section 80-1 includes general specifications for constructing fences except Type ESA temporary fences.

#### **80-1.02 CLEARING**

Remove earth, trees, brush, and other obstructions that interfere with fence construction.

#### **80-1.03 CONNECTIONS**

Connect new fences to existing fences.

Place a corner post with a brace for each direction of strain at each junction with an existing fence.

Fasten the wire in the new and existing fences to each post.

If ordered, at a structure, connect the new fence to the structure such that stock can pass freely through or under the structure; otherwise, install an end post and connect the fence to it.

#### **80-1.04 FOOTINGS AND DEADMEN**

For concrete for metal post and brace footings and for deadmen, use:

1. Commercial quality aggregates and cementitious material
2. At least 470 pounds of cementitious material per cubic yard

Crown each concrete footing to shed water.

#### **80-1.05 POST PLACEMENT**

Measure post spacing parallel to the ground slope. Place each post in a vertical position except where the Engineer orders you to set the post perpendicular to the ground surface.

#### **80-1.06 SURPLUS EXCAVATED MATERIAL**

After constructing a fence, uniformly spread the surplus excavated material along the adjacent roadway where designated by the Engineer.

#### **80-1.07 TEMPORARY FENCES**

A temporary fence must comply with the Contract for a permanent fence of the same type except:

1. You may use used materials if the used materials are good, sound, and suitable for the purpose intended
2. Materials may be commercial quality if the dimensions and sizes of the materials are equal to or greater than the dimensions and sizes shown on the plans or specified in section 80.
3. Posts must be either metal or wood
4. The Department does not require:
  - 4.1. Galvanizing or painting of steel elements
  - 4.2. Treating wood with a wood preservative
  - 4.3. Concrete footings for metal posts

#### **80-1.08–80-1.09 RESERVED**

#### **80-1.10 PAYMENT**

The fence payment quantity does not include the width of openings.

The fence is measured:

1. Parallel to the ground slope
2. Along the fence

**80-2 BARBED WIRE AND WIRE MESH FENCES****80-2.01 GENERAL****80-2.01A Summary**

Section 80-2 includes specifications for constructing barbed wire and wire mesh fences.

**80-2.01B Definitions**

**alignment angle:** Change in a line where the angle of deflection is less than:

1. 5 degrees for a steel post barbed wire or wire mesh fence
2. 15 degrees for a wood post barbed wire or wire mesh fence

**corner:** Change in a line where the angle of deflection exceeds:

1. 5 degrees for a steel post barbed wire or wire mesh fence
2. 15 degrees for a wood post barbed wire or wire mesh fence

**fence, Type BW:** Barbed wire fence consisting of 5 lines of barbed wire.

**fence, Type WM:** Wire mesh fence consisting of wire mesh fabric and 3 lines of barbed wire.

**80-2.01C Submittals**

Reserved

**80-2.01D Quality Control and Assurance**

Reserved

**80-2.02 MATERIALS****80-2.02A General**

Reserved

**80-2.02B Metal Posts and Braces**

Line posts must comply with ASTM A 702 except packaging of posts is not required. Each post must be Class B steel. You may omit the anchor plate if the post is set in a concrete footing with a minimum cross sectional dimension of 6 inches and a depth equal to the full penetration of the post.

Each end, latch, pull, and corner post must have:

1. Minimum resisting section modulus of 0.32 cubic inch in any direction
2. Length of at least 7 feet
3. Weight of at least 3.1 lb/ft

Each brace and brace post must have:

1. Length of at least 7 feet
2. Weight of at least 1.93 lb/ft

**80-2.02C Wood Posts and Braces****80-2.02C(1) General**

Each wood post and brace must be treated except where untreated wood is specified.

Each wood line post to be driven must be machine pointed at the small end.

Sweep must not exceed 0.08 foot in 6 feet.

**80-2.02C(2) Untreated**

Each untreated wood post and brace must be:

1. Redwood, cedar, Douglas fir, or Southern yellow pine
2. Straight and free from loose or unsound knots, shakes over 1/3 the post thickness, or other defects that would make it unfit structurally for the purpose intended

Post knots must be sound, tight, well spaced, and not over 2 inches on any face.

