Installation Guidelines for Cattleguards with Ground Sills

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1. Introduction

Cattleguards are frequently installed on British Columbia’s roads through the cooperation of various ministries, including the BC Ministry of Transportation and Infrastructure (MoTI) and the BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD).

These “Installation Guidelines for Cattleguards with Ground Sills” ("Guidelines") are intended to assist government staff, and those individuals working together with them, when installation of cattleguards is required. Use of the Guidelines is at the discretion of local ministry authorities and is not mandatory unless contractually required.

FLNRORD, in collaboration with MOTI, has developed standard cattleguard superstructure drawings (STD-ECAT-010 -01 to 12) which are recommended to be referenced for purchases of cattleguards. FLNRORD also has a document entitled "Cattleguard Requirements and Specifications" that provides typical contract language and an ordering template that assists in preparing orders for the purchase of new cattleguard superstructures.

Scope of Guidelines

These Guidelines apply to the cattleguard superstructures that are most commonly ordered by Range Branch of FLNRORD, and have the following characteristics:

- a vehicle load rating of BCL625, L-100, and Light Off-Highway as depicted in the standard cattleguard superstructure drawings; and

- ground sills (i.e.; sill option 3 from the standard cattleguard superstructure drawings- and also shown in Figure 1 of these Guidelines).

This does not limit staff from using the other standard cattleguard superstructure types shown on the standard cattleguard superstructure drawings. It is expected that various aspects of these Guidelines will prove to be helpful for installations of the other superstructure types even though certain details may not apply. Additional installation guidance for other cattleguard superstructure types may be developed by the province in the future.
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2. Cattleguard Load Ratings

These Guidelines have been developed to apply to the installation of cattleguard superstructures that have the most commonly used load rating. These superstructures are known as BCL625, L-100, and Light Off-Highway cattleguards. They are designed to carry highway-legal and slightly heavier vehicles. BCL625, L-100 and Light Off-Highway are three configurations of vehicles that can safely cross these cattleguards. The standard cattleguard superstructure drawings show diagrams of these design vehicles.

The drawing sheets from the standard cattleguard superstructure drawings that apply for this strength of cattleguard are STD-ECAT-010-01, 03, 04, 07, and 08. Other drawing sheets included in the standard drawing set depict cattleguards with different load ratings (i.e., they are designed for other vehicle types).

3. Cattleguard Sill Options

The supports/bearings at the base of cattleguard superstructures are known as “sills.” The standard cattleguard superstructure drawings illustrate three sill option types.

These Guidelines are written for cattleguards with sill option 3 (i.e., “ground sills” where the cattleguard is placed directly on the ground without the use of concrete or timber footings). Cattleguards with sill option 3 have horizontal pipes welded to the bottom of the superstructure. Figure 1 (copied from the standard cattleguard superstructure drawings) illustrates sill option 3.

Figure 1: Sill Option 3 Superstructure Detail

![Figure 1: Sill Option 3 Superstructure Detail](image)
4. **Qualified Person (QP) for Cattleguard Installations**

Cattleguard location, installation, load rating, safety and traffic signage should be determined and confirmed by a Qualified Person (QP) that takes responsibility for cattleguard installation at a specific site. This section describes the QP’s responsibilities.

1. The QP should consider the appropriateness of these Guidelines for a specific site. The QP may vary from the Guidelines as necessary for a safe and appropriate cattleguard installation. QP considerations should include but not be limited to: site geometry, approach road visibility, roadway type, traffic type and volume, design vehicle loading, roadway alignment and speed, responsible ministry and branch expectations, road user expectations, surrounding improvements and works including underground and overhead utilities, applicable land ownership and rights-of-ways, environmental protection, construction safety, construction detour needs and fencing requirements.

2. If the QP is not a Professional Engineer and determines that engineering advice is required, a qualified Professional Engineer should be contacted.

3. The QP should collate cattleguard superstructure documentation (e.g., applicable superstructure drawings, in-plant fabrication quality assurance inspection reports, etc.) and provide to the appropriate authority for retention in ministry files.

4. The QP should document and photograph satisfactory cattleguard installation and provide to the appropriate authority for retention in ministry files.

5. The QP should document rationale for deviations (if any) from the recommended guidance contained within this document and provide to the appropriate authority for retention in ministry files.

6. The QP should make recommendations regarding inspection and maintenance of the cattleguard following installation and provide to the appropriate authority for retention in ministry files.

5. **Locating Cattleguards**

This section provides details describing appropriate locations for cattleguards.

1. The cattleguard location should have good visibility and should not be in a dip (low point) in the road.

2. The cattleguard should be installed on a straight road section.

3. The cattleguard site should allow for construction of a bypass road for livestock movement and tracked vehicle passage (where required).

