SECTION M.10
FENCE, RAILING AND POSTS

M.10.01--Cable Guide Railing and Anchorages: The materials for this work shall conform to the following requirements:

1--Wire Rope: Wire rope shall be class A, 19 mm in diameter, conforming to the requirements of AASHTO M 30.

2--Fittings: All fittings shall conform to the details as shown on the plans. Fittings subject to the direct action of the wire rope shall be sufficiently strong to develop the full specified tensile strength of the rope. Fittings used in the attachment of two ropes shall be sufficiently strong to develop the full specified tensile strength of both ropes. Other fittings shall be in accordance with standard commercial specifications, and shall be free from flaws or defects that would tend to impair their use or durability.

All metal fittings shall be galvanized, after fabrication, to meet the requirements of ASTM A 153.

3--Steel Posts and Channel Anchors for Use with Three-Cable Guide Railing: All steel posts and channel anchors shall conform to the requirements of ASTM A 36.

Steel posts and channel anchors shall conform to the details shown on the plans as to size, shape and mass; and they shall be punched or drilled as indicated on the plans. After fabrication, all posts and channel anchors shall be galvanized to meet the requirements of ASTM A 123.

4--Anchorages: Anchorages shall be as shown on the plans.

M.10.02--Metal Beam-Type Rail and Anchorages: The materials for this work shall comply with the plans as to size, shape and mass.

1. Steel Posts, Post Plates, Brackets and Back-Up Rails: All steel posts, post plates, brackets and back-up rails shall conform to the requirements of ASTM A 36. After fabrication, all steel posts, post plates, brackets and back-up rails shall be galvanized to meet the requirements of ASTM A 123.

2. Wood Posts: Wood posts shall conform to the requirements of Article M.10.01-3 except the following shall govern:

(a) Wood posts shall be used as shown on the plans in construction of anchorages.

(b) All wood posts, where required, shall be 152 mm in diameter as required by the plans.

3. Rail Element, Rub Rail and Terminal Sections: The rail element, rub rail and terminal sections shall conform to the requirements of AASHTO M 180 except the following shall govern:

(a) Class A: Base metal nominal thickness, 2.7 mm as shown on the plans.

(b) Class B: Base metal nominal thickness, 3.5 mm as shown on the plans.

(c) Zinc coating shall be Type 2.

(d) Acceptance shall be based on Article 14.3 "Acceptance by Brand Registration and Guarantee" of AASHTO M 180.

(e) Material for the box beam rail element shall conform to ASTM A500, Grade A or B, or ASTM A501. All plates shall conform to ASTM A36. All material for box beam rail elements and splices shall be galvanized after fabrication in accordance with AASHTO M111 (ASTM A123).

4. Steel Eyebolt and Standard Turnbuckle: The steel eyebolt and standard turnbuckle shall conform to the requirements of ASTM A 237 and shall be zinc-coated to conform to the requirements of ASTM A 153.

5. Connector Plate Bolts: The connector plate bolts shall conform to the requirements of ASTM A 325 and shall be zinc-coated to conform with the requirements of ASTM A 153.

6. Cast Steel Connector Plate: The cast steel connector plate shall conform to the requirements of ASTM A 27, Grade [450-240] and shall be zinc-coated to conform with the requirements of ASTM A 153.

7. Malleable Iron Connector Plate: The malleable iron connector plate shall conform to the requirements of ASTM A 47, Grade 24018 and shall be zinc-coated to conform to the requirements of ASTM A 153.

8. Structural Steel Anchor Rod, Steel Plates, Steel Washer Plates and Square Steel Washers: These steel fittings shall conform to the requirements of ASTM A 36 and shall be zinc-coated to conform to the requirements of ASTM A 153 unless otherwise noted on the plans.

9. Bolts, Washers, Nuts and Fittings: Anchor bolts shall conform to ASTM A449. The nuts and washers for anchor bolts shall conform to ASTM A563, Grade B. All other bolts and nuts shall conform to the requirements of ASTM A307 unless otherwise noted in the plans Miscellaneous washers and fittings, unless otherwise shown on the plans, shall conform to ASTM A 36.

