Bulletin: Guard Rail Requirements

Purpose

The purpose of this bulletin is to provide a consistent interpretation of the installation of cable or glass guard rails as outlined in Part 4 and Section 9.8 of the 2018 BC Building Code (BCBC). The following information will provide clarification for typical installation standard requirements to ensure minimum Building Code standards are achieved where cable or glass guard installations are proposed.

Implementation

Effective immediately all cable or glass guard installations that do not incorporate structural top rails shall be reviewed by a professional engineer and site/job specific manufacturer instruction(s) (Complete with Engineer Seal) AND Schedule B shall be submitted with the Building Permit Application.

All guards shall be designed to withstand loads specified in 4.1.5.14. of the BC Building Code for Part 3 buildings or 9.8.8.2. for Part 9 buildings, including houses. Owners and/or contractors shall be responsible for ensuring documentation is provided at the time of permit plan review, or prior to installation of the guards. Permit drawings should indicate the guardrail design. Heights and restrictions to openings as outlined in Section 9.8 must also be adhered to.

Verification of Cable Guard Design

Where horizontal or vertical cable guard systems are proposed, the following is to be provided by a Registered professional Engineer:

- Engineer of record for the building project (verification of shop drawings), including Letters of Assurance; or
- Where there is no Engineer of record for the building project, third party verification from a Structural Engineer, including Letters of Assurance, for the design and field installation of the guards.

Verification of Glass Guard Design

Standard Aluminum/Wood with glass infill panels:

Manufacturer's specifications provided for review by inspector showing conformance to Table 9.8.8.2. Projects under the supervision of a Registered Professional must provide confirmation of installation as outline within the Letters of Assurance.

Custom or topless free standing glass guard systems:

Where custom site built or topless glass guard rail systems are proposed, the following is to be provided by a Registered Professional Engineer:

- Engineer of record for the building project (verification of shop drawings), including Letters of Assurance; or
- Where there is no Engineer of record for the building project, third party verification from a Structural Engineer, including Letters of Assurance, for the design and field installation of the guards.

Bulletin: Guard Rail Requirements

Residential Guard design must include verification to: (including proprietary guard shop drawings)

- 9.8.8.2 Loads on Guards
- 9.8.8.3. Height of Guards
- 9.8.8.5. Openings in Guards
- 9.8.8.6. Design of guards to Not Facilitate Climbing
- 9.8.8.7. Glass in Guards – including the glass guard complies with the structural redundancy requirement without the top rails (CAN/CSB -12.20-M89)

Non-Compliance

Guard/handrail assemblies that cannot be shown to meet these standards are to be removed or remediated to meet structural standards under supervision of a Structural Engineer (submission of Letters of Assurance). On-site installations that vary from the original design/install specifications will require a review from a Structural Engineer and non-occupancy of the deck until installation confirmation is received (submission of Letters of Assurance).

Background: Guardrail Systems

The use of cable guards is relatively new. Engineer certification that the cables will maintain tension such as that it will not allow gaps larger then 4“ along any section of the length, at any time is required.

The use of glass guardrail systems has been increasing for several years and has led to questions on the structural integrity of the glass and rail components as well as impact resistance to objects both horizontally and vertically. Glass is a strong material but is very brittle and must be designed to meet structural loads and have redundancy of fail-safe load transfer. Failure of the glass can result in instantaneous failure resulting in no protection for a fall hazard.

Concerns with Structural failures when glass is used as the main structural component:

• No top rail to resist vertical & horizontal impacts.

• Tempered glass fails instantaneously into many blunt pieces.

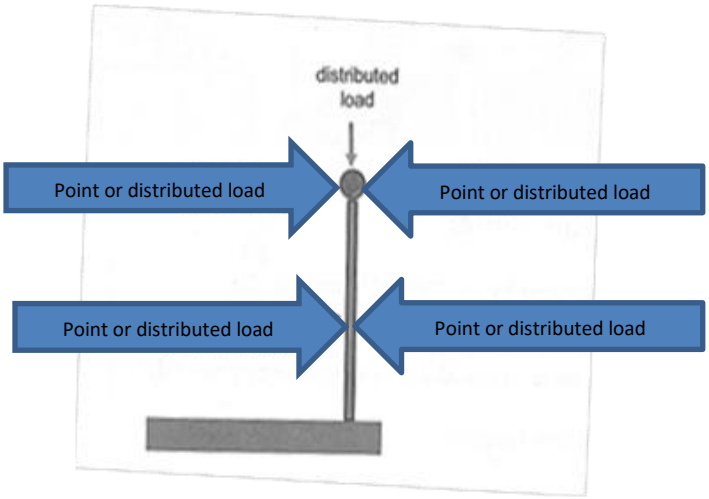
• Manufacturing of glass can include imperfections in the glass, which can expand and cause the glass to fail.

• Design and installation of framing brackets. Who is designing for the loads and ensuring proper installation in the field?

Loads within the BCBC are expressed in kN or kN/m (kilo Newton metre) in simple terms this is a quantity very similar to 100Kg (220lb) of pressure per metre length. If for example it is stated that there is 1.0kN/m it will be approximate the equivalent of one person weighing 100kg(220lbs) putting their full weight on one metre length.

