



Rural Opportunities, Tenures and Engineering Division

Engineering Branch

Considerations for Use of Ministry Standard Drawings STD-EC-010-05 and STD-EC-010-17 to 22 Bridge Approach Barriers for FSR Bridges

1.0 Purpose

The Ministry of Forests, Lands, Natural Resource Operations and Rural Development (**FLNRORD**) has prepared this document to guide the use of the following ministry standard drawings:

- STD-EC-010-05 “**Simple Bridge Approach Barrier Concepts**”, and
- STD-EC-010-17 to 22 “**Anchored/Connected Bridge Approach Barriers**”.

2.0 Terminology

The various approach barrier concepts shown on STD-EC-010-05 and STD-EC-010-17 to 22 can be categorized using the following terms, listed in order from the least robust concept to the most robust concept:

- **Unanchored & Unconnected:** Where the approach barriers are not anchored into the ground and are not physically connected to the bridge guardrail. The concrete barrier concept and the guide log concept shown on STD-EC-010-05 are unanchored & unconnected. STD-EC-010-17 to 22 should not be used for unanchored and unconnected situations, since it would be an added expense without substantial benefit.
- **Anchored & Unconnected:** Where the approach barriers are anchored into the ground but are not physically connected to the bridge guardrail. This is an option included in STD-EC-010-17 to 22;
- **Connected & Unanchored:** Where the approach barriers are connected to the bridge guardrail but are not anchored into the ground. This is an option included in STD-EC-010-17 to 22;
- **Anchored & Connected:** Where the approach barriers are anchored into the ground and are also physically connected to the bridge guardrail. This is an option included in STD-EC-010-17 to 22. It provides the most robust ministry standard barrier system.

3.0 Development of STD-EC-010-17 to 22

3.1 Key Concept Objectives and Features

Some bridge sites may need more robust approach barriers than those shown on STD-EC-010-05 to meet the following two key objectives:

- improved safety for errant light vehicles;
- decreased level of maintenance on bridge approach barriers, bridge guardrails, and bridge decks.

3.2 Detailed Design and Performance Criteria

1. Smooth, flush transition between approach barriers and bridge guardrail.
2. Accommodate approach road barrier to bridge barrier angles - 0 to 45 degrees:
 - a. Concepts:
 - i. simplicity,
 - ii. efficiency of cost and fabrication effort,
 - iii. standardized and flexible approach,
 - iv. simple, inexpensive installation.
 - b. Fixed angle option to constrain installation to fixed (designed) barrier alignment angle;
 - c. Variable angle option to allow for field flexibility.
3. Precast Concrete Transition Segment (Anchor CRB):
 - a. Single, non-proprietary, standard (left + right);
 - b. Minimum transverse resistance (developed from buried anchorage) 30 kN (unfactored) force, 500 mm above the ground surface and perpendicularly at centre of the anchorage;
 - c. Consideration for use as anchored/unconnected; anchored/connected; and connected/unanchored (depending on the site safety needs and geometry);
 - d. Connectivity to standard ministry bridge guardrails (HSS CL-2 or HSS CL-3) and CRBs;
 - e. Weight and dimension considerations for economics, handling and transportation;
 - f. Consider differential settlement & bridge thermal expansion;
 - g. Robust design that can withstand minor impacts without significant damage;
 - h. Provide for limited bridge barrier to approach barrier longitudinal displacement for impact absorption.
4. Additional Criteria:
 - a. Consider anchorage options: (1) an option that can be installed from the surface without the requirement for excavation and (2) an option that can be installed in an open excavation and then backfilled;
 - b. Drawings to reflect that use of the anchored/connected approach barrier system is not mandatory for all bridges; guidance to be developed.

4.0 Reference Documents

The reference documents listed below provide detailed information for engineering design of bridge approaches and bridge approach barriers. A professional engineer can consider these references when designing approach barriers for specific bridges on Forest Service roads (FSRs).

- FLNRORD "Guidance for Selecting Bridge Guardrail Containment Level and Determining Need for Bridge Approach Barriers on FSRs"
- BC Ministry of Transportation and Infrastructure "Supplement to TAC Geometric Design Guide"
- FLNRORD "Bridge Approach Barriers on FSRs" by Gary McClelland, PEng
- FLNRORD "Guideline for Barrier Selection and Design" by Associated Engineering Ltd.

5.0 Considerations for Use of Standard Drawings for Bridge Approach Barriers

In addition to determining an appropriate standard approach barrier concept for a specific bridge site, a professional engineer should determine the site-specific approach road geometry and detailed approach barrier requirements (including lengths and angles).

Approach Roadway Design, Pullout, and Signage Requirements

Approach roadway design, pullout, and signage requirements are not supplied on the ministry standard drawings. A professional engineer should specify these requirements for a specific bridge site.

Length of Approach Barriers

The length of a line of approach barriers at a bridge corner should be determined with consideration of keeping light vehicles from leaving the roadway in high hazard locations, which may not only be at the bridge end, but also along the side of the bridge approach (e.g., where there are high cribs, canyons, steep slopes).

Retrofitting Approach Barriers at an Existing Bridge Site

For existing (rather than new) bridges, approach barriers may be retrofit (i.e., added or improved) without making improvements to bridge guardrails, if improvements to bridge guardrails are either not necessary or would be prohibitively expensive. For some approach barrier retrofit situations, where a bridge guardrail type other than CL-2 or CL-3 is already in place, a professional engineer could arrange the installation of anchored/unconnected barriers using STD-EC-010-17 to 22.

Adequacy of Bridge Approach fills to Support Approach Barriers

A common problem with approach barriers installed on FSRs has been maintaining their position and stability as required for visual and structural purposes. A professional engineer responsible for design of the approach road geometry and detailed approach barrier requirements, and the related construction, should pay particular attention to site specific general arrangement drawings, contract specifications, and field reviews to ensure approach fills will remain stable and provide adequate foundation support for the approach barriers.

Bridge Ballast Walls

To achieve sufficiently level, wide and stable approach fills for placement of approach barriers, a professional engineer responsible for bridge conceptual and approach barrier design may need to specify a custom ballast wall (e.g.; a modification from those specified on ministry standard substructure drawings). In this case, ballast wall structural design and detailing will need to adequately account for increased earth pressures compared to the earth pressures on standard ministry ballast walls. Special attention to this issue is required for skewed bridges, high angle approach barrier layouts, bridges on curves, etc.

Alternatives to Standard Transition and Bull-nose Barriers

The ministry standard approach barrier drawings depict each line of barriers ending (away from the bridge) with two barriers: a standard BC Ministry of Transportation and Infrastructure (**TRAN**) “precast concrete transition barrier 690 mm to 460 mm - CTB-1E” plus a standard TRAN “precast concrete bull-nose 460 mm - CBN-H.”

Alternatively, a professional engineer may choose to specify a one-piece combined transition/bull-nose barrier that is 690 mm high at one end, tapering down to a bull-nose shape at the other end. A professional engineer who specifies this alternative component should provide detailed engineering and geometric specifications at the time of ordering, since a standard TRAN drawing for this alternative does not exist.