Bolts, nuts and washers shall be galvanized to meet the requirements of AASHTO M232 (ASTM A153). Fittings shall be galvanized after fabrication to conform to AASHTO M111 (ASTM A123).

10. Anchor: The bar reinforcement for anchors shall conform to the requirements of Article M.06.01-1. The Class "A" concrete for anchors shall conform to the requirements of Article M.03.01.

11. Paint: The zinc dust-zinc oxide paint shall conform to the requirements of Type I, II, or III as specified in FS TT-P-641. The aluminum paint shall conform to the requirements of Article M.07.06.

M.10.03--Barways: The materials for this work shall conform to the following requirements:

1--Wood Posts: Wood posts shall conform to the requirements of Article M.10.04-2 except the minimum diameter shall be as shown on the plans.

2--Wood Rails: Wood rails shall be made of Number 1 Common Fir or other approved lumber of equal quality and shall be dressed on four sides.

3--Fittings: Fittings shall be of the type and dimensions shown on the plans and shall be approved by the Engineer.

M.10.04--Wire Fence: Materials for this work shall conform to the following requirements:

1--Wire Fencing: The wire fencing shall be composed of woven wire fencing of an approved type.

It shall be 1.2 m in height, plus or minus 12.5 mm, and shall be constructed of not smaller than No. 9 gage (American Steel & Wire) wire. There shall be not less than 8 horizontal wires spaced at various distances apart with the smaller spaces at the bottom to the fence.

Vertical stays, securely welded or fastened to the horizontal wires, shall be provided at intervals of 300 mm, plus or minus 3 mm, and shall run from top to bottom of the fence.

Each wire shall be galvanized by the hot-dip method conforming to the requirements of ASTM A 116, Class 2 or protected with other protective coating approved by the Engineer.

2--Wood Posts: Wood posts for wire fence shall conform to any one of the following specifications, provided that all posts on any one project shall conform to the same specification:

(a) Untreated Posts: These posts shall be cut from either of the species locust or red cedar.

All posts shall be round, straight and of the length shown on the plans. Red cedar posts shall have a minimum diameter of 125 mm at the small end; for locust posts the same minimum diameter shall apply after removal of the bark. The bottom shall be sawed off square and all knots hewn flush with the surface. On locust posts, the inner and outer bark shall be removed and the surface shaved smooth.

(b) Treated Posts: These post shall be cut from one of the following species: Norway (red) pine, southern yellow pine, scotch pine, pitch pine, oak, red maple, black birch or yellow birch.

All posts shall be round, straight, of the length shown on the plans, and after removal of the bark, shall have the minimum diameter at the small end as shown hereinbelow. Top and bottom of the posts shall be cut off square, with a maximum permissible deviation of 10 degrees at the butt end. Reduction of the total diameter of the butt end by felling undercuts of up to 25 percent is permissible, but not more than one such undercut will be permitted on a post. The posts shall be peeled as soon after cutting as possible and shall be conditioned for treatment by air-seasoning to a moisture content of 20 to 35 percent (dry basis). The outer bark must be removed completely. No single patch of inner bark on any post may be more than 19 mm wide nor more than 305 mm long, and adjacent patches must be separated from each other by a strip of bark-free wood at least 25 mm wide. Branch stubs and overgrown knots shall be trimmed close to the face of the post. All posts shall be treated for their full length.

Timber preservatives used and method of treatment shall be one of the following:

Creosote Pressure Treatment: Posts to be treated with creosote shall have at the small end a minimum diameter of 100 mm, as determined by a circumference tape. The method and the preservative used shall conform to the requirements of AWPB LP-55.

Pentachlorophenol Cold-Soaking Treatment: Posts to be treated with pentachlorophenol shall have at the small end a minimum diameter of 125 mm, as determined by a circumference tape. The pentachlorophenol shall conform to the requirements of AASHTO M 133. Pentachlorophenol may be obtained as liquid concentrates containing up to 40 percent pentachlorophenol. The concentrate shall be reduced to 5 percent strength by the addition of Stoddard solvent, kerosene or No. 2 fuel oil. Treatment shall be by immersing the posts in cold preservative for a sufficient length of time to provide for the retention specified below. Retention of 5 percent pentachlorophenol solution immediately after treatment shall be greater than 80 kg/m^3 of wood. Radial penetration at a point midway between the ends of the post shall be 25 mm or more.