Each untreated wood line post and brace may be split material and must have:

1. Length of at least 7 feet
2. Perimeter of at least 16 inches
3. Each cross-section dimension of at least 4 inches

Each untreated wood end, corner, and brace post must be sawed or hewed and have:

1. Length of at least 8 feet
2. Nominal size of at least 6 by 6 inches

#### 80-2.02C(3) Treated

Each treated wood post and brace must be:

1. Douglas fir, Hem-Fir, Southern yellow pine
2. Round or sawed rectangular
3. Free of heart center

Each Douglas fir, Hem-Fir, and Southern yellow pine post and brace must be graded under section 57.

Each sawed post and brace must be of the minimum grade and species shown in the following table:

Grades and Species		
Nominal size	Minimum grade	Species
4 by 4 inch	Construction light framing	Douglas fir
	No. 1 structural light framing	Hem-Fir
	No. 2 structural light framing	Southern yellow pine
6 by 6 inch	Select structural posts and timbers No. 1	Douglas fir
	Select structural posts and timbers	Hem-Fir
	No. 1 timbers	Southern yellow pine

Each round post and brace must be free from:

1. Decay
2. Shakes over 1/3 the post diameter
3. Splits longer than the thickness or diameter of the post
4. Loose or unsound knots
5. Multiple crooks
6. Other defects that would weaken the post or brace or otherwise make it structurally unsuitable for the purpose intended

Pressure treat each post and brace under section 57 and AWP A U1, Use Category UC4A, Commodity Specification A or B.

Treat posts after pointing.

Instead of the imprint specified in section 57, the treating plant may hammer stamp either end of a treated post and brace with the symbol or name of the company performing the treatment.

For each round post and brace:

1. Peel to remove outer bark and inner cambium bark except minimal strips of inner bark may remain if not over 1/2 inch wide or over 3 inches long
2. Trim knots flush with sides
3. Remove spurs and splinters
4. Cut ends square



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Each line post and brace must be 7 feet long. Any other post must be 8 feet long. Each length may be at most 1 inch shorter and 2 inches longer.

The small end of each round line post and brace must have a cross-sectional dimension between 3-1/2 and 5 inches. The small end of any other round post must have a cross-sectional dimension between 5-1/2 and 7 inches.

The taper from end to end of each round post and brace must not exceed 1-1/2 inches.

Each sawed rectangular line post must have a nominal size of at least 4 by 4 inches. Any other sawed rectangular post must have a nominal size of at least 6 by 6 inches.

### 80-2.02D Barbed Wire

Barbed wire must:

1. Comply with ASTM A 121
2. Have 2 point barbs
3. Be one of the following:
  - 3.1. 12-1/2 gage, Class 1
  - 3.2. 13-1/2 gage, Class 3
  - 3.3. 15-1/2 gage, Class 3

### 80-2.02E Wire Mesh

Wire mesh must:

1. Comply with ASTM A 116, Class 1
2. Be 32 inches wide
3. Have 8 horizontal wires with vertical stays spaced 6 inches apart

The top and bottom wires must be 10 gage.

The intermediate wires and vertical stays must be 12-1/2 gage.

### 80-2.02F Tension Wires, Hardware, and Grounding Materials

Tension wire must be 8-gage galvanized wire.

Galvanized bolts and nuts for attaching braces and straps to metal posts and galvanized devices for holding barbed wire and wire mesh in position must be commercial quality.

Each staple used to fasten barbed wire and wire mesh fabric to wood posts must be:

1. At least 1-3/4 inches long
2. Manufactured from 9-gage galvanized wire

Wire used to fasten barbed wire and wire mesh to metal posts must be galvanized and at least 11 gage. Clips and hog rings used for metal posts must be at least 9 gage.

Wire used to tie the lower line of barbed wire to the top wire of wire mesh must be 12-gage galvanized wire.

