

To: All HQ Directors: Operations, Planning & Major Projects
All Regional Directors and Project Managers
All District Highway Managers
All Engineering Branch Section Heads
All Regional Managers of Professional Services/Engineering
All Regional Managers, Rehab. & Maintenance Service

Subject: **Wire Rope Safety Fence (WRSF)**

Purpose:

The purpose of this Technical Circular is to establish the inclusion of Wire Rope Safety Fence as a treatment option for road safety barrier.

Background and Benefits:

A WRSF system consists of tensioned wire ropes supported by frangible posts with anchors at both ends of the system as a minimum. The kinetic energy of the impacting vehicle is absorbed by both the wire ropes and the frangible posts to reduce impact acceleration to vehicle occupants. The WRSF must meet the requirements of NCHRP Report 350 Test Level 3.

The open design of WRSF 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 a normal repair after a crash is approximately 1.5 to 2 hours for a 3-person crew.

Wire rope safety fence has been proven to effectively prevent median cross over crashes and off-road crashes. Studies from South Carolina Department of Transportation have shown that WRSF can reduce highway fatalities by 30%. Reports from the Colorado Department of Transportation and Australian transportation authorities concluded that the number of fatal accidents have been significantly reduced since the installation of wire rope safety fence.

Policy:

Wire Rope Safety Fence may be considered as one of the treatment options for median and roadside barrier on rural and urban highways, in accordance with Technical Bulletin DS04004, attached to this Technical Circular.

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Attachments:

Technical Bulletin DS04004 Wire Rope Safety Fence

Subject: Wire Rope Safety Fence (Medians and Roadsides)	
Date: December. 6, 2004	Author: Mandy Lo, EIT
Bulletin Number: DS04004	Action Required: Immediate
Bulletin Type: New Standard	Effective Date:
Contacts	Standards Affected
Richard Voyer, P.Eng. Senior Geometric Standard & Design Engineer Engineering Branch, Victoria (250) 387-7761 Darwin Tyacke, AScT Senior Geometric Standards Technologist Engineering Branch, Victoria (250) 356-7928	Add to Safety Elements Chapter, Tab 600, at the back of Section 630.

1. Background:

A Wire Rope Safety Fence (WRSF) 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. (Figure A, Page 5) The kinetic energy of the impacting vehicle is absorbed by both the wire ropes and the frangible posts which reduces impact acceleration to vehicle occupants.

WRSF has been used for several years worldwide. Example of typical applications is shown on Figure B and C (Page 6). It effectively reduces median crossover crashes, minimizes view obstruction and improves stopping sight distance on highways. The cost of installation is comparable to the cost of installing concrete median barriers or W-beam guardrails.

WRSF products must meet all the NCHRP Report 350 Test Level 3 evaluation criteria.

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 spacing.

End treatments within the clear zone must be **NCHRP 350 TL-3** compliant or protected by a separate concrete barrier or W-beam guardrail. **Non-NCHRP 350 TL-3** compliant end treatments may be used **ONLY** outside the clear zone.

Depending on the manufactured WRSF product, the typical post spacing will range from 2.4 m to 3.2 m, the typical post height is between 1.0 m to 1.2 m, and the typical size of a concrete anchor is approximately 1.0 m x 1.0 m x 1.0 m. Typically, It is more cost-effective to install WRSF on highway segments that require lengthy barrier protection because of the installation cost of the end anchors.

2. Basic Criteria:

- A 4-cable Wire Rope Safety Fence (WRSF) may be considered for the median and roadside under the following situations:
 1. On divided highway sections with a history of median crossover crashes.
 2. On highway sections with curvilinear alignment to improve stopping sight distance.
 3. On scenic routes to minimize view obstruction.
 4. At locations where drifting snow creates a hazard.
 5. At wild life habitat areas where small size animals may travel across the highway.

- A WRSF should NOT be considered as a **Median Barrier** when:
 1. The distance behind the WRSF available for wire rope 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 radius specified in the vendor's design guideline.

- A WRSF 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. Contact the appropriate BCMoT Representative if additional guidance is needed.

- Individual locations need to be evaluated carefully to determine if WRSF is the appropriate barrier treatment. Consult with the vendor for details. Contact the appropriate BCMoT Representative if additional guidance is needed.

- As the cost of installation of end anchors are relatively high, the length of fence required needs to be evaluated carefully to determine if WRSF is a cost-effective barrier treatment option.

- All projects that involve WRSF should be submitted for ICBC Cost-Sharing evaluation.

3. Application Guidelines and Restrictions

- A Wire Rope Safety Fence (WRSF) may be used typically as:
 1. Median Barrier on divided highways.
 2. Roadside Barrier on highways.
- An engineering review is required when considering using WRSF 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 radius of curve. Contact the vendor for more detail. (i.e. K-value and crest curve, etc)

4. Design Guidelines:

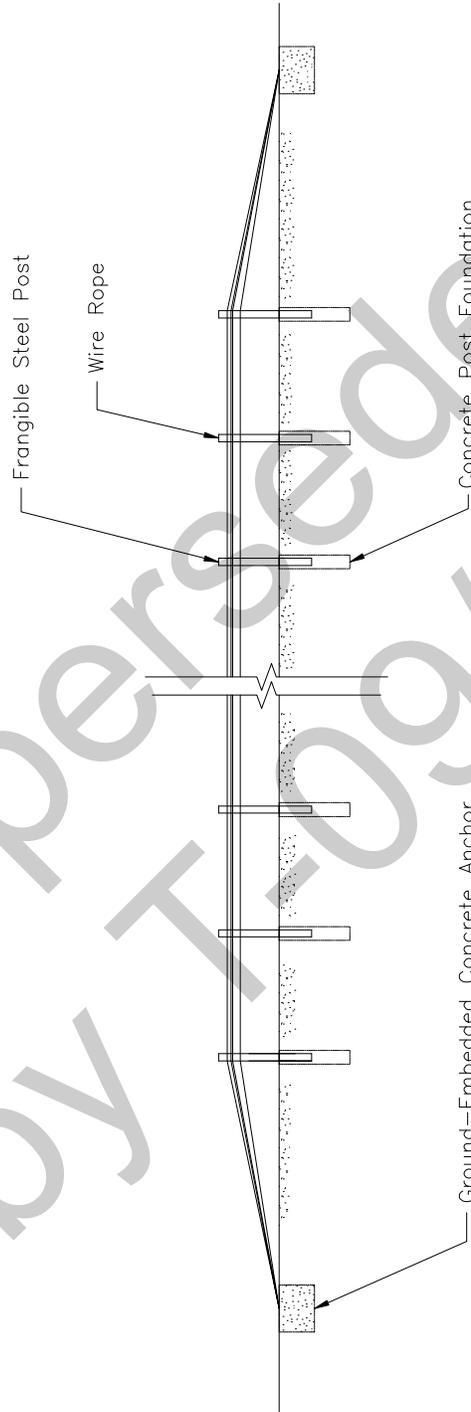
- As different Wire Rope Safety Fence (WRSF) products have substantial differences in design, specification and method of installation. Consult with the vendor for design details and specifications. (i.e. clearance from road shoulders, clearance from drop-off, barrier application on steep slope, concrete foundation design, flared end treatment, transition between different types of barriers, typical length of fence, cable tensioning, etc.)
- The height of the wire ropes (measured from ground level beneath the line of the WRSF) is critical to the containment properties of a barrier system. Consult with the vendor for design details (i.e. wire rope height tolerance, etc.) and specifications.
- Experience from other jurisdictions indicates that heavy accumulation of snow behind the WRSF may bend the frangible supporting posts when it settles. An engineering review is required when considering using WRSF in areas with heavy snow accumulation.
- A WRSF should **NOT** be connected directly to any other safety fence or bridge parapet. However, the WRSF can be interfaced with certain other types of safety fence when installed in accordance with the details specified by the vendors. An engineering review is required.
- The concrete post foundation shall be of sufficient size to ensure that it is not displaced when the post is knocked down under vehicle impact. Consult with the vendor for design details.
- A sleeve should be used in the socket of a concrete post foundation to facilitate removal of the damaged post. Consult with the vendor for design details.

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- Retro-reflective delineators should be considered for placement on the caps of the support posts. Consult with the vendor for design details.
 - An engineering review is required when considering the use of WRSF in a manner that does not conform to the specifications in the vendor's design guideline. Contact the appropriate BCMoT Representative if additional guidance is needed.

5. Action:

- Insert this Technical Bulletin behind Tab 6 of the BC Supplement to the TAC Geometric Design Guide at the back of Section 630.

Figure A: Wire Rope Safety Fence (WRSF) System



NOT TO SCALE

Figure B: Typical Application of WRSF System

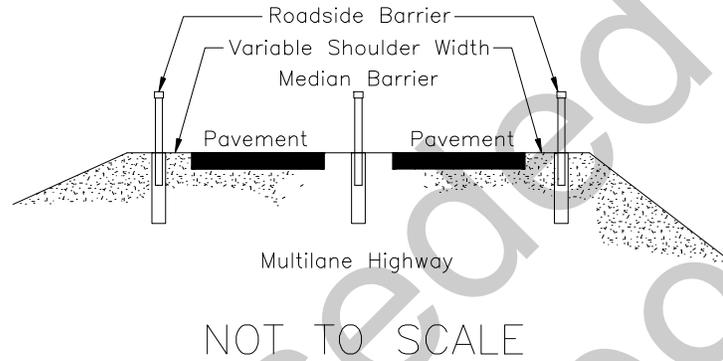


Figure C: Typical Roadside Application

