WIRE ROPE SAFETY FENCE (WRSF) SPECIFICATIONS

1.0 Description

This specification covers all materials used in the installation of Wire Rope Safety Fence (WRSF) together with construction methods for installation.

2.0 General

The WRSF described by these specifications shall be of the four (4) rope type, capable of roadside or median mounting, meeting NCHRP 350 TL3. The manufacturer shall provide a FHWA letter of acceptance prior to approval. The type and design of the WRSF shall have been in use for a minimum of three (3) years and show proof thereof. Only designs which incorporate “interwoven” technology may be used whereby a minimum of three (3) of the four (4) ropes are each woven on alternating sides of sequential line posts for the entire segment length. Each rope beginning with the bottom rope is placed on the opposite side of the next higher rope.

3.0 Materials

All materials used in this construction shall comply with the following requirements:

3.1 Wire Rope

(a) The galvanized wire rope shall be ¾” (19mm) 3 x 7 construction meeting AASHTO M 30-92 (2000)/ASTM A741-98 Type 1 Class A coating except as modified below:

Table 1 Type 1 Breaking Strength Minimum = 39,000 pounds (17.7 tonnes)

(b) In addition to this provision, the wire rope shall be prestretched during manufacture to exhibit a minimum modulus of elasticity of 11,805,090 pounds/in². (8300 kg/mm²) after prestretching.

3.2 Fittings

(a) Threaded Terminals (swaged type) shall be furnished and may be shop or field swaged. Threaded terminals shall be Right Hand (RH) or Left Hand (LH) threaded M24 X 3 pitch to ANSI B1.13M.

The body of the threaded terminal shall provide a minimum of 5.9 inches (150 mm) wire rope engagement depth. Fully fitted ropes shall develop a Minimum Breaking Load (MBL) of 36,800 pounds (16.7 tonne.) Threaded terminals shall be galvanized, after threading, to ASTM A-153.

(b) Turnbuckle or Rigging Screws, as they are sometimes called, shall be of the size and shape as shown in the plans. One end of the rigging screw shall be threaded RH and the other end LH to ANSI B1.13M M24 X 3 to accept threaded rope terminals. Rigging screws shall be of the solid or closed body type with two (2) inspection holes to determine threaded rope terminal penetration. They shall allow for a minimum of six (6) inches (150mm) of penetration from each end. Rigging screws shall develop minimum tensile load without yielding to 36,800 pounds (16.7 tonne) and shall be galvanized to ASTM A-153 after threading.
(c) **Mechanical Anchor Fittings** shall be provided at the Standard End Terminal ends of each wire rope. They shall be of a cylindrical barrel design with an interior tapered bore into which the wire rope is inserted from the narrower end. A set of grooved wedges are inserted from the opposite end between the barrel and the wire rope. A cap is then screwed in place compressing a coil spring against the wedges preventing accidental release of the wedges while tension in the wire rope pulls the wedges tighter around the wire rope. This mechanical fitting shall be coated with Tufftride and Wax oil for protection. The mechanical fitting shall insure infinite adjustment along the wire rope for proper length and shall develop minimum tensile load of the entire wire rope of 36,800 pounds (16.7 tonne) without yielding. They shall be capable of release and reuse.

(d) **Tensile Rods with Combination Mechanical Fittings** shall be provided at the WRGT End Terminal ends of each wire rope. The combination mechanical fitting shall be of a cylindrical design into which the wire rope is inserted, and threaded to accept the tensile rod. The fitting shall insure proper adjustment of the wire rope for length and shall develop minimum tensile load of the entire wire rope of 36,800 pounds (16.7 tonne) without yielding. They shall be capable of release and reuse.

### 3.3 Line Post

(a) All posts shall be of the size and shape shown in the plans. Posts shall have rounded edges on the traffic approach side. They shall typically be available in a socketed version for use when a metal sleeve is installed in the ground for insertion of the post. They shall also be available, if specified, in a driven post version with a welded soil plate. All required welding shall be by Certified Welders to AWS D1.1. Posts and soil plates shall be ASTM A-36 steel galvanized to A-123, after fabrication. All posts shall have a means of holding the wire ropes at the design height without metal hooks or other metal hardware.

For socketed posts, a low-density polyethylene excluder profiled to fit tightly around the post shall be provided to prevent debris from entering the socket. All posts shall be furnished with a low density polyethylene post cap. If specified, the post cap shall be provided with retro-reflective sheeting properly sized to fit the traffic approach side of the post cap and meeting AASHTO M-268 Type Four (4) adhesive sheeting. Minimum size shall be 7.875/in$^2$. If so specified, plans shall indicate sheeting color, post pattern, and whether required on one or both sides of the cap.

When socketed posts are required, sockets conforming to the plans shall be provided. Sockets shall be fabricated from ten (10) gauge, hot rolled mild steel galvanized to ASTM A-123, after fabrication. An eight (8) inch diameter (200mm) reinforcing ring with four (4) inch (100mm) overlap made from number three (3) deformed rebar shall be furnished for installation in post concrete foundations as shown in the plans or this reinforcement may be formed as a box shape with approximately ten (10) inch (250mm) diagonal dimension and four (4) inch (100mm) overlap.

### 3.4 End Terminals

Two types shall be available; the Standard End Terminal for use outside the clear zone or if appropriately shielded from impact by traffic; and the WRGT End Terminal for use both within and outside the clear zone. The WRGT End Terminal is accepted by FHWA as meeting NCHRP-350 TL-3.

1. **Standard End Terminal**
   This end terminal incorporates two separate concrete foundations, each of which anchors two wire ropes, and includes two deflection posts placed in sockets which are set in concrete foundations.

