

## PART 4: GENERAL CONDITIONS

### WORK AREA GUARDS AND HANDRAILS

#### Definitions

4.54 In sections 4.54 to 4.63:

“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** ~~an intermediate~~ 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.

#### Specifications for guards and guardrails

4.58

- (1) Guards in a building must be appropriate for the use and occupancy of the area.
- (2) Guards in areas not part of a building must meet the applicable criteria of subsections (3) to (5), or other standard acceptable to the Board.
- (3) Unless otherwise permitted by subsections (4) **and (4.1)**, guardrails must be installed to withstand a load applied horizontally and normal to the span of the rail, of 550 N (125 lbs) applied at any point along the rail, and a vertical, downward load of 1.5 kN per m (100 lbs per ft) along the top rail, but the horizontal and vertical loads need not be considered to act simultaneously.
- (4) Guardrails temporarily installed during the construction, demolition, **maintenance** or renovation of a work area must **be able to withstand a load of 550 N (125 lbs) applied perpendicular to the span in a horizontal or vertically downward direction at any point on the top rail, or be built to the criteria of subsection (5).**
  - ~~(a) be able to withstand a load of 550 N (125 lbs) applied perpendicular to the span in a horizontal or vertically downward direction at any point on the top rail, or be built to the criteria of subsection (5), and~~
  - ~~(b) not be made of fibre or wire rope without the prior approval of the Board.~~

**(4.1) If part or all of the top rail or a mid rail of a guardrail that is temporarily installed during the construction, demolition, maintenance or renovation of a work area is made of fibre rope, wire rope, chain or other non-rigid material, that part of the guardrail must meet the requirements of WorkSafeBC Standard 4.58 Guardrails made with rope rails March 2010.**

- (5) Unless designed by a professional engineer, temporary wooden guardrails on floors and platforms must meet the following criteria:
  - (a) posts must be spaced not more than 2.4 m (8 ft) apart, except a scaffold may have posts spaced not more than 3 m (10 ft) apart;
  - (b) wooden top rails must be at least 38 mm x 89 mm (2 in x 4 in nominal) lumber for a span of up to 2.4 m between supports, and at least 38 mm x 140 mm (2 in x 6 in nominal) lumber for a span of 2.4 m to 3 m between supports;
  - (c) wooden **mid rails** ~~midrails~~ must be 19 mm x 140 mm (1 in x 6 in nominal) or 38 mm x 89 mm (2 in x 4 in nominal) lumber;
  - (d) wooden rails must be secured to the tops or inner sides of their vertical supports;
  - (e) wooden guardrail posts must be at least 38 mm x 89 mm (2 in x 4 in nominal) lumber, and must be installed with the narrow dimension facing the open edge;

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- (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.

**Handrails on stairways**

- 4.62**
- (1) Stairs with more than 4 risers must have continuous handrails on
    - (a) any open side of the stairway,
    - (b) one side of enclosed stairways 112 cm (44 in) or less in width, and
    - (c) both sides of enclosed stairways over 112 cm (44 in) wide.
  - (2) The top of a handrail must be 76 cm to 92 cm (30 in to 36 in) above the stair tread, measured vertically from the nose of the tread, and the height must not vary on any flight or succession of flights of stairs.
  - (3) A handrail on an open side of a stairway must have a **mid rail** midrail located approximately midway between the top of the handrail and the nose of the stair tread.
  - (4) A handrail must be able to withstand a load of 1.3 kN (300 lbs) applied vertically or horizontally at any point along the handrail.
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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 sections 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
2009	4
<i>Total</i>	29

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.

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The proposed amendments for this section are an alternative way to achieve a safe and healthy workplace and are not intended to reduce worker health and safety. WorkSafeBC has, as part of its mandate under the *Workers Compensation Act*, the responsibility to establish reasonable standards for the health and safety of workers. Since temporary rope guardrail systems are being used, it is consistent with duties imposed on WorkSafeBC by the *Act* to establish in the OHSR the requirements for such rope guardrail systems. This will ensure stakeholders are aware of the minimum requirements for such systems and will maintain or improve worker safety.

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, chain or other flexible materials, 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. It will also require the employer ensure an inspection of the completed installation by a qualified person prior to the rope guardrail system being relied on as the fall protection system for the work area. 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. 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.

**WorkSafeBC Standard 4.58**  
**Guardrails made with rope rails**  
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**1. Scope**

- 1.1 This standard sets out the minimum requirements for the design and use of a guardrail system 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, *qualified* has the same meaning as the definition set out in Part 1 of the OHSR, which is being knowledgeable of the work, the hazards involved and the means to control the hazards, by reason of education, training, experience or a combination thereof.
- 2.3 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 able to withstand a load of 550 N (125 lb.) applied in any direction at any point on the rope rail.
- 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 550 N (125 lb.) applied at any point the rope rail will not deflect past 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 by-products 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.

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**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 for a guardrail system to be used at a specific workplace 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 rails to any 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 instructions required by clause 4.1 for a guardrail system intended for use at a number of workplaces of similar design and construction must include:

- (a) The seal and signature of the professional engineer providing the written instructions;
- (b) A description of the type of structure where the rope guardrail system may 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 rails to any 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.

4.4 The written instructions required by clause 4.1 must be available at the workplace when the rope guardrail system is 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 a rope guardrail system 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.

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- 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 m (6.5 ft.)
- 5.4 The employer must ensure a rope guardrail system is inspected by a qualified person, once installation of the system is complete and prior to the system being relied on as the fall protection system for the work area, to ensure the installation conforms to the engineer's written instructions.
- 5.5 The person conducting the inspection required by section 5.4 must, once satisfied the guardrail system is installed in conformance with the engineer's instructions, produce a written record of the inspection stating the guardrail system is properly installed and a copy of this record must be available at the workplace while the guardrail system is installed.
- 5.6 In addition to the inspection required by section 5.4, the employer must ensure a rope guardrail system is inspected by a qualified person at the start of each work shift to verify the rope tension meets the requirements of sections 3.1 and 3.2, and the guardrail system conforms to the engineer's instructions.
- 5.7 Whenever any deficiencies are found with the rope rails or the guardrail system, no work is to take place in the affected area until all deficiencies are corrected 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 most commonly used is 10 mm (3/8 in.) in diameter. The synthetic fibre rope size most commonly used is 16 mm (5/8 in.) in diameter. Sufficient rope tension must be maintained in rope rails so the top rail is 102 cm to 112 cm (40 in. to 44 in.) above the work surface, and the mid rail is 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. When a load of 550 N (125 lb.) is applied horizontally at any point along a rope rail, no part of the rope rail may deflect beyond a vertical plane intersecting the edge of the work surface. 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.

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

Under sections 4.58(4) and 4.1 of the OHSR, 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 the *British Columbia Building Code 2006* provide 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 if the post is installed to act 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.

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

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support and anchorage. For posts at corners, and where rope terminations occur, sufficient bracing needs to be included.

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