TABLE OF CONTENTS

PART 03000 - MATERIALS

Section 03010 - Fencing Materials

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Description

03010.00 Scope - This section consists of the test requirements, specifications and tolerances for barbed wire, woven wire and chain link fabric, metal posts, braces, hardware, and gates.

Materials

03010.10 Barbed Wire - The barbed wire shall be two-strand and either 2.51 mm (12 1/2 gage) or 1.70 mm (15 1/2 gage) with four-point barbs spaced at 130 mm (5 inch) intervals conforming to the requirements of AASHTO M 280 (ASTM A 121). Galvanizing shall be Class 3.

All barbed wire installed on the Project shall be new or like new, and the same diameter unless otherwise approved.

03010.20 Woven Wire Fabric - The woven wire fabric shall be 2.51 mm (12 1/2 gage) galvanized steel wire conforming to the requirements of AASHTO M 279 (ASTM A 116), Class 3 coating or 3.05 mm (11 gage) or 2.51 mm (12 1/2 gage) aluminum coated steel wire conforming to the applicable requirements of ASTM A 584. The 2.51 mm (12 1/2 gage) aluminum coated steel wire shall have the same coating thickness required for 3.05 mm (11 gage) steel wire in Table 2 of ASTM A 584.

03010.30 Chain Link Fabric, Ties, and Tension Wire - Chain link fabric, ties, and tension wire shall conform to the requirements of AASHTO M 181 supplemented and modified as follows:

- Fabric may be zinc-coated steel meeting Type I, Class D coating requirement, aluminum-coated steel, or aluminum alloy. Use only one type on any Project.
- Wire fabric ties, wire ties, and hog rings may be zinc-coated steel wire, aluminum-coated steel, or aluminum alloy as elected, regardless of the type of wire fabric used.
- Use ductile, zinc-coated steel meeting the coating requirements of ASTM A 641/A 641M, Class 1 for wire fabric ties, wire ties, and hog rings. Aluminum-coated steel wire fabric ties, wire ties and hog rings shall be coated with at least 90 g/m^2 (0.30 ounce per square foot).
- Tension wire shall have a Class 2 coating.
- Fabric for the fence to be installed with pickets shall be 3.76 mm (9 gage) wire woven in 90 mm by 140 mm (3 1/2 inch by 5 1/2 inch) diamond mesh. Top and bottom selvage shall be knuckled finish.

03010.31 Pickets - Pickets shall be either standard Grade A redwood or cedar pickets, 9 mm x 65 mm x 1.8 m (3/8" x 2 1/2" x 6'), or industry standard metal, or plastic pickets as shown or approved.

03010.40 Vinyl Clad Fabric - Vinyl clad chain link fabric shall conform to AASHTO M 181, Type IV. The color of the PVC coating shall be either medium or dark green.

03010.50 Metal Fence Posts, Braces, and Appurtenances - Metal fence posts, braces and appurtenances shall conform to the requirements indicated on the plans and the following:

(a) Painted Metal Posts - All painted metal posts shall be of the same kind and color.

(b) Posts, Braces, and Appurtenances for Chain Link Fence - Posts, braces, and appurtenances for chain link fence shall conform to the requirements of AASHTO M 181.

Posts for bridge protective fence shall be galvanized and conform to the requirements of ASTM A 53/A 53M, Grade B. Braces and appurtenances for bridge protective fence shall conform to the requirements of AASHTO M 181.

(c) Posts, Braces, and Appurtenances for Barbed Wire and Woven Wire Fence:

(1) Tubular Steel Posts - Tubular steel posts, braces and appurtenances shall conform to the requirements of AASHTO M 181. Tubular posts shall be fitted with a snug-fitting, galvanized metal cap.

(2) Other Shapes - Metal posts and braces, other than tubular shape, for barbed wire and woven wire fences, shall conform to AASHTO M 281 (ASTM A 702), except that galvanizing may conform to the requirements of AASHTO M 111M/M 111 (ASTM A 123/A 123M). The posts and braces may be either galvanized or painted, as elected. Wire fasteners shall meet the coating requirements of ASTM A 641/A 641M, Class 1.

(3) Fence Stays, Brace Guys, and Wire Loops - Metal fence stays, brace guy wires, wire loops for gateways and other miscellaneous wire used in barbed and woven wire fences shall be furnished with Class 1 coating as required by ASTM A 641/A 641M. Either 3.61 mm (9 1/2 gage) or 3.43 mm (10 gage) wire is acceptable for fence stays.

(d) Concrete In Footings - Concrete for footings shall conform to Section 00440.

(e) Grounding Rod - 16 mm by 2.4 m (5/8 inch by 8 foot), nonrusting, copper covered steel rod with a bronze grounding wire clamp.