Each ground rod must:

1. Be galvanized or copper-coated steel
2. Be 8 feet long
3. Have a diameter of at least 1/2 inch

Conductor must be no. 6 solid copper or equal.

### 80-2.02G Gateways

Fence materials and end post bracing must comply with the specifications and plans for the fence type in which the gateway is constructed.

Except for length, end bars must comply with the line post specifications and plans.

Vertical stays for gateways must be:

1. Pretwisted
2. 9.5-gage galvanized wire
3. Evenly spaced between end bars at 66-inch maximum intervals

Wire loops must be 6-gage galvanized wire.

The chain for the latching device must be commercial quality short link steel coil chain. The latching bar for the latching device must be commercial quality steel pipe. Bolts and nuts for attaching the chain to the end posts and latching bar must be commercial quality and galvanized.

#### 80-2.03 CONSTRUCTION

Excavate high points that interfere with placing fence fabric to the clearance shown.

Brace adjacent line posts at alignment angles with diagonal tension wires unless impractical. If impractical, brace as specified for bracing corner posts.

Set each metal diagonal brace and metal corner, end, latch, gate, and pull post in a concrete footing.

You may drive metal line posts.

Set solid each wood line post one of the following ways:

1. Drive it into place.
2. Install it firmly in a drilled hole of the same dimension as the post.
3. Install it in a drilled or dug hole larger than the dimension of the post, backfill around the post, and compact the backfill.

Install each wood post that is not a line post in a drilled or dug hole larger than the dimension of the post, backfill around the post, and compact the backfill.

Install each round post installed in a drilled hole butt end down.

Securely fasten tension wires to wood posts. Make an extra loop around each post at each attachment point and staple the wire to the post.

Connect each wood brace to its adjacent post with a 3/8- by 4-inch steel dowel. Twist the tension wires until the installation is rigid.

Stretch barbed wire and wire mesh fabric and fasten to each wood post.

Attach barbed wire and wire mesh fabric to the private property side of posts.

On wire mesh fence, tie the lower line of barbed wire to the top wire of the wire mesh with wire at 4-foot intervals between posts. Attach the wire mesh fabric to each post by fastening the top and bottom wires and alternate longitudinal wires with at least 5 fasteners.

At each grade depression, snub or guy the fencing by means of a double 8-gage or a double 9-gage galvanized wire connected to:

1. Each horizontal line of barbed wire or to the top and bottom of wire mesh fabric
2. A deadman weighing about 100 lb and buried in the ground at least 2 feet

Stretch and fasten the fencing before snubbing or guying.

Fence fabric and fence wires of fences using wood line posts must be grounded. Ground by substituting a metal fence post for a wood post at intervals at most 500 feet with at least 1 metal post in any length of fence over 200 feet between openings. With wire, tightly fasten each line of barbed wire and alternate longitudinal wires of the fence to the metal post.

Where an electric transmission, distribution, or secondary line crosses a wood-post fence, ground the fence with a ground rod installed directly below the crossing point. Drive the rod vertically until the top is 6



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inches below the ground surface. Connect the ground rod to the fence with a conductor. The connections must be either brazed or fastened with authorized noncorrosive clamps.

Where a powerline runs parallel or nearly parallel to and within 100 feet of the wood post fence, ground the fence with a ground rod at each end post or at intervals of at most 1,500 feet.

If you cannot reach the specified vertical ground rod penetration, install an Engineer-authorized equivalent grounding system.

After you attach fencing to untreated wood posts, cut off any long post that makes the fence look nonuniform.

### 80-2.04 PAYMENT

Not Used

## 80-3 CHAIN LINK FENCES

### 80-3.01 GENERAL

#### 80-3.01A Summary

Section 80-3 includes specifications for constructing chain link fences.

#### 80-3.01B Definitions

**corner:** Change in a line where the angle of deflection exceeds 30 degrees.

**diamond count:** Number of mesh openings in each height of chain link fence.

**fence, Type CL:** Chain link fence. "Type CL" is followed by a number representing the width in feet of the fence fabric. The number is shown in the bid item description.