4. Roadway width (including shoulders) near the cattleguard should not be more than 1.5 m wider than the cattleguard superstructure width.
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6. Cattleguard Installation Details

An example cattleguard installation is visually illustrated in Figure 2 “Example Cattleguard General Arrangement for Sill Option 3”. The following provides information relating to cattleguard installation details.

1. Each cattleguard sill should be installed level (measured transverse across the road).

2. The cattleguard longitudinal grade (parallel to the road) should match the road grade and be less than 4%. The ground that the sills bear upon should be prepared with this longitudinal grade.

3. The cattleguard should be aligned so that running strips are parallel (not skewed) with the roadway.

4. Soil slopes should be constructed no steeper than 1.5 horizontal to 1.0 vertical.

5. Foundations should have a minimum 200 kPa allowable bearing capacity. If existing foundation soils are incompetent (e.g., peat, organic soils, loose silts and fine sands, soft clays, etc.) they should be sub-excavated and replaced with well-compact ed, granular material and/or crushed rock. The cattleguard should be founded on foundation soils that are well above the water table that will not be susceptible to frost heave.

6. A drainage trench should be provided underneath the cattleguard at mid-span so that water does not accumulate underneath the cattleguard. Roadway ditches near the cattleguard should match the ditching standards for the roadway and should not have ponding water at the cattleguard location. In some cases, a drainage pit may need to be located to one or both sides of the roadway (beyond the roadway and ditches) to provide a low point that will collect drainage water.

7. After setting the cattleguard superstructure into the required location, appropriate granular backfill should be placed and compacted in 200 mm lifts in order to establish the approach roadway subgrade on both sides of the cattleguard.

8. Road surfacing should be appropriate for the roadway in accordance with specific details provided by the ministry for a specific cattleguard installation site.

9. Elevation of the top of the cattleguard superstructure should be monitored and maintained to be between 35 mm above the adjacent road grade and 25 mm below the adjacent road grade. The QP should consider possible settlement of the cattleguard subjected to design vehicle loading and possible settlement of approach fills when determining the initial installation elevation of the top of the cattleguard in relation to the top of the roadway.

10. Following cattleguard installation the area should be left in a clean, tidy and free-draining condition.
Figure 2: Example Cattleguard General Arrangement for Sill Option
7. **Fill Retention at Corners of Cattleguards**

Retention of fill is frequently necessary to provide safe vehicle use for the full cattleguard width and to avoid potentially hazardous vehicle wheel impacts at the corners of cattleguards. Figure 3 illustrates exposed superstructure end plates at the cattleguard corners after installation, which is to be avoided.

1. Fill retention should be provided at the corners of the cattleguard unless the cattleguard is significantly wider than the roadway at the site (some examples of fill retention methods are illustrated in Figure 2).

2. Various means can be used to retain fill at cattleguard corners including: standard precast concrete interlocking blocks, bull-nose barriers (CBN-H), or rock-filled gabions. Alternatively, locally derived large rocks or boulders, well-placed, may be sufficient to retain fill at the corners.

3. If used, standard precast concrete interlocking blocks should be fabricated in accordance with the FLNRORD "Bridge Component Concrete Standard".

4. If used, the CBN-H should be fabricated as per Section 941 of the "MoTI Standard Specifications for Highway Construction".

**Figure 3: Exposed Superstructure End Plate at Cattleguard Corner** (to be avoided)

8. **Traffic Signs**

Traffic signs must be installed to warn traffic approaching the cattleguard from both directions.

1. Signage shall be in accordance with the BC Ministry of Transportation and Infrastructure "Manual of Standard Traffic Signs & Pavement Markings".
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2. W-46 cattleguard warning signs (Figure 4) should be installed at the side of the roadway in advance of the cattleguard.

**Figure 4: Cattleguard Warning Sign (W-46)**

3. If the cattleguard is significantly narrower than the typical roadway near the site, W-51 Narrow Structure warning signs (Figure 5) should also be installed in advance of the cattleguard.

**Figure 5: Narrow Structure Warning Sign (W-51)**

4. As shown in Figure 6, either a W-54R or W-54L Object Marker (commonly referred to as “Right Delineator” and “Left Delineator”) should be located appropriately at each of the four (4) corners of the cattleguard or alternately they should be attached to the angled fence posts that are inserted into the sleeves at midspan of the cattleguard superstructure. In either case there should be four (4) delineators total per cattleguard. The bottom of the delineators should be greater than 300 mm higher than the top of the cattleguard superstructure elevation.

**Figure 6: Object Marker/ Delineator Signs (W-54 L and W-54 R)**