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ROADWAY DESIGN BULLETIN 07-08

DATE: October 25, 2007

TO: District Design Engineers, Plans Preparation Manual Holders

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COPIES: Lora Hollingsworth, Brian Blanchard, Tim Lattner, Robert Robertson, Duane Brautigam, Lap Hoang, Chris Richter, FHWA

SUBJECT: High Tension Cable Barriers

INTENT

Developmental Specification 540 High Tension Cable Barrier System has been developed. This specification is for use until the Department has issued both standard specifications with QPL requirements and design standards for these systems. The intent of this bulletin is to provide interim guidance for the design and use of High Tension Cable Barrier systems.

OVERVIEW

High tension cable barrier is a flexible barrier system that can be used on a roadside or as a median barrier. It should be noted that high tension cable barriers are a relatively new type of cable barrier system and should not be confused with the non-proprietary low tension three-strand cable system that has been used for many years in a number of states. The low tension system was never adopted for use in Florida for a number of reasons, including maintenance concerns.

High tension cable barriers typically consist of 3 or 4 pre-stretched galvanized cables supported by break away galvanized steel posts. High tension cable barrier systems require greater deflection space than guardrail and concrete barrier but where adequate deflection space is available, these systems offer several advantages for consideration. The primary advantage of high tension cable barrier is that it provides effective vehicle containment and redirection while imposing the lowest deceleration forces on the vehicle's occupants. In many cases, the cables are maintained at proper height after a collision and are able to contain and redirect other vehicles that may impact the same area prior to replacement of damaged posts. Initial cost of the

high tension cable barrier is also less than other barrier options. High tension cable barrier is often considered more aesthetically pleasing in that it does not present a visual barrier along the roadway.

Maintenance is a consideration because routine maintenance is necessary to maintain tension in the cables and even small (nuisance) hits will require repair. However, these repairs are often achieved with minimal manpower and equipment. Presently, all the high tension cable barrier systems are proprietary. While all use the same type of cable, each use a different post design, different mounting hardware, and different cable mounting heights and spacing. Therefore, the posts and hardware used in one system are not interchangeable with posts and hardware used in other systems.

The cable barrier system is composed of a basic length of need (LON) section with the cables supported at the design height, end anchors at each end of the run of cable and transition sections between the LON cable and the anchors.

LENGTH OF A RUN (SEGMENT)

Due to the length needed for transition sections from end anchors to the standard cable section, cable barriers are not well suited for short barrier runs. The minimum length of a run should be about 1000 feet. In the beginning, some of the manufacturers were limiting maximum runs to about 10,000 feet. Their position now is that they see no practical reason to limit the length of a run.

When establishing the length of cable runs on a project, the designer should consider the location (existing or future) of median crossovers for emergency use. Current policy is that emergency crossovers should not be greater than 5 miles apart. Length of run should also consider the location of overpass piers and other structures that conflict with the system performance.

CABLE ANCHORS

There are three options for cable system end anchorages – concrete deadman, guardrail attachment and crashworthy.

Concrete deadman anchors must be placed outside the clear zone or behind another crashworthy barrier such as guardrail. The end anchor should be at least 75 feet from the end of a guardrail approach end anchor and should allow a minimum of 10 feet of separation between the guardrail end anchorage and the cable barrier.

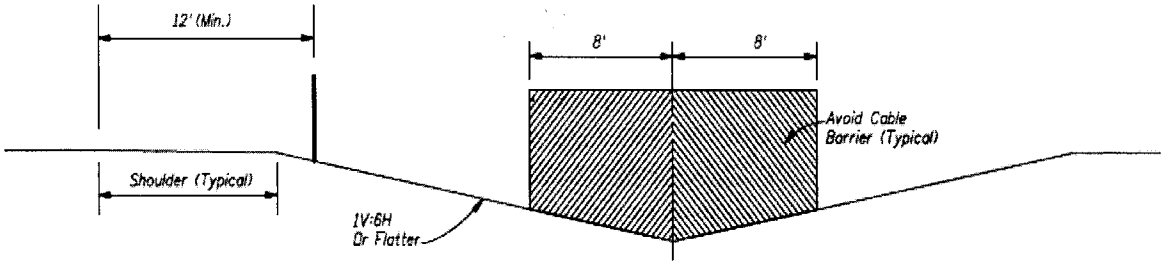
Currently cable barrier to guardrail anchors have been accepted by FHWA for the CASS (Trinity), Brifen, Nucor Marion and Gibraltar systems. Each system was accepted based on specific post spacing in the approach to the guardrail anchorage.