3--Metal Post: Metal posts shall be of the length shown on the plans, straight and true to section, and shall be of a standard commercial type.

All posts, braces, anchors, plates and other devices shall be zinc-coated on all inner and outer surfaces by an approved method.

The zinc coating shall have a mass of not less than 610 g/m^2 when tested in accordance with AASHTO T 65.

All end posts shall have one brace; all corner and intermediate braces or pull posts shall have two braces.

(a) Intermediate or Line Posts: Intermediate or line posts shall conform to one of the following types and to the minimum requirements stated for each:

Quadruple Ribbed Tee Post: Quadruple ribbed tee post minimum mass per meter, 2 kg.

Channel or U Post: Channel or U Post, minimum mass per meter, 1.7 kg.

Standard Tee Post: Standard tee post, minimum mass per meter, 1.8 kg.

Tubular Post: Tubular post, minimum outside diameter 45 mm minimum gage No. 15. (U.S. Standard).

Angle Post: Angle post, minimum section 50 mm X 50 mm X 6.4 mm.

(b) End posts, corner posts, pull posts and braces shall conform to one of the following types and do the minimum requirements stated for each:

Tubular Section Post and Brace: Tubular section post and brace, minimum outside diameter 64 mm, minimum gage No. 8 (U.S. Standard).

Standard Pipe Section Post and Brace: Standard pipe section post and brace, minimum mass per meter, 5.4 kg.

Angle Post and Brace: Angle post and brace, minimum section of post 64 mm X 64 mm X 6.4 mm, minimum section of brace 50 mm X 50 mm X 6.4 mm.

The minimum mass stated for the several types of posts do not include anchors, plates or other devices. Intermediate or line posts shall be provided with a plate or anchor or other satisfactory means to hold the posts in proper alignment and plumb. Plates or anchors shall be securely fastened to the post by welding or by a minimum of 2 rivets per plate.

All posts having a tubular or pipe section shall be provided with a suitable cap at the top.

M.10.05--Chain Link Fence: All gage measurements of finished wire shall be United States Steel Wire Gage or equivalent. Tolerance for wire sizes shall be as specified in AASHTO M-181. Materials for this work shall conform to the following requirements:

1--Fabric: Wire Fencing shall be composed of woven wire of the chain link type. It shall be not less than the height specified on the plans or in the special provisions and shall be constructed of not smaller than No. 9 gage wire. The wire shall be woven to form a continuous fabric having 50 mm mesh. The chain link fabric shall have a knuckled finish on both edges.

(a) Aluminum-Coated Steel Fabric: The base metal of the fabric shall be of steel wire having a minimum tensile strength of 550 MPa, coated with aluminum alloy applied at the rate of not less than 122 g/m^2 of uncoated wire surface.

(b) Polyvinyl chloride-coated steel fabric shall conform to the requirements of FS RR-F-00191, Type IV, and shall be the color green.

(c) Aluminum Alloy Fabric shall conform to the requirements of ASTM B211, Alloy 6061 wire having a minimum tensile strength of 345 MPa.

2--Metal Posts and Rails: Metal posts shall be straight, true to section and of sufficient length to enable the post to be encased for a depth of 815 mm in a concrete footing which shall have a depth 1 m below ground.

All posts, rails, braces, anchors, plates and other devices shall meet one on the following specification.

Galvanized material shall be made of steel of a standard commercial type, hot-dip galvanized with a zinc coating having a mass of not less than 610 g/m^2 when tested in accordance with AASHTO T65 or shall be in accordance with AASHTO M181, Class 2.

The Contractor shall provide a Materials Certificate in accordance with Article 1.06.07 for materials conforming to AASHTO M181, Class 2.

