September 11, 2006

Special Provision

SECTION 02845 S

HIGH TENSION CABLE BARRIER

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Cable barrier materials and installation procedures.

1.2 RELATED SECTIONS

A. Section 02317: Structural Excavation

B. Section 03055: Portland Cement Concrete

C. Section 02324: Compaction

D. Section 02841: W-Beam Guardrail

1.3 REFERENCES

A. AASHTO M 30: Zinc coated Steel Wire Rope and Fittings for Highway Guardrail

B. AASHTO M 268: Retroreflective sheeting for Traffic Control

C. ASTM A-36: Standard Specification for Carbon Structural Steel

D. ASTM A500: Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

E. ASTM A1011: Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability

F. ASTM A-123 Standard Specifications for Zinc-Coated (Hot Dip Galvanized) Coatings on Iron and Steel Products

G. ASTM A741-98 (2003) Standard Specifications for Zinc-Coated Wire Rope and Fittings for Highway Guardrail

H. AWS D1.1: Structural Welding Code

I. NCHPR-350: Recommended Procedures for the Evaluation of Highway Features

PART 2 PRODUCTS

2.1 GENERAL

A. Provide cable barrier system with the following requirements:
   1. Capable of roadside or median mounting
   2. System meeting NCHRP-350 Test Level 3 on a 6H:1V or flatter slope.
   3. Maximum deflection of 8 feet under NCHRP 350 TL-3 conditions.
   4. NCHRP 350 approved terminals and transitions.
   5. Non-NCHRP-350 anchor.

B. Provide a socketed (pre-cast or cast-in-place concrete foundations) line post option or a driven sleeve line post option.

C. Provide all hardware and miscellaneous items associated with cable barrier system.

D. Receive pre-qualification prior to bidding system. Provide manufacturer's FHWA Letter of Acceptance(s).

E. Have system parts available within 48 hours of request.

F. Conduct manufacturer-supplied training, prior to the installation of the system.

2.2 MATERIALS

A. Wire Rope: Galvanized wire rope ¾ inch 3 x 7 construction meeting AASHTO M 30/ASTM A741-98 Type I Class A coating except Table 1 Type 1: Breaking Strength Minimum = 39,000 pounds.
   1. Wire rope is to manufacturer's specifications: pre-stretched ¾ inch 3 x 7. Pre-stretch wire rope during manufacturing to exhibit a minimum modulus of elasticity of 16,500,000-pounds/sq. in. after pre-stretching.
      a. If the wire rope is an out-sourced product of the cable barrier system manufacturer supply a separate certification from the wire rope manufacturer stating it meets the cable barrier manufacturer's requirements.

B. Hardware and miscellaneous items:
   1. Meet manufacturer's requirements for all hardware and miscellaneous items as outlined in the manufacturer's specifications for the installation of the cable barrier system. Items to include but not limited to the following:
      a. Anchor and terminal fittings
      b. Turnbuckles and rigging screws
      c. Post caps and sleeve caps
      d. Parts used to separate and hold cable barrier at designed height.

C. Line post, sleeve sockets and direct drive sleeve:
   1. Size as shown in manufacturer's specifications.
      a. Line posts.
         1) Meet all manufacturer's specifications.
         2) Posts as per ASTM A-1011 or ASTM A-36.
         3) Galvanized to ASTM A-123, after fabrication.
         4) Post has a means of holding the wire ropes at the design height.
      b. Line post sleeve.
         1) Meet all manufacturer's sleeve specifications for the selected post foundation option.
         2) Sleeves as per ASTM A-500.
         3) Welds as per Certified Welders to AWS D1.1.
         4) Galvanized to ASTM A-123, after fabrication.
   2. Line post foundations, cast in place with sleeve, precast concrete with cast in sleeve or direct driven sleeves.
      a. Cast in place post foundation option will require the complete filling of each excavated hole with concrete.
         1) Reinforcing steel as required by manufacturer.
         2) Do not use a tubular concrete form for casting of foundation.
      b. Pre-cast post foundations as per manufacturer's specifications.
         1) Excavated holes will require the area around the excavation to meet Standard Specification Section 02324 for compaction.
      c. Direct drive post sleeves with an industry standard approved method for driving post sleeve.
   3. Line Post delineation.
      a. Delineation using AASHTO M 268 Type III or greater retroreflective sheeting.
         1) Sheeting color: White or yellow, color to correspond with the adjacent edge line.
         2) Minimum size: 7 sq. in. per side (2" x 3½")
         3) Delineation required on both sides of post as per this section, 3.6, D.