Also, each of the five cable barrier systems currently has an accepted crashworthy end treatment. When hit head-on, these terminals release the cables, preventing the vehicle from ramping up on the cable and possible overturning.

CABLE BARRIER PLACEMENT

When cable barriers are placed to shield roadside hazards, the length of need for both approach end and trailing end should be addressed in a similar manner as with guardrail. Since the length of need point on the cable system varies by manufacturer, the length of need point should be indicated on the plans and allow the end anchor location to be adjusted in the field to ensure that adequate protection is provided for the hazard.

Cable barriers may be installed on shoulders or on slopes up to 1V:6H, at a minimum 12 foot offset from the travel lane. Placement on slopes steeper than 1V:6H must be approved by the State Roadway Design Engineer. When placed on median slopes, the cable barrier should not be placed in the region eight feet up the slope from the center V. A vehicle's suspension is compressed when it hits the bottom of the ditch and the front bumper may not recover to the bottom cable height within this area.

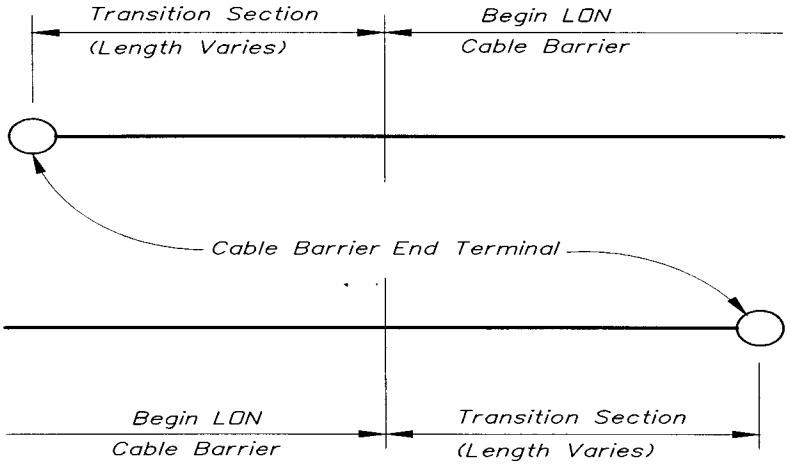


Care should be exercised when placing barriers in superelevated sections. (See the Roadside Design Guide, Section 5.6 for roadside barriers and Section 6.6 for median barriers). The primary objective is to place the barriers for optimum containment of errant vehicles.

The vertical alignment of the system is essential since the location of the bottom cable with respect to the ground is crucial to capturing smaller vehicles. Special attention should be placed on sag vertical alignments. The cables and/or posts placed in sockets are free standing (not held down by the system) and will come to a taut elevation between two tangent points when the cable is tensioned, creating a larger distance from the ground line to the bottom cable than allowed by the manufacturer's installation manual. Grading may be required to ensure a consistent height of the barrier above the ground.

The placement of the system should also take into consideration the drainage facilities located in the median. Cross drainage structures with less than 36 inches cover pose a challenge for placing posts. Structures of less than 16 feet can be spanned and construction of runs of cable should take these structures into account prior to setting post locations.