(f) Grounding Wire - AWG 4/0 Solid Copper or No. 6 bare aluminum wire with clamps.

03010.60 Fence Gates:

(a) General - Tubular steel gate frames shall conform to AASHTO M 181. Fabric in gates used with chain link fence shall be chain link of the same gauge and conforming to applicable requirements of 03010.30. Fabric in gates used with woven wire fence shall be woven wire fabric conforming to 03010.20 or chain link fabric conforming to the applicable requirements of 03010.30, except that the zinc coating may be either Class C or Class D.

(b) Hardware - All fence and gate hardware shall conform to the requirements of AASHTO M 181, except that the thickness of galvanizing shall be according to AASHTO M 232M/M 232 (ASTM A 153/A 153M).

03010.70 Rock Protection Fences and Slope Protection Mat:

(a) Concrete in Footings and Anchors - The concrete for footings and anchors shall conform to requirements of Section 00440.

(b) Posts and Braces - Fence posts and braces for the rock protection fence shall be 90 mm (3 1/2 inch) nominal (100 mm (4 inch) outside diameter) pipe size, Schedule 40, hot-dip galvanized steel pipe conforming to ASTM A 53/A 53M Grade B. The posts shall have a hot-dip galvanized steel post cap securely mounted on the top, or be capped with a 6 mm (1/4 inch) steel plate welded in place to completely close the top of the post. Repair all cutting, welding and drilling as well as other damage to the galvanizing according to 02420.10(d).

(c) Cable - Cable shall be 9 mm (3/8 inch) diameter, 6x19 classification, galvanized wire rope with independent wire rope core made from extra improved plow steel. It shall have a minimum zinc coating of 60 g/m^2 (0.20 ounce per square foot) on all wires, and a minimum breaking force of 57.8 kN (13,000 pounds).

Submit a 2.4 m (8 foot) long sample of the cable for testing.

(d) Hardware - All rings shall be drop-forged steel, heat treated after forging. Lightweight wire rope thimbles weighing approximately 6.2 kg (13.8 pounds) per hundred shall be used with the 9 mm (3/8 inch) diameter cable. Galvanize all rings, thimbles, wire rope clips and U-bolts according to AASHTO M 232M/M 232 (ASTM A 153/A 153M), Class C, except castings shall be Class A and forgings shall be Class B.

(e) Anchor Rods, Post Anchor Rods and Tie Rods - All rods shall be manufactured from steel meeting the requirements of ASTM A 36/A 36M and be galvanized according to AASHTO M 232M/M 232 (ASTM A 153/A 153M). The eye of the rod may be drop forged or formed with a full penetration weld and shall develop 100% of the rod strength. Repair any damaged galvanizing according to 02420.10(d).

Post anchor rods and tie rods shall be sized as shown, and be continuously threaded. The dimensions shall be as shown on the plans, except the length of the tie rods shall be designated by the Engineer for each individual location as dictated by the slope at that location.

(f) Hook Bolts and Spacer Blocks - The hook bolts shall conform to the dimensions shown on the plans, be manufactured from steel meeting the requirements of ASTM A 36/A 36M, and be hot-dip galvanized according to AASHTO M 232M/M 232 (ASTM A 153/A 153M) after bending and threading. Fabricate spacer blocks to the dimensions shown and hot-dip galvanize according to AASHTO M 232M/M 232 (ASTM A 153/A 153M) after complete fabrication.

(g) Spring Anchorage Assemblies - Construct spring anchorage assemblies at both ends of each run of rock protection fence, except for barrier mounted fence. The anchorage assembly shall consist of anchor, anchor rod, anchor spring, spring holder, turnbuckle, wire rope clips and wire rope thimble. Hot-dip galvanize all components of the spring anchorage assembly, except the anchor spring, according to AASHTO M 232M/M 232 (ASTM A 153/A 153M). Repair any damaged galvanizing according to 02420.10(d).

- **Concrete Anchors** - Concrete anchors may be precast or cast-in-place.

- **Anchor Rod** - Size the anchor rod as shown and manufacture from steel meeting the requirements of ASTM A 36/A 36M.

- **Anchor Spring** - The anchor spring shall be a helical, flat ended steel spring meeting the requirements of ASTM A 125. The spring shall have a free length of approximately 230 mm (9 inches) with a 28.5 mm (1 1/8 inch) pitch and shall develop a minimum compressed strength of 26.6 kN (6,000 pounds). Furnish a test results certificate according to 00165.35 verifying the anchor spring conforms to ASTM A 125.