D. Cable Barrier Terminals, Cable Barrier Transitions and Cable Barrier End Anchor:

1. Cable Barrier Terminals, Cable Barrier Transitions and Cable Barrier End Anchor will be of the size and shape required by the manufacturer and meet manufacturer's specifications.
    a. Cable Barrier Terminal: NCHRP-350 Approved
        1) Approved terminal using Cable Release Posts (CRP) (commonly referred to as the TTI Cable Anchor).
        2) Cable Barrier Terminal line posts with sleeve
        3) Object marker delineation using AASHTO M 268 Type III or greater retroreflective sheeting.
    b. Cable Barrier Approach Transition using w-beam.
        1) Approved w-beam guardrail to cable barrier transition.
        2) Meet Section 02841 for w-beam, post, blocks and hardware.
            (a) Meet manufacturer's requirements for w-beam, post, blocks and hardware when items required to meet approach transition design needs exceed UDOT requirements.
        3) Delineation using AASHTO M 268 Type III or greater retroreflective sheeting for terminal ends as per Standard Drawing CC-1.
    c. Cable Barrier Departure Transition using w-beam, thrie beam or a combination of:
        1) Approved departure transition from w-beam to cable barrier.
        2) Meet Section 02841 for w-beam, post, blocks and hardware.
            (a) Meet manufacturer's requirements for guardrail elements, post, blocks and hardware when items required to meet departure transition design needs exceed UDOT requirements.
        3) Delineate using AASHTO M 268 Type III or greater retroreflective sheeting for terminal ends as per Standard Drawings CC-1 and GW-9 .
    d. Non-NCHRP-350 Cable Anchor (dead-man anchor)
        1) Barrier protection for this end anchor is required when placed within 1.2 times the clear zone.
            (a) See plan set for offsets and required external barrier protection.
2. Terminals not described above must meet NCHRP-350 testing requirements and have FHWA Acceptance Letter issued. Obtain prior approval from the Division of Traffic & Safety before bidding terminal

E. Shop drawings, 4 sets, for the installation of the following:

1. Cable Barrier Terminal (NCHRP-350 approved)

2. Cable Barrier Approach Transition (NCHRP-350 approved)
3. Cable Barrier Departure Transition (NCHRP-350 approved)
4. Cable Barrier anchor terminal (non-NCHRP-350)
5. Typical installation of line posts and cable.

F. Training Materials
1. Installation manuals
2. Maintenance manuals
3. Materials deemed necessary to conduct training for proper installation and maintenance of cable barrier system.

PART 3 EXECUTION

3.1 TRAINING AND LITERATURE

A. Provide all training materials in hard copy and electronically in PDF format.

B. Notify and provide installation and maintenance training and certification.
1. Training conducted by the supplying manufacturer.
   a. Provide one training session prior to construction to the following:
      1) Contractor (Prime)
      2) Installation Contractor (Sub)
      3) Resident Engineer and/or designee.
   b. Provide one training session prior to UDOT accepting project and invite the following:
      1) Region Maintenance Engineer and/or designee
      2) Region Operations Engineer and/or designee
      3) District Engineer and/or designee
      4) Area Supervisor and/or designee
      5) Local Maintenance Station personnel
      6) Engineer for Maintenance (Complex) and/or designee
      7) Representative from the Division of Traffic and Safety
      8) FHWA-Utah Division representative
2. Provide 4 sets of shop drawings as stated in this section 2.2, F.
   a. Distribution
      1) Resident Engineer
      2) Prime Contractor
      3) Installation Contractor (sub)
      4) Local Maintenance Station

3.2 PREPARATION

A. Site considerations:
   1. Complete all grading to final grade requirements as per plan prior to installing cable barrier post foundations, terminals, transitions or anchor system.
   2. Apply a bare ground treatment 2 feet on each side of the cable system using Sahara Bare Ground Herbicide.
      a. Apply after cable barrier foundations have been installed and the excess material has been removed or graded into surrounding area.
      b. Follow product-labeling requirements for selected product.
      c. Apply herbicide at a rate of 10 pounds per acre.
      d. Have a license issued by the Utah Department of Agriculture for Right of Way application.

