

# Safety Boot® Guardrail System

## ◆ INSTALLATION INSTRUCTIONS ◆

See inside for detailed illustrations and stress engineering report summary

 **WARNING! NEVER USE NAILS OR UNSPECIFIED FASTENERS**

to Anchor the Safety Boot - Different Types of Subfloor Material Require Different Types of Fasteners In Order to Exceed The Provinces & Territories' Guardrail Requirements

## ◆ IMPORTANT WARNING ◆

All specifications and dimensions for building compliant railing systems given within these installation instructions are written to meet the Canadian provinces & territories' OHS codes and regulations which are subject to change. Individual provinces and territories OHS agencies might have slightly different and varying specifications for guardrail requirements. Be sure to check and confirm your particular local code and regulations. Always follow the specific safety regulations for your province or territory. This system is designed and tested for flat surface applications only.



**FAILURE TO OBSERVE WARNINGS COULD  
RESULT IN SERIOUS INJURY OR DEATH**



MAKE SURE EACH PERSON READS AND UNDERSTANDS THESE INSTRUCTIONS PRIOR TO USE. MANUFACTURER ASSUMES NO LIABILITY IN THE EVENT OF IMPROPER INSTALLATION, PRODUCT MISUSE, OR FAILURE OF WOOD CONSTRUCTION SUBSTRATE. NEVER ALTER OR MODIFY THE SAFETY BOOT. ALWAYS CAREFULLY INSPECT EACH SAFETY BOOT BEFORE EVERY NEW INSTALLATION. REPLACE IMMEDIATELY IF YOU NOTICE ANY SIGNS OF EXCESSIVE WEAR, DAMAGE, ABUSE OR PLASTIC DEGRADATION.

**CHECK YOUR LOCAL OCCUPATIONAL HEALTH & SAFETY CODE  
& REGULATIONS FOR SPECIFIC GUARDRAIL REQUIREMENTS**

For Technical Support

Call Toll Free 1-866-902-4041

[www.safetyfirstcanada.com](http://www.safetyfirstcanada.com) email [info@safetyfirstcanada.com](mailto:info@safetyfirstcanada.com)

**Safety  
Boot®**



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# Safety Boot® Guardrail System

## ◆ FASTENER SPECIFICATIONS ◆

**WARNING!**  **NEVER USE NAILS OR UNSPECIFIED FASTENERS**

**to Anchor the Safety Boot - