

## OVERVIEW

### TITLE Wire rope guardrails

Part 4, General Conditions  
Section 4.58(4)(b), Specifications for guards and guardrails

#### 1. WHAT IS THE NATURE OF THE PROBLEM TO BE SOLVED?

Section 4.58(4)(b) of the Occupational Health and Safety Regulation (“OHSR”) requires guardrails temporarily installed during construction, demolition or renovation of a work area not be made of fibre or wire rope without the prior approval of the Board.

Processing requests for prior approval under section 4.58(4)(b) requires resources from both external stakeholders and WorkSafeBC. The following table shows the number of requests for approval processed in the past few years.

Year	Section 4.58(4)(b)
2007	16
2008	9
up to May 2009	3
<i>Total</i>	<i>28</i>

Approval is usually granted once all the necessary information has been assembled by the applicant and received by WorkSafeBC. The construction industry is the main industry sector affected by the provisions of section 4.58(4)(b). An association representing many of the affected employers has requested the section be amended to allow a professional engineer to design or certify the installation and use of wire rope guardrails, and that the requirement for obtaining prior approval of the Board be deleted.

The process for handling these requests has matured to the point where the factors to be considered can be set out in a standard. The standard will set out the responsibility of the employer or prime contractor for having a design for each installation and for ensuring the guards are installed, inspected and maintained to meet the standard. The standard will require rope guardrails be installed and used in accordance with written instructions from a professional engineer. For example, the anchor points and other attachment points and all rigging components for the rails must be strong enough to safely resist the loads imparted by the flexible guardrail components and the flexible

components must be tensioned to control deflections within the limits specified in the standard. These aspects require engineering.

## **2. WHAT IS THE PURPOSE OF THIS INITIATIVE?**

The proposed amendments eliminate the need for an employer or prime contractor to get prior approval from the Board to use guardrails with top rails or intermediate rails made using wire rope or similar flexible materials, when the guardrails are temporarily installed during construction, demolition or renovation of a work area. The need for prior approval will be replaced with a requirement for such installations to meet a WorkSafeBC standard. This will place responsibility for planning, design, installation and use of such guardrails solely with the employer or prime contractor, and the professional engineer engaged to be responsible for the engineering aspects of each installation.

This will eliminate the administrative burden on stakeholders and WorkSafeBC due to the current WorkSafeBC process used for processing requests for prior approval under section 4.58(4)(b).

## **3. SOURCE OF REQUEST**

Council of Construction Associations



**PROPOSED AMENDMENTS FOR PART 4: GENERAL CONDITIONS  
IN THE OCCUPATIONAL HEALTH AND SAFETY REGULATION**

- (f) plastic or wire mesh fencing of adequate strength may be used in place of the **mid rail** midrail, but posts and top rails must comply with the requirements of this section and such fencing must be secured in place.

[Amended by B.C. Reg. 312/2003.]

<b>Handrails on stairways</b>	<b>4.62</b>	(3) A handrail on an open side of a stairway must have a <b>mid rail</b> midrail located approximately midway between the top of the handrail and the nose of the stair tread.
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**Explanatory Note:**

It is proposed to amend the definition of “guardrail” in section 4.54 of the Occupational Health and Safety Regulation (“OHSR”) by replacing the term “intermediate rail” with the simpler and more commonly used term “mid rail”. The term “intermediate rail” is not used in sections 4.54 to 4.63 however the term “midrail” is used in three places. It is proposed to amend section 4.59(c), 4.58(f) and 4.62 to correct the spelling of this term to “mid rail”.

Section 4.58(4)(b) of the OHSR requires guardrails temporarily installed during construction, demolition or renovation of a work area not be made of fibre or wire rope without the prior approval of the Board.

The following table shows the number of requests for such approval processed by WorkSafeBC in the past few years.

Year	Section 4.58(4)(b)
2007	16
2008	9
up to May 2009	3
<i>Total</i>	<i>28</i>

Processing requests for prior approval under section 4.58(4)(b) requires resources from both external stakeholders and WorkSafeBC. Approval is usually granted once all the necessary information has been assembled by the applicant and received by WorkSafeBC. Getting all the necessary information assembled typically requires several exchanges between the applicant and WorkSafeBC.

The construction industry is the main industry sector affected by the provisions of section 4.58(4)(b). An association representing many of the affected employers has requested the section be amended to allow a professional engineer to design or certify the installation and use of wire rope guardrails, and that the requirement for obtaining prior approval of the Board be deleted.

The process for handling requests for prior approval under section 4.58(4)(b) has matured to the point where the factors to be considered can be set out in a standard.