3.3 CONCRETE FOUNDATIONS AND DIRECT DRIVE REQUIREMENTS

A. Line posts
   1. Precast post foundation
      a. Supply as per manufacturer's specification.
      b. Install precast foundation as per manufacturer's specification.
      c. Install precast foundation to a point that the top of foundation is at final grade level.
      d. Excavate holes and backfill with excavated material. Compact material around the precast foundations to a minimum of 95 percent of maximum laboratory density refer to Section 02324. Dispose of excess material by removal or grade into surrounding area.
         1) Other methods of installing foundation will require approval from the Resident Engineer.
   2. Cast in place post foundation
      a. Excavate hole to diameter and depths as per manufacturer's specification.
         1) Do not over excavate hole.
         2) Install required reinforcing steel.
         3) Install post sleeve ½ to 1 inch above finished grade.
         4) Fill the excavated hole with concrete, dome concrete down from top of post sleeve to flush with finished grade.
            (a) Do not use a tubular concrete form for casting of foundation.
      b. Use AA(AE) concrete, refer to Section 3055.
      c. Allow concrete to cure a minimum of seven (7) days and to achieve 4000 psi before installing any other elements of the barrier system.
   3. Direct drive line post sleeve.
      a. Use an industry standard approved method for driving post sleeve.

1) Do not excavating hole for post sleeve.

b. Drive sleeve to a point ½ inch or less above finished grade.

1) Do not drive sleeve below finished grade.

B. Terminal, Anchor and Transitions

1. Supply and install cast in place NCHRP-350 approved terminal using Cable Release Posts (CRP) (commonly referred to as the TTI Cable Anchor), and terminal line post.

a. Excavate Cable Release Posts (CRP) holes and terminal line posts to diameter and depths as per cable manufacturer's specification.

1) Do not over excavate hole.

2) Install required reinforcing steel as per manufacturer's specifications.

3) Install Cable Release Post (CRP)

(a) Place bottom section of post in such a manner that top section of post can be attached and the bottom of the hinged portion is at finished grade level.

(b) Fill the excavated hole with concrete, ensure top of concrete is flush with final grade.

(c) Do not use a tubular concrete form for casting of foundation.

(c) Use AA(AE) concrete, refer to Section 3055.

(d) Allow concrete to cure a minimum of seven (7) days and to achieve 4000 psi before installing any other elements of terminal or barrier system.

4) Terminal line post

(a) Use post sleeve as per manufacturer's specification.

(b) Follow same installation procedure, and use same concrete material and allow same curing time as required in this Section, 3.3, A, 2.

C. Precast anchor (deadman anchor)

1. Supply and install precast anchor block as per manufacturer's specification.

a. Excavate hole and install anchor block, backfill with excavated material. Compact material around the precast anchor block to a minimum of 95 percent of maximum laboratory density refer to Section 02324. Dispose of excess material by removal or grade into surrounding area.

1) The top of the anchor block will be at the same grade and elevation as the three consecutive posts foundations approaching the anchor block.

2) Anchor block will not move more than 3 inches toward the opposite cable anchor or terminal during or after tensioning has been completed. If anchor block moves more than 3 inches it will be either removed and replaced with larger

block or secured such that no more decrease of cable tension occurs.

2. Supply and install anchor line posts with sleeves as required for anchor system to manufacturer's specification.
   a. Use post sleeve as per manufacturer's specification.
   b. Install required reinforcing steel as per manufacturer's specifications.
   c. Follow same installation procedure, and use same concrete material and allow same curing time as required in this Section, 3.3, A, 2.