When ending a run of cable barrier, the cable barrier terminals should be located, when possible, behind some protection, such as guardrail at the end of bridges. The crashworthy terminals are NCHRP 350 crash tested and accepted, and can be placed in locations with no protection, but since they provide the anchorage for the cable barrier system, protecting them from possible hits is recommended. These terminals are also gating (meaning they will not prevent a vehicle from going through). When switching the cable barrier from one side of the median to the other and the terminals are not protected, overlapping the runs of cable barrier is recommended to provide adequate protection from possible crossovers.



DEFLECTION

The design plans should specify the deflection to be allowed for the project. Normally, a maximum deflection of 8 feet should be considered.

Cable barrier systems deflection is based on it being installed along a tangent or when struck on the "concave" side (from inside) of a curve. When the cable is struck on the "convex" side (from the outside) of a curve, the barrier must deflect enough to develop a "concave" condition. In order to minimize the length over which this occurs, closer post spacing through curves is recommended. Placement of median barrier on the convex side of curves should be considered to allow maximum median availability for deflection.

RECOMMENDED CURVE ADJUSTMENT	
Radius (ft.)	Post Spacing
650 - 2500	6'- 8''
2501 - 5500	10'
> 5500	Normal Spacing

If an obstruction currently protected by guardrail is located within a run of cable barrier and there is a minimum of 12 feet clear from the cable barrier to the obstruction, the guardrail may be removed. If there is less than 12 feet clear from the cable barrier to the obstruction a determination must be made on the proper treatment. Options include terminating the cable with a cable anchor system; terminating the cable with a cable to guardrail anchor; or continuing the cable with a reduced post spacing to reduce the deflection distance. If the latter option is selected, the reduced deflection area should extend sufficiently prior to the hazard to insure protection (see Length of Advancement, Index 400).

SOILS

Soil parameters for the design of post and end terminal footings are given in the specification for cable barriers. Where cable barriers are to be placed on the roadway shoulder, no soil borings will be required.

Where the cable barrier is to be placed beyond the shoulder point (in the median or outside the roadway) obtain 20 foot deep soil borings in the vicinity of each proposed end terminal to verify that the existing soil is equal to or stronger than the soil parameters given in the specification. In addition to the soil borings at the end anchors, a geotechnical assessment of the soils along the cable barrier alignment between the anchor locations shall occur. This may be done using any of the normal preliminary investigation methods (topographic maps, aerial photos, geological maps and reports, etc.) as well as original roadway plans. As a minimum, a visual assessment in the field is required. Areas that appear to have high organic content or that are saturated for extended periods should be investigated by taking site specific borings as needed.

Record the soils data location and content in the plans.

MOW STRIP

Unless determined otherwise by the District, place a 2" thick by 3' wide miscellaneous asphalt mow strip under the cable barrier, similar to that used for guardrail. The mow strip should be centered along the cable barrier alignment. Since no standard index drawings have been issued at this time, the mow strip must be detailed in the plans. Payment for the mow strip will be made under the miscellaneous asphalt pay item.

UTILITIES

Horizontal alignment and lateral placement of the cable may be affected by the presence of utilities. This is especially true in the vicinity of end anchors. The designer should follow the Plans Preparation Manual guidance on identifying utilities within the project and the quality level of utility locates required.

PAY ITEM

Pay item 904-540-1 has been established for the high tension cable barrier system.

STATEWIDE WORK PLAN FOR CABLE BARRIERS

Cable barrier projects proposed on Federal Aid facilities must be added to the Statewide Work Plan for Incorporating Experimental High Tension Cable Barriers on Federal Aid Projects in Florida. The Work Plan includes general language for all cable barrier projects and individual projects are added by Addendum. The Addendum gives the specifics of the project being added.

OTHER CONSIDERATIONS

The manufacturers of the high tension cable barrier systems are continuing to test and make modifications to their systems in an ongoing basis. Together with experience gained in field installations, it is reasonable to expect that additional changes and guidance will be forthcoming.

Questions related to use and placement of high tension cable barrier systems may be directed to the State Roadway Design Engineer.