It is proposed to amend section 4.58(4)(b) to eliminate the requirement for obtaining the prior approval of the Board and replace this with a requirement that guardrails made using fibre or wire rope, or chain, for the top rail or mid rail must meet the requirements of a new WorkSafeBC Standard. This standard will require the rope guardrails be installed and used in accordance with written instructions from a professional engineer. This will place responsibility for planning, design, installation and use of such guardrails solely with the employer, prime contractor or owner, as applicable, and the professional engineer engaged to be responsible for the engineering aspects of each installation.

**PROPOSED AMENDMENTS FOR PART 4: GENERAL CONDITIONS  
IN THE OCCUPATIONAL HEALTH AND SAFETY REGULATION**

WorkSafeBC involvement would continue through reviewing the status of compliance with section 4.58(4)(b) where guardrails of this type are observed to be in place during workplace inspections.

Note it is also proposed to add “maintenance” to the list of activities where guardrails may need to be temporarily installed to guard a fall hazard or to control entry due to some other hazard. For example in industrial operations, when a major piece or component of plant equipment is removed for servicing or replacement, often there is a need to provide guarding for the opening until such time as the piece or component is back in place.

WorkSafeBC has published *OHS Guideline G4.58(4)(b) Prior approval for wire rope guardrails* to assist an applicant (employer, prime contractor or owner) in the process for seeking prior approval under section 4.58(4)(b). If this proposed amendment is adopted, a new WorkSafeBC Standard will come into use. A draft of the proposed standard follows.

DRAFT

**WorkSafeBC Standard 4.58**  
**Guardrails made with rope rails**  
**(Draft for Public Consultation in 2009)**

**1. Scope**

- 1.1 This standard sets out the minimum requirements for the design and use of guardrails temporarily installed in a workplace and made using wire rope, fibre rope, chain or similar non-rigid materials for the top rail or mid rail of the guardrail system.
- 1.2 This standard does not apply to guardrails that are permanently installed in a workplace.

**2. Definitions**

- 2.1 In this standard, *guardrail* has the same meaning as the definition set out in section 4.54 of the Occupational Health and Safety Regulation (“OHSR”), which states a guardrail means a guard consisting of a top rail 102 cm to 112 cm (40 in. to 44 in.) above the work surface, and a mid rail located approximately midway between the underside of the top rail and the top of the toeboard, if one is provided, or the work surface if no toeboard is provided.
- 2.2 In this standard, *rope* means a wire rope, synthetic fibre rope, chain or other non-rigid material having similar engineering properties that make it suitable for use as a material for the rails in a guardrail system.

**3. Performance Requirements**

- 3.1 Rope rails in a guardrail system must be installed and maintained with sufficient tension in the rail so that when the rail is subjected to a load of 900 N (200 pounds) applied in any direction at mid span, the rope does not deflect more than 100 mm (4 inches) in any direction.
- 3.2 A guardrail system using rope rails must be installed with sufficient setback from the open edge of the floor or work surface, floor opening or other hazard, such that when the rope rail is subjected to a horizontal load of 900 N (200 pounds) applied at any point the rope rail will not deflect passed the open edge of the floor or work surface or to the other hazard.
- 3.3 Rope rails must be made of a material that will remain stable and functional having consideration of climatic conditions, exposure to high temperature sources, exposure to byproducts of high temperature processes such as welding or cutting, or chemical exposures which might occur due to the location of the workplace where the guardrail system is to be installed and the work process that will be taking place around the guardrail system.
- 3.4 Rope rails must not be made of natural fibre rope or other material relying on natural fibre for tensile strength.

#### 4. Engineering Requirements

4.1 Rope rails forming part of a guardrail system must be installed and used in accordance with written instructions from a professional engineer.

4.2 The written instructions required by clause 4.1 must include:

- (a) The seal and signature of the professional engineer providing the written instructions;
- (b) The address and location in the workplace where the rope guardrail system is to be used;
- (c) The name of the employer(s), prime contractor or owner for whom the written instructions were prepared;
- (d) A description or illustration for the configuration of the guardrail system;
- (e) Detail for the connection of the rope to all supports and anchors;
- (f) Detail on the size and grade of rope and all required rigging hardware to be used;
- (g) Detail for corner posts and points where rope terminations occur;
- (h) The maximum span permitted between supports;
- (i) The tension required in the rope and the means to achieve it;
- (j) The means for testing rope tension during inspections of the system;

4.3 The written instruction required by clause 4.1 must be available in the workplace when the rope rails are being installed and when the rope rails are in place.

#### 5. Installation and Use Requirements

5.1 Workers involved in the installation, maintenance and removal of rope guardrail systems must use fall protection if required by Part 11 of the OHSR.