**fence, Type CL, slatted:** Chain link fence with wood or plastic slats inserted vertically in the chain link fabric.

**resisting moment:** Product of a member's section modulus about the designated axis and its yield strength.

#### 80-3.01C Submittals

If you use the protective coating system specified in section 80-3.02B, submit a certificate of compliance for the system.

#### 80-3.01D Quality Control and Assurance

Under California Test 674, test:

1. 1 post from each lot of 1,500 or fewer chain link fence posts
2. 1 brace from each lot of 500 or fewer chain link fence braces

If the post or brace fails, test 2 additional posts or braces from the same lot. If 1 of these posts or braces fails, the Department rejects the lot.

### 80-3.02 MATERIALS

#### 80-3.02A General

Galvanize or coat ferrous materials.

Do not use materials imperfectly galvanized or coated or with serious abrasions.

For barbed wire on a chain link fence, comply with section 80-2.02D.

#### 80-3.02B Posts and Braces

The base metal for posts and braces must be commercial quality weldable steel.

Galvanize posts and braces under section 75-1.05 except, instead of galvanizing, tubular posts and braces may have a protective coating system complying with the following:

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1. Exterior surfaces of tubular posts and braces must have a combination coating consisting of hot-dip galvanized primer followed by a chromate conversion coating followed by a finish coat of clear, cross-linked organic coating. For this combination coating:
  - 1.1. Thickness of the zinc coating must be at least 0.9 mil as determined from the average results of at least 2 samples and at least 0.8 mil on an individual sample.
  - 1.2. Chromate conversion coating must be at least 15 µg/sq in.
  - 1.3. Total thickness of the combination coating must be at least 1.7 mils.
  - 1.4. Exterior clear coated surface of the pipe must have demonstrated the ability to resist 1000 hours of exposure to salt fog with a maximum of 5 percent red rust when tested under ASTM B 117.
  - 1.5. Clear finish coat must not have any film cracking after 500 hours of exposure in an artificial weathering device under one of the following:
    - 1.5.1. ASTM G 152, cycles 1, or 3 Carbon Arc artificial weathering device.
    - 1.5.2. ASTM G 155, cycles 1, or 2 Xenon Arc artificial weathering device.
  - 1.6. Clear finish coat must not have blistering or cracking after 500 hours of exposure to 100 percent relative humidity under ASTM D 2247.
2. Interior surfaces must have a zinc coating or a cross-linked organic coating containing a corrosion inhibitor. For these coatings:
  - 2.1. Coating thickness must be at least 0.3 mil.
  - 2.2. Interior coated surface must have demonstrated the ability to resist 300 hours of exposure to salt fog with a maximum of 5 percent red rust when tested under ASTM B 117.

Obtain authorization of the protective coating system before you use it. Any change to the protective coating system is a new system that requires authorization.

Line, end, latch, and corner posts must have the following minimum resisting moments:

**Minimum Resisting Moments of Line, End, Latch, and Corner Posts**

	Minimum resisting moments (ft-lb)		
	Line posts		End, latch, and corner posts
	Perpendicular to fence line	Parallel to fence line	Any direction
Fence height			
≤ 6	800	400	1,400
> 6 feet	1,400	700	2,400

Each brace must have a minimum resisting moment of 400 ft-lb about the center of the major axis and 300 ft-lb about the minor axis.

Each end, latch, and corner post must have a midpoint deflection about either axis of at most 0.25 inch. Each post and brace must have a permanent set about either axis at most 0.01 inch when tested under California Test 674.

Before galvanizing and manufacturing, the nominal thickness of the material of each:

1. Post must be at least 0.105 inch
2. Brace must be at least 0.075 inch

A line post having a resisting moment about the weaker axis:

1. Less than 75 percent of the required minimum resisting moment perpendicular to the fence line must not be used at an angle point in the fence line where the deflection angle exceeds 10 degrees.
2. Not less than 75 percent of the required minimum resisting moment perpendicular to the fence line may be used at an angle point in the fence line up to a deflection angle of 30 degrees.

