Technical Circular T-02/13
August 7, 2013

To: All HQ Directors: Operations, Planning and Major Projects
All Regional Directors
All Regional Managers, Engineering
All Regional Traffic Engineers
All District Managers Transportation
All Project Managers

Subject: Cable Barrier

Purpose:

This Technical Circular replaces Technical Circular T-09/09 Cable Barrier. This revised Technical Circular establishes updated crash test requirements for cable barrier as well as updated design guidelines for general cable barrier placement as outlined in Technical Bulletin DS13001.

Background:

A cable barrier system consists of tensioned wire ropes supported by frangible posts with, as a minimum, anchors at both ends of the system. The kinetic energy of the impacting vehicle is absorbed by the wire ropes to reduce impact acceleration to vehicle occupants.

The open design of cable barrier minimizes the visual obstruction that other barriers can present, reduces the accumulation of drifting snow along the roadway and provides better sight distance for roads with curvilinear alignment.

The average time for repair after a crash is approximately 1.5 to 2 hours for a 3-person crew.

Cable barrier has been proven to effectively prevent median cross over crashes and off-road crashes. Studies in Washington State and North Carolina have shown that Cable Barrier can reduce highway fatalities and injuries substantially compared to other types of median barriers. Most States that have installed cable median barriers report a decrease in cross-median crash fatalities of 90 percent or more.

Policy:

A 4-cable barrier system may be considered as one of the treatment options for median and roadside barrier in accordance with Technical Bulletin DS13001 (attached to this Technical Circular). The Technical Bulletin contains information on general cable barrier placement guidelines for medians and roadsides.

For median applications, the cable barrier must meet the crash test requirements of either the **Manual for Assessing Safety Hardware (MASH) or National Cooperative Highway Research Program (NCHRP) Report 350** Test Level 4. For roadside applications, the cable barrier must meet the crash test requirements of either **MASH** or **NCHRP Report 350** Test Level 3.

Each cable barrier design is unique to its location and therefore each design must have an Engineer of Record (EOR). Upon completion of the final design, and prior to construction, the EOR shall execute and submit to the Ministry Representative an original of the "Assurance of Professional Design and Commitment for Field Reviews" form H1252, including Schedule A- Summary of Design and Field Review Assignments, specimen attached. The forms are located at:

H1252 -http://www.th.gov.bc.ca/forms/getForm.aspx?formId=1107
Schedule A -http://gww.th.gov.bc.ca/forms/getForm.aspx?formId=1110

Upon construction completion, the EOR will execute and submit to the Ministry Representative an original of the "Assurance of Field Reviews and Compliance" form H1254, specimen attached. The form is located at http://www.th.gov.bc.ca/forms/getForm.aspx?formId=1105.

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Subject: Cable Barrier (Median and Roadside)

Date: August 7, 2013	**Author**: Joy Sengupta, P.Eng.
Bulletin Number: DS13001 **Bulletin Type**: Revised Standard	**Action Required**: Immediate **Effective Date**: August 7, 2013
Contacts	**Standards Affected**
Joy Sengupta, P.Eng. Senior Highway Safety Engineer Engineering Branch, Victoria Phone: 250-356-5292	Replaces previous Technical Bulletin DS09001 and supplements Technical Circular T-02/13. Insert at the back of Section 640 of the BC Supplement to TAC.

1. Background:

Cable barrier system consists of tensioned galvanised steel wire ropes and support posts with anchors at both ends of the system. The wire rope is held in place by frangible support posts with a concrete foundation. The kinetic energy of the impacting vehicle is absorbed by the wire ropes which reduces impact acceleration to vehicle occupants.

Cable barrier has been used for several years worldwide to effectively reduce off-road and median crossover crashes. It minimizes view obstruction and improves stopping sight distance on highways. The cost of installation is comparable and for longer installations it may be less than the cost of installing concrete median barriers or W-beam guardrails.

Crash test results have shown that the typical wire rope deflection is approximately 2.5 m for a 3.0 m typical post spacing. The deflection can be reduced by using a tighter post and anchor spacing.

Median cable barrier products must meet the **Manual for Assessing Safety Hardware (MASH) or National Cooperative Highway Research Program (NCHRP) Report 350 Test Level 4** evaluation criteria. Note, the Ministry's current 810 mm high concrete median barrier meets the Test Level 4 design specification. Roadside cable barrier products must meet **MASH or NCHRP Report 350 Test Level 3**.

2. Basic Criteria:

- A 4-cable barrier system may be considered as a treatment option, similar to concrete and steel barriers, for median and roadside. However, a cable barrier may be the preferred option under the following situations:

1. On highway sections with curvilinear alignment to improve stopping sight distance.
2. On scenic routes to minimize view obstruction.
3. At locations where drifting snow creates a hazard.

- Cable barrier should NOT be considered as a Median Barrier when:
  1. The distance behind the cable barrier available for cable deflection upon crashes is less than the minimum space specified in the vendor's design guideline.
  2. The radius of horizontal curve of a road section is lower than the minimum radius specified in the vendor's design guideline.
  3. The radius of curve of a vertical sag of a road section is lower than the minimum k-value specified in the vendor's design guideline.

- Cable barrier should NOT be used as a Roadside Barrier where the soil or rock condition does not provide sufficient stability to hold the concrete foundation of the supporting posts in place under vehicle impact. Consult with the vendor for details.
- Locations need to be evaluated carefully to determine if cable barrier is the appropriate barrier treatment. Contact the MoT Sr. Highway Safety Engineer if additional guidance is needed.
- As the cost of installation of end anchors is relatively high, the length of cable required needs to be evaluated carefully to determine if cable barrier is a cost-effective barrier treatment option.
- All projects that involve cable barrier should be submitted for ICBC Cost-Sharing evaluation.