D. Cast in place anchor (deadman anchor)
   1. Install as per manufacturer's specification.
      a. Excavate hole and form and cast in place anchor.
         1) Use AA(AE) concrete for anchor system, refer to Section 03055.
         2) Install reinforcing steel per cable manufacturer's requirements.
         3) Install hardware as per cable manufacturer's requirements for the attachment of cable.
         4) The top of the anchor block will be at the same grade and elevation as the three consecutive posts foundations approaching the anchor block.
      b. Allow concrete to cure a minimum of seven (7) days and to achieve 4000 psi before installing any other elements of the barrier system.
      c. Backfill with excavated material. Compact material around the cast in place anchor block to a minimum of 95 percent of maximum laboratory density refer to Section 02324. Dispose of excess material by removal or grade into surrounding area.
         1) Anchor block will not move more than 3 inches toward the opposite cable anchor or terminal during tensioning or after tensioning has been completed. If anchor block moves more than 3 inches it will be either removed and replaced with larger block or secured such that no more decrease of cable tension occurs.
   2. Install anchor line posts with sleeves and hardware for the attachment of cable as required for anchor system as per manufacturer's specification.
      a. Install foundations with post sleeves for anchor posts as per manufacturer's requirements.
         1) Follow same installation procedure, and use same concrete material and allow same curing time as required in this Section, 3.3, A, 2.

3.4 CABLE BARRIER TO GUARDRAIL TRANSITIONS

A. Cable Barrier Approach Transition using w-beam guardrail.
   1. Supply and install all components of cable barrier to w-beam approach transition to UDOT'S and manufacturer's specifications.
      a. W-beam guardrail elements will meet the standards and specifications of Section 02841 W-Beam Guardrail and be installed as per Standard Drawings BA 4 series. Use guardrail elements that the manufacturer of the cable barrier system requires to be greater than those specified under standard specification Section 02841 W-Beam Guardrail.

B. Cable Barrier Departure Transition
   1. Supply and install all components of approved cable barrier departure transition to UDOT'S and manufacturer's specifications.
      a. Guardrail elements will meet the standards and specifications of Section 02841 W-Beam Guardrail and be installed as per Standard Drawings BA 4 series. Use guardrail elements that the manufacturer of the cable barrier system requires to be greater than those specified under standard specification Section 02841 W-Beam Guardrail.

3.5 POST AND CABLE INSTALLATION

A. Install posts per manufacturer's requirements to insure proper cable height.
   1. Install sleeve cover.
   2. Install post caps.

B. Install cable per manufacturer's requirements.

C. Tension immediately after initial installation to manufacturer's requirements.
   1. Recheck and adjust tension five (5) days, ten (10) days and fifteen (15) days after initial tensioning.
   2. Maintain tension log showing time, date, location, ambient temperature, and final tension reading, signed by the person performing the tension reading.
   3. Give log to the Engineer after work is completed.
      a. Include manufacturer's recommended tension chart.

3.6 DELINEATION

A. Cable Release Posts Terminal (CRP) (commonly referred to as the TTI Cable Anchor).
   1. Install appropriate object marker sheet on all cable release posts in such a manner it is visible to approaching traffic.
      a. Use a minimum 120 sq. inches (5" x 24") per post.

b. Install delineation on post # 6 of the terminal line posts as per this Section, 3.6, D.

B. Cable Barrier Approach Transition
1. Install appropriate object marker sheet on terminal end as per Standard Drawing CC-1.
2. Install delineation on rail elements as per Standard Drawing GW 9.
a. Sheeting color: White or yellow, color to correspond with the adjacent edge line.

C. Cable Barrier Departure Transition
1. Install delineation on transition as per Standard Drawing GW-9.

D. Line Posts

1. Install appropriate sheeting on the first and last line post and every fourth post of barrier system.
a. Sheeting color: White or yellow, color to correspond with the adjacent edge line.
b. Place on both sides of post.
c. Use a minimum 7 sq. inches (2" x 3½") per side of post.

3.7 PART AND CONTACTS

A. Manufacturer of system will supply the following to the Maintenance Division of the Department no later than 5 days after projects acceptance
1. Installation details and parts list of system. (4 sets)
a) Distribution to Central Maintenance, Region/District Maintenance Engineer, Maintenance Area Supervisor, and Maintenance Station Foreman
2. List of suppliers of repair parts, with contact information.
3. Supply parts directly to the Maintenance Division within 48 hours of notification of need.
4. List of Utah based, manufacturer trained installers.

END OF SECTION