All aluminum coated steel posts and rails shall conform to ASTM F669, minimum yield strength 345 MPa, for industrial chain link fence. The posts and rails shall be manufactured by roll forming aluminum coated steel strip and electric resistance welding into tubular form. The outside of the weld area shall be metallized with commercially pure aluminum to a thickness sufficient to provide resistance to corrosion equal to that of the remainder of the outside of the tube. The aluminum coating mass on the outer and inner surfaces shall be a minimum of 230 g/m^2, triple spot test, 215 g/m^2, single spot test, as measured in accordance with ASTM A428.

Polyvinyl chloride-coated material shall be made of steel of a standard commercial type coated inside and outside with the same polyvinyl chloride coating as the chain link mesh or shall have all surfaces galvanized with the outside galvanized surface coated with the same polyvinyl chloride coating as the chain link mesh.

Aluminum Alloy shall conform to the requirements of FS RR-F-00191.

3--Fittings: These shall be malleable iron, pressed steel, or aluminum alloy. The fittings shall be either hot-dip galvanized, polyvinyl chloride-coated, or aluminum alloy.

a. Hot-dip galvanizing shall conform to the requirements of ASTM A 153.

b. Polyvinyl chloride-coated material shall have the same polyvinyl chloride coating as the chain link mesh.

c. Aluminum alloy shall conform to the requirements of FS RR-F-00191.

4--Tension and Tie Wire:

a. Tension wire for steel fence shall be coil spring steel not less than 7 gage. The base material shall have a minimum tensile strength of 550 MPa with an aluminum coating applied at a rate of 122 g/m^2. of surface area.

Aluminum tension wire shall not be less than 6 gage 6061-T6 or 5052-H38 Aluminum Alloy.

b. Wire clamps for fastening fabric to line posts shall not be less than 6 gage. Tie wires or hog rings used to fasten the fabric to the top rail or tension wire shall be not less than 9 gage aluminum for aluminized or aluminum fabric fence and not less than 9 gage polyvinyl chloride coated steel wire for polyvinyl chloride fence.

Aluminized steel hog rings for aluminized fabric shall not be less than 11 gage.

5--Gates: Gates shall be of the same type of materials used for the chain link fence.

M.10.06--Vacant

M.10.07--Vacant

M.10.08--Three-Cable Guide Railing (I Beam Posts) and Anchorages: The materials for this work shall conform to the following requirements:

1--Wire Rope: Wire rope shall be class A, 19 mm in diameter, conforming to the requirements of AASHTO M 30.

2--Fittings: All fittings shall conform to the details as shown on the plans. Fittings shall be sufficiently strong to develop the full strength of a single cable or cable assembly, as the case may be.

Single Cable Assembly--Min. Tensile Strength = 112 kN.

Three-Cable Anchor Assembly--Min. Tensile Strength = 445 kN.

Other fittings shall be in accordance with standard commercial specifications, and shall be free from flaws or defects that would tend to impair their use or durability.

Material indicated as "Cast Steel" shall conform to the requirements of ASTM A 27. Grade [450-240] castings shall be furnished unless otherwise specified.

Material indicated as "Malleable Iron" shall conform to the requirements of ASTM A 47, Grade 24018.

All metal fittings required by the plans to be galvanized and all forged cast fittings shall be galvanized, after fabrication, to meet the requirements of ASTM A 153.

Hook bolts, as installed, shall develop an ultimate pull-open strength of from 2.3 kN to 4.5 kN applied in a direction normal to the longitudinal axis of the post.

3--Steel Posts and Post Plates: All steel posts and post plates shall conform to the requirements of ASTM A 36. Steel posts and post plates shall conform to the details shown on the plans as to size, shape and mass; and they shall be punched or drilled as indicated on the plans. After fabrication, all posts and post plates shall be galvanized to meet the requirements of ASTM A 123.

4--Anchorages: Anchorage shall be as shown on the plans. Where Class "A" concrete is specified, it shall conform to the requirements of Article M.03.01. Bar reinforcement shall conform to the requirements of Article M.06.01-1.

Anchorage angles, rods, hex nuts, washers and anchorage plates shall conform to the requirements of ASTM A 36. The angles, rods and top nuts and washers shall be galvanized in accordance with the requirements of ASTM A 153.