(a) **Fabricated anchor frames and deflection posts with sockets** shall be of the size and shape as shown in the plans. Anchor frames and deflection posts shall be fabricated from materials meeting ASTM A-36 and galvanized after fabrication to A-123. All welding is to be per AWS D1.1. All deflection posts shall be placed in sockets set in concrete foundations.
(b) **Safety Check Ropes** shall be furnished for each of the ¾” (19mm) wire rope’s end anchor termination. Safety check ropes shall be 5/16” (8mm) galvanized 6 X 19 construction with eye terminals on each end. Each main wire rope is fed through one end of their respective safety check rope prior to end anchorage termination with mechanical fitting. The other end of the safety check rope is attached to the end anchorage by use of a screw pin shackle. Assembled safety check ropes shall develop minimum breaking load of 8,150 pounds (3.7 tonne).

(c) **Heavy Duty Steel Washers and HDPE Plastic Washers** shall be furnished at each slotted end anchor point. They shall be of the size and shape shown in the plans. Heavy steel washers shall be fabricated from ASTM A-36 material, galvanized after fabrication, to A-123.

2. **WRGT End Terminal**
   All four wire ropes of this NCHRP-350 complaint end terminal shall be anchored into one concrete foundation; four special posts placed in sockets set in concrete foundations shall be included.

(a) **Fabricated anchor components** shall be of the size and shape shown in the plans. The 4-slot breakaway anchorage frame assembly, reinforcing cage, posts and sockets shall be fabricated from materials meeting ASTM A-36 and galvanized after fabrication to A-123. All welding is to be per AWS D1.1. All posts shall be placed in sockets set in concrete foundations.

(b) **Heavy Duty Steel Washers and HDPE Plastic or Nylon Washers** shall be furnished at each slotted end anchor point. They shall be of the size and shape shown in the plans. Heavy steel washers shall be fabricated from ASTM A-36 material galvanized after fabrication to A-123.

(c) **FHWA Acceptance** letter shall be provided by the manufacturer.

3.5 **Concrete**

It is preferred that the concrete for end terminal foundations be placed in excavations of natural, undisturbed ground, to the size and shape shown in the plans. If over-excavation is unavoidable, then either extra concrete may be used to completely fill the excavation, or else the end terminal foundations shall be formed, cast, and backfilled per Agency specifications to minimum density of 95% after form removal. Cost for excavation, concrete, forming, and backfilling shall be included in the bid price for a complete & functional End Terminal.

All concrete used in the installation of the WRSF shall be 4,000 PSI meeting all requirements of Agency specifications. Refer to applicable sections of Portland cement concrete specifications.

4.0 **Construction Methods**

4.1 **Description**

This work consists of furnishing all labor, materials, equipment, and performing all operations in connection with the installation of a complete and operational WRSF.

4.2 **General**

The alignment and location of the WRSF shall be according to the plans or as directed by the Engineer. Extreme care shall be taken to insure proper wire rope height. Edge drop-offs and other depressions between edge of traveled way and WRSF shall be filled and the area graded smooth. Compacted earth, asphalt millings or other material may be used as directed by the Engineer. Posts shall be of the type specified and spaced as shown in the plans. Posts shall be set plumb, in line, to provide an aesthetically pleasing line of sight. Wire rope shall be placed per manufacturer’s recommendations and be tensioned.
immediately after initial installation. Tension shall be rechecked three (3) to five (5) days after initial tensioning on segment lengths over 2,500 feet (760m) and adjusted, if necessary. A tension log form shall be completed showing the time, date, location, ambient temperature, and final tension reading, signed by the person performing the tension reading. This log shall be furnished to the Engineer upon completion of work. This form shall also include the WRSF manufacturer’s recommended tension chart.

### 4.3 Basis of Acceptance

Basis of acceptance of the WRSF furnished shall be based on the following:

1. Prequalification as set forth under this specification, Section 2.0 above.
2. Visual inspection of all items furnished for condition and conformance with dimensional and other requirements.
3. Receipt of manufacturer’s certification and material test reports for wire rope, posts, and anchor frames.
4. Determination (at project site prior to installation) of the weight of galvanized coating by means of a magnetic gauge.

### 4.4 Method of Measurement

Unless otherwise specified by the Engineer, WRSF will be measured complete in place and the measurement will be in two (2) parts:

(a) The line post length of need section shall be measured to the nearest linear foot (meter), not including End Terminals on each segment. Unless specified otherwise in the contract documents, socket-type posts shall be used.

(b) WRSF End Terminal units, either Standard or WRGT, will be measured separately by the unit. One End Terminal unit is required for each end of the WRSF. The contract documents shall specify the type and number of end terminals being used.

### 4.5 Basis of Payment

Work completed, measured and accepted as provided above will be paid for at the contract unit price bid per linear foot (meter) for WRSF and per each WRSF End Terminal Unit. The price bid shall be full compensation for furnishing all material; for installing all posts with caps, wire rope and reflectors (if specified in plans); for excavation, concrete and backfill; and for all labor, equipment, tools, and incidentals necessary to complete the work. Payment will be made under:

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<tr>
<th>Description</th>
<th>Pay Unit</th>
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<tbody>
<tr>
<td>WRSF Socketed Line Post System</td>
<td>Linear Foot (Meter)</td>
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<tr>
<td>WRSF Driven Line Post System</td>
<td>Linear Foot (Meter)</td>
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<tr>
<td>WRSF End Terminal (Standard)</td>
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<td>WRSF End Terminal (WRGT)</td>
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