Each post length must be at least the depth of the concrete footing plus the height of the fabric less 4 inches. The length does not include any top fixture or other top tension wire support integral with the post.

Each post must have provisions to securely hold the top tension wire in position and allow for post removal and replacement without damaging the wire. Fit each tubular post with a rainproof top.



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Post tops, extension arms, stretcher bars, and other fittings and hardware must be:

1. Steel or malleable or wrought iron
2. Galvanized after fabrication under section 75-1.05

### 80-3.02C Fabric

Chain link fabric must comply with AASHTO M 181 for Type I fabric with a Class C coating unless vinyl-clad fabric is described in the fence bid item, in which case the fabric must comply with AASHTO M181 for Type IV fabric with a medium or dark green Class A coating.

The wire for the fabric must be:

1. 11 gage for fence 84 inches or less in height
2. 9 gage for fence over 84 inches in height and for slatted chain link fence

Chain link fabric for nonslatted fence must have the diamond count corresponding to the fabric height shown in the following table:

Diamond Counts							
Fabric height (inches)	36	42	48	60	72	84	96
Diamond count	10-1/2	12-1/2	13-1/2	17-1/2	20-1/2	24-1/2	27-1/2

Chain link fabric for slatted fence must have 3-1/4-inch-vertical and 5-1/4-inch-horizontal mesh.

Knuckle finish fabric on the top and bottom edges.

### 80-3.02D Tension Wires, Hog Rings, Turnbuckles, Truss Tighteners, Truss Rods, and Stretcher Bars and Bar Bands.

Tension wire must be commercial quality 7-gage coil spring steel.

Tie wires and hog rings must be at least 9-gage steel.

Post clips must be at least 6-gage steel.

Galvanize tension and tie wires, hog rings, and post clips under ASTM A 116, coating Class 3.

Turnbuckles and truss tighteners must be:

1. Commercial quality steel, malleable iron, or wrought iron
2. Galvanized under section 75-1.05
3. Equal in tensile strength to the truss rod

Truss tighteners must have a strap thickness of at least 1/4 inch.

Each truss rod must be steel and have a diameter of at least 3/8 inch.

Each stretcher bar must be at least 1/4 by 3/4 inch.

Each stretcher bar band must be at least 1/8 by 3/4 inch.

### 80-3.02E Slats

Slats must be wood or plastic.

Wood slats must be one of the following:

1. Clear redwood
2. Medium-weight wood produced from the species *Shorea* (*Meranti*)

Each wood slat must have:

1. Thickness of at least 1/4 inch
2. Width about 2-5/8 inch
3. Length enough to fill the vertical openings of the fabric



Each plastic slat must:

1. Be a high density polyethylene with ultraviolet inhibitors
2. Have a flat tubular cross section with:
  - 2.1. Wall thickness of about 0.03 inch
  - 2.2. Depth of about 0.325 inch
  - 2.3. Width of about 2.38 inches
  - 2.4. Length equal to the fence height

The plastic slat material properties must have at least the values shown in the following table:

**Plastic Slat Material Property Requirements**

Property	Test method	Value
Melt index	ASTM D 1238	0.24
Density	ASTM D 1505	0.951
Low temperature brittleness	ASTM D 746	-76 °F
Tensile strength	ASTM D 638	3,700 psi

### 80-3.03 CONSTRUCTION

Brace each end, latch, and corner post to the nearest line post with either of the following:

1. Diagonal brace used as a compression member.
2. Horizontal brace used as a compression member and truss rods used as tension members.

Brace each gate post to the nearest line post with a horizontal brace used as a compression member and truss rods used as tension members.

Equip each steel truss rod with a turnbuckle or truss tightener.

Brace line posts horizontally and truss in both directions at intervals of at most 1,000 feet unless the fabric is installed by stretching with equipment.

Fasten chain link fabric on the side of the posts designated by the Engineer.

Stretch and securely fasten the fabric to the posts.

Fasten the top and bottom edges of the fabric to the tension wires. Stretch the tension wires tight.