There are two basic loads that are required to be met: (a) loading on the handrail and (b) loading on the infill. The loading on the handrail is called a "uniformly distributed line load". (Basically, meaning that the load needs to be calculated in a fashion that allows for even distribution of the pressure along the

complete length of the element, as opposed to the sum of the load applied to one point). The load on the infill, be it glass, metal, or other, is tested and calculated in two separate ways; a distributed load and a "point load". This means the infill of the railing, balustrade or barrier must be able to stand an evenly distributed pressure as well as a concentrated pressure on a small point.



Load path example

Guards

B.C. Building Code

9.6.1.3. Structural Sufficiency of Glass

1) Except as permitted by Sentence (2), glass used in buildings shall be designed in conformance with

a) CAN/CGSB-12.20-M89, “Structural Design of Glass for Buildings,” or

b) ASTM E 1300, “Standard Practice for Determining Load Resistance of Glass in Buildings.” (See also Article 4.3.6.1.).

CAN/CSB – 12.20- M89 STRUCTURAL DESIGN OF GLASS FOR BUILDINGS

• This is a limit states design code. The code addresses the brittle nature of glass where used as a structural material by stipulating that support members be designed with a redundant load path. The underlying principle being that if one member fails a cascading or catastrophic failure mechanism does not develop.

• Free standing glass guards must have a top cap which spans over two or more panels and be designed to resist the factored load after failure of alternate panels.

• The deflection of the guard at the point of application of the load, with all panels intact must not exceed 40 mm.

Bulletin: Guard Rail Requirements

9.8.8.2 Loads on Guards

1) Guards shall be designed to resist the specified loads prescribed in Table 9.8.8.2. - Refer to the attached Table.

9.8.8.7. Glass in Guards

1) Glass in guards shall be:

a) safety glass of the laminated or tempered type conforming to CAN/CGSB-12.1-M90, “Tempered or Laminated Safety Glass,” or

b) wired glass conforming to CAN/CGSB-12.11-M, “Wired Safety Glass.”

Publications:

- CAN/CSB-12.20-M “Structural Design of Glass for Buildings”
- VIEW the Engineers & Geoscientists BC website for their publication on Designing Guards for Buildings

Guard: means a protective barrier around openings in floors or at the open sides of stairs, landings, balconies, mezzanines, galleries, raised walkways or other locations to prevent accidental falls from one level to another. Such a barrier may or may not have openings through it.

Guardrail Design

Guards must be constructed to be strong enough to protect persons from falling under normal use. Many guards installed in dwelling units or on exterior stairs serving one or two dwelling units have demonstrated acceptable performance over time. The loading described in the first row of Table 9.8.8.2. (attached) is intended to be consistent with the performance provided by these guards.

Typical Residential Guards

Bulletin: Guard Rail Requirements

9.8.8.2. Loads on Guards

(See Note A-9.8.8.2.)

1) Except as provided in Sentences (2) and (4), *guards* shall be designed to resist the specified loads prescribed in Table 9.8.8.2.

Table 9.8.8.2.
Specified Loads for Guards
Forming Part of Sentence 9.8.8.2.(1)

Location of *Guard*	Minimum Specified Loads		
	Horizontal Load Applied Inward or Outward at any Point at the Minimum Required Height of the *Guard*	Horizontal Load Applied Outward on Elements Within the *Guard*, Including Solid Panels and Balusters	Evenly Distributed Vertical Load Applied at the Top of the *Guard*
Guards within *dwelling units* and exterior *guards* serving not more than 2 *dwelling units*	0.5 kN/m OR concentrated load of 1.0 kN applied at any point(1)	0.5 kN applied over a maximum width of 300 mm and a height of 300 mm(2)	1.5 kN/m
Guards serving access ways to equipment platforms and similar areas where the gathering of many people is improbable	Concentrated load of 1.0 kN applied at any point	Concentrated load of 0.5 kN applied over an area of 100 mm by 100 mm located at any point on the element or elements so as to produce the most critical effect	1.5 kN/m
All other *guards*	0.75 kN/m OR concentrated load of 1.0 kN applied at any point(1)	Concentrated load of 0.5 kN applied over an area of 100 mm by 100 mm located at any point on the element or elements so as to produce the most critical effect	1.5 kN/m

Notes to Table 9.8.8.2.:
(1) The load that creates the most critical condition shall apply.
(2) See Sentence (2).

2) For *guards* within *dwelling units* and within houses with a *secondary suite* including their common spaces and for exterior *guards* serving not more than 2 *dwelling units*, where the width and spacing of balusters are such that 3 balusters can be engaged by a load imposed over a 300 mm width, the load shall be imposed so as to engage 3 balusters.

3) None of the loads specified in Table 9.8.8.2. need be considered to act simultaneously.

4) For *guards* within *dwelling units* and within houses with a *secondary suite* including their common spaces and for exterior *guards* serving not more than 2 *dwelling units*, Table 9.8.8.2. need not apply where the *guard* construction used has been demonstrated to provide effective performance.

Conversion Factors: 1.5 kN/m = 1106 lb-ft, 1.0kN= 224 lbs, 0.5kN = 112lbf (pound force)

(Note: None of the loads specified in Table 9.8.8.2. need be considered to act simultaneously)

Bulletin: Guard Rail Requirements

Glass Guards Requiring Structural Confirmation

Contact Information

District of Peachland

PLANNING AND DEVELOPMENT | 5806 Beach Ave Peachland BC V0H 1X7

BUILDING DEPARTMENT PH 250 767 3709

building@peachland.ca