3. Application Guidelines and Restrictions

- Cable barrier may be used as:
  1. Median Barrier
  2. Roadside Barrier

- An engineering review is required when considering using cable barrier on Highway Segments with the following physical characteristics:
  1. On highways with narrow median.
  2. On the center line of undivided highway sections.
  3. On a horizontal alignment with a small radius of curve. Typical minimum value is 200 m. Contact the vendor for more detail.
  4. On a sag vertical alignment with a small k-value.

4. Design Guidelines:

- Cable barrier placement guidelines shall be in accordance with *NCHRP Report 711 - Guidance for the Selection, Use, and Maintenance of Cable Barrier Systems*, Chapter 6, Section 6.3. For systems that do not meet NCHRP Report 711 placement guidelines, the Ministry will require FHWA acceptance of the product for the specific median profile and specific barrier system.
- Cable deflection shall be designed to prevent intrusion of opposing vehicles into the travel lane caused by the back-side impact to the cable system after crossing the median.
- Design deflection distances noted by each manufacturer are based on the deflection that resulted from the MASH or NCHRP Report 350 test at 100 km/h, 25° impact angle with a pickup truck impacting a cable barrier with specific post and end-anchor spacings. In the field, deflections can be greater depending on the specific impact conditions that occur and the installation setup. Individual manufacturers should ensure that plots are available showing the effects of end-anchor and post spacings on barrier deflection. The figure shown below is an example plot taken from NCHRP Report 711.

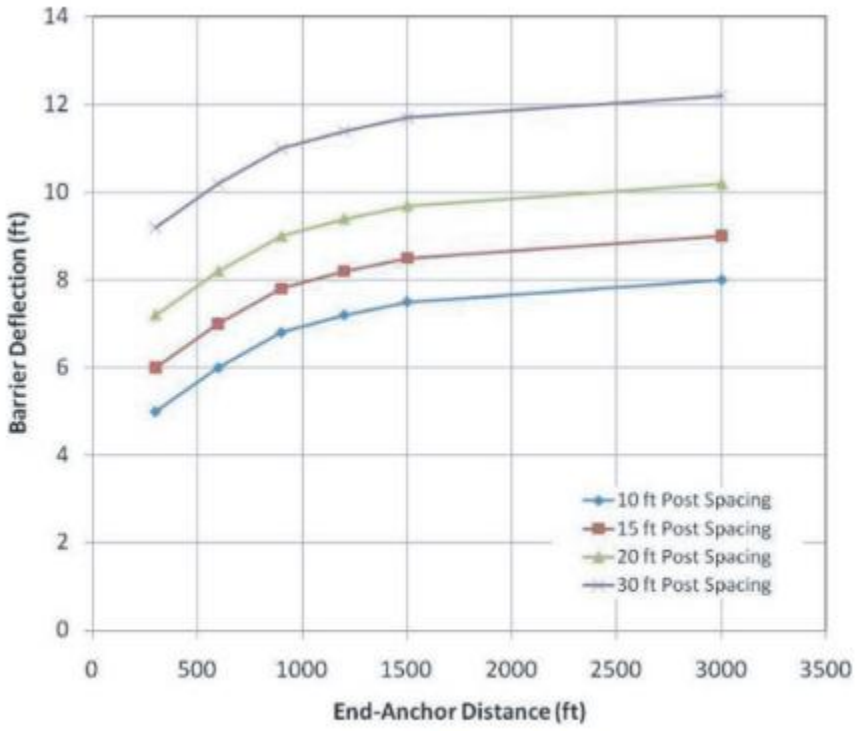

Figure 6.5. Hypothetical plot of barrier deflection vs. end-anchor and post spacings.

- Cable barrier products have substantial differences in design, specification and method of installation. Consult with the vendor for design details and specifications (i.e. end-anchor spacing, post spacing, clearance from road shoulders, clearance from drop-off, barrier

application on steep slope, concrete foundation design, flared end treatment, transition between different types of barriers, typical length of barrier, cable tensioning, etc.).

- End anchors should be designed based upon an analysis of the soil where the cable barrier will be placed. Based on the soil data and climate information, static and dynamic geotechnical analyses or testing should be performed to determine the appropriate size for the end anchor.
- Experience from other jurisdictions indicates that heavy accumulation of snow behind the cable barrier may bend the frangible supporting posts when it settles. An engineering review is required when considering using cable barrier in areas with heavy snow accumulation.
- Cable barrier should NOT be connected directly to any other safety barrier or bridge parapet. However, the cable barrier can be interfaced with other types of barrier when installed in accordance with the details specified by the vendors and adequate performance is achieved.
- The cable barrier shall be installed on socketed posts with concrete foundations adequate for existing soil and climate condition. The concrete post foundation shall be of sufficient size to ensure that it is not damaged or displaced when the post is knocked down under vehicle impact. Consult with the vendor for design details.
- A sleeve shall be used in the socket of a concrete post foundation to facilitate removal of a damaged post. Consult with the vendor for design details.
- For median cable barrier, retro-reflective delineators should be installed every 12.5 m on top of the support post caps.
- For roadside cable barrier, retro-reflective delineators should be installed every 25 m on top of the support post caps.
- An engineering review is required when considering the use of cable barrier in a manner that does not conform to the specifications in the vendor's design guideline. Contact the MoT Sr. Highway Safety Engineer if additional guidance is needed.

5. Action:

Insert this Technical Bulletin in the *BC Supplement to TAC Geometric Design Guide* following Section 640.

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