- **Spring Holder** - The spring holder shall consist of a cast-iron spring washer, 25 mm (1 inch) thick steel plate, four 19 mm (3/4 inch) bolts conforming to ASTM A 307 or SAE Grade 5, and a 19 mm (3/4 inch) eye bolt and bolt turnbuckle with 200 mm (8 inch) take-up, all dimensioned and assembled as shown.

- **Wire Rope Clips** - Wire rope clips shall have an 11 mm (7/16 inch) diameter for use with 9 mm (3/8 inch) diameter cable.

- **Thimbles** - Thimbles shall be lightweight, wire rope thimbles for use with 9 mm (3/8 inch) diameter cable.

(h) Rock Bolt Post Foundations:

(1) Rock Bolts and Stop Type Couplings - Rock bolts shall be 19 mm (3/4 inch) diameter, continuously threaded, and include the expansion shell anchor complete with a keyhole bearing plate, grout tube, washer and nut. The rock bolts shall meet AASHTO M 31M/M 31 (ASTM A 615/A 615M), Grade 520 (70). All rock bolts shall have rolled threads.

All bolts shall be free of any coating except at the coupling end. The bolts shall be completely fabricated at the point of manufacture under controlled shop conditions.

Stop type couplings for connecting rock bolts to tie rods shall be 50 mm (2 inches) long and shall have a center stop so that each section is connected by an equal length of thread and shall be as strong as the bolt.

(2) Grout - All cement used in the grouting of rock bolts shall be Type III portland cement. The ratio of water to cement by mass (weight) shall be between 0.38 and 0.50. Add an approved fluidifying agent and commercial grade aluminum powder, or equal, to the grout in the proportion of 0.005% by mass (weight) of cement. Before injecting the grout, mix the mixture for a minimum time of three minutes by means of high-speed mechanical agitator and sieve through a 1.14 mm (0.045 inch) cloth sieve.

Use the grout as soon as possible after thoroughly mixing all ingredients, but in no event more than one hour after the addition of water to the cement, otherwise it shall be wasted. Use water meeting the requirements of Section 02020.

(3) Keyhole Plates, Washers, and Nuts - The keyhole plates, washers and nuts shall conform to ASTM F 432. The keyhole plates shall be 9 mm (3/8 inch) flat steel plates providing not less than 150 mm by 150 mm (6 inch by 6 inch) area for each bolt. Each keyhole plate shall be prefabricated with a 25 mm (1 inch) high, 9 mm (3/8 inch) thick post stabilizing collar. The beveled washers shall be steel or malleable iron. Machine washers shall be hardened steel. All nuts shall be the manufacturer's heavy-hexagonal type. Keyhole plates shall have provision for a grouting tube.

(4) Lubricant - Lubricant for threads shall be molybdenum disulfide grease.

(5) Threads of Bolts and Nuts - Protect the threads of bolts and nuts by a plastic tape or molded protector. Strip off just before installation.

(6) Grouting Accessories - Grout tubes, grout sealers and other grouting accessories for grouting rock bolts shall be of types recommended by the manufacturer and as approved.

(7) Tests - Test shall be made according to ASTM F 432 of the various parts that make up a rock bolt.

(8) Contractor Furnished Data - Furnish a test results certificate according to 00165.35 verifying conformance of the rock bolts to ASTM F 432.

(i) Gabion Wire Mesh Fabric - Use galvanized steel wire for gabion wire mesh fabric meeting the requirements of ASTM A 641/A 641M, with a nominal diameter of 3.05 mm (0.120 inch), Class 1 coating and a minimum tensile strength of 413 MPa (60,000 psi). Maximum mesh size shall be approximately 120 mm (4 3/4 inches) with triple twist and hexagonal shape.

(j) Hog Ring Fasteners - Fabricate hog ring fasteners from 3.76 mm (9 gage), zinc-coated steel wire conforming to AASHTO M 279 (ASTM A 116), Class 1.

03010.75 Protective Fence Materials, On and Off Structures - Provide certification according to the requirements of 00165.35 that the anchor system selected conforms to requirements shown on the plans.

- **Resin Bonded Anchor System** - The resin bonded anchor system used to install the fence post anchor rods in the concrete bridge rail shall be from the QPL and be installed according to the manufacturer's recommendations.

- **Posts** - Modify posts to attach to the structure as shown.

- **Steel Plates, Angles, and Bolts** - Steel plates, angles, and bolts shall meet the applicable requirements of Section 02530 and galvanized according to 02530.70.

- **Chain Link Fabric, Ties, and Tension Wire** - Chain link fabric, ties, and tension wire shall conform to the requirements of 03010.30.

- **Pickets** - Pickets shall meet the requirements of 03010.30.

03010.80 Acceptance - Acceptance of fencing materials will be according to 00165.35 and this Section.

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