5.2 Rope rails meeting this standard are intended for use as guardrails and must not be used as a horizontal lifeline unless a professional engineer specifically authorizes such use and provides written instructions for such use.

5.3 If the lack of visibility of rope guardrails may pose a hazard, high visibility coloured markers or flagging must be installed on the top rail at intervals not exceeding 2 metres (6.5 feet)

5.4 Rope rails must be inspected at the start of each work shift to verify the rope tension meets the requirements of section 3.1 and the guardrail system conforms to the engineer's instructions.

5.5 Whenever any deficiencies are found with the rope rails or the guardrail system, no work is to take place in the affected area unless workers in the area are protected by an alternative fall protection means meeting the requirements of Part 11 of the OHSR.

## 6. Explanatory Materials

### 6.1 Configuration of a temporary rope guardrail system

Guardrail systems made with rope rails will typically contain a minimum of two ropes, with the rope for the mid rail installed approximately midway between the rope for the top rail and the floor or other surface on which a person is supported (or the top of the toeboard, if applicable). The wire rope size commonly used is 10 mm (3/8 inch) in diameter. Sufficient rope tension must be maintained so that, when subjected to a load of 900 N (200 pounds) applied vertically downward at mid-span, the rope rail does not deflect more than 100 mm (4 inches). When a load of 900 N (200 pounds) is applied horizontally at any point along a rope rail, no part of the rope rail can deflect beyond a vertical plane intersecting the edge of the work surface, or more than 100 mm (4 inches). It should be noted that when a load is applied on the rope, the supports or posts may also deflect and such potential for deflection will need to be considered as contributing to the total deflection of the rope rail.

A rope guardrail system provides fall protection by preventing a person from inadvertently moving beyond the open edge of the work surface on which the person is supported. A rope guardrail system is not a horizontal lifeline and may not be used for such purposes unless it has been specifically designed by a professional engineer to serve that function. OHS Guideline G11.7 addresses the design and installation of temporary horizontal lifelines.

### 6.2 Specified loads to be used for design calculations

Under section 4.58(4)(a) of the *OHS Regulation*, temporary guardrails used during the construction, demolition, maintenance or renovation of a work area are required to be able to withstand a load of 550 N (125 lb.) applied horizontally or vertically. These are *specified* loads to which load factors are then applied in order to obtain the factored *design* loads. This is achieved using the Limit States Design (“LSD”) method in accordance with the applicable codes and standards. LSD is a method of engineering that is mandated by all Canadian Building Codes and design standards. The *National Building Code of Canada 2005* (“NBCC 2005”) sets forth the fundamental safety criterion that needs to be met in LSD:

$$\text{Factored Resistance} \geq \text{Effect of Factored Loads} \\ \phi R \geq \alpha (\text{Specified Loads})$$

The resistance factor ( $\phi$ ) is applied to a specified material property or to the resistance of a member, connection or structure to recognize the limit state under consideration, due to the variability of dimensions and material properties, workmanship, type of failure and uncertainty in the prediction of resistance. The load factor ( $\alpha$ ) is applied to the *specified* loads to recognize that loads higher than those anticipated may occur. It also takes into account the approximations used in the analysis of the effects these loads have on the structure.

Section 4.1.3 of the NBCC 2005 and of the *British Columbia Building Code 2006* provides an outline of the LSD method and definitions of the various applicable factors. Following that method, the *specified* load of 550 N (125 lb.) would result in a factored *design* load of approximately 900 N (200 lb.)

### 6.3 Design calculations for posts and rails

Structural design calculations are considered separately for posts and rope rails. The load applied to a length of rope guardrail is considered as a concentrated load applied to the top rope at any point in any direction.

*Posts:*

Lateral loads that are applied to the top rope of a guardrail system produce the maximum bending moment on the posts. The post acts as a vertical cantilevered member in resisting the lateral load applied to the rope rails or posts. A concentrated load applied laterally to the rope is distributed to the adjacent posts. An end post also needs to resist loads imposed at wire rope terminations.

*Rope rails:*

A concentrated load applied to the rope at any point and in any direction creates the maximum tension and deflection in the rope when applied at mid-span. The number of spans in a rope rail system between terminations of the rope depends on how terminations are configured. In a tensioned rope rail, WorkSafeBC considers a deflection of 100 mm (4 inches) to be the maximum allowable.

A complete design for a rope guardrail system will include the design of connections to the existing structure to ensure that loads are effectively transferred to adequate points of support and anchorage. For posts at corners, and where rope terminations occur, sufficient bracing needs to be included.