Install the bottom tension wire on a straight grade between posts by excavating high points of the ground. Do not fill in low points.

Fasten the fabric to end, latch, corner, and gate posts with stretcher bars and stretcher bar bands at 1-foot intervals except fabric may be fastened to end and corner posts by threading through loops formed on the posts.

Fasten the fabric to line posts with tie wires or post clips and to tension wires with tie wires or hog rings. Space the fasteners at about 14 inches on line posts and about 18 inches on tension wires. Give wire ties at least 1 complete turn. Close each hog ring with ends overlapping. Wrap tension wires around terminal posts. The top of the fabric to the top tension wire must be at most 2 inches.

If barbed wire supporting arms are shown, extend each upwards from the top of the fence at an angle of about 45 degrees. Fit it with clips or other means for attaching 3 lines of barbed wire. Attach the top outside wire to the supporting arm at a point about 12 inches above the top of the chain link fabric and 12 inches out from the fence line. Attach the other wires to the arm spaced evenly between the top of the fence and the top outside wire.

For a chain link fence with slats, install slats vertically in the mesh openings such that the slats fit snugly. Fasten them in a way that prevents easy removal or displacement.

### 80-3.04 PAYMENT

Not Used

**80-4-80-9 RESERVED****80-10 GATES****80-10.01 GENERAL****80-10.01A Summary**

Section 80-10 includes specifications for constructing gates in fences.

Constructing a gate in an existing fence includes removal of the fence.

**80-10.01B Definitions**

**gate unit for a barbed wire or wire mesh fence:** 1 gate with fittings, hardware, and gate posts with braces.

**gate unit for a chain link fence:** 1 gate with fittings, hardware, and gate and latch posts with braces.

**80-10.01C Submittals**

Reserved

**80-10.01D Quality Control and Assurance**

Reserved

**80-10.02 MATERIALS**

Each drive gate for a chain link fence must be the length shown in the bid item description.

Each drive gate for a barbed wire or wire mesh fence must be at least 48 inches and at most 58 inches high.

Each walk gate must be 4 feet wide.

A gate greater than 8 feet in length must have vertical stays such that no panel exceeds 8 feet in length.

A gate frame must be made with pipe at least 1-1/2 in diameter. Interior vertical stays must be made with pipe at least 1 inch in diameter. Pipe must comply with the specifications for posts and braces in section 80-3.02B.

Each gate frame panel must be cross trussed with adjustable truss rods at least 3/8 inch in diameter.

Fasten and reinforce each corner of a gate frame with a malleable iron or pressed steel fitting or by welding.

Each pressed steel fitting must:

1. Have a nominal thickness before galvanizing of at least 0.135 inch
2. Be fastened to develop the strength of connected members

Welds must be smooth and develop the strength of the connected member.

Galvanize fittings, latches, rods, and other gate hardware under section 75-1.05.

Fabric for gates in a barbed wire or wire mesh fence must comply with the specifications for non-slatted chain link fence in section 80-3.

Fabric for gates in chain link fences must comply with the specifications for the fabric for the fence in which the gate is installed.

Attach chain link fence fabric to the gate frame using stretcher bars and tie wires as specified for fence construction. Space tension connectors at 1-foot intervals.

For a chain link walk gate installed in an existing fence, gate mounting hardware must not contain open-end slots for the fastening bolts.

Each gate must have a combination steel or malleable iron catch and locking attachment that does not rotate around the latch post.



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Hang each gate with at least 2 steel or malleable iron hinges at least 3 inches in width such that the gate is securely clamped to the gate post and permits the gate to be swung back against the fence. The bottom hinge must have a socket to take the ball end of the gate frame.

Construct stops to hold gates open and a center rest with catch.

For a walk gate constructed in an existing fence, remove a line post and install the gate such that the gate is centered on the hole of the removed post. When not working on the walk gate, close the opening made in the existing fence with existing fence fabric or 6-foot chain link fabric.

### **80-10.04 PAYMENT**

The gate payment quantity is the quantity of gate units.

**80-11-80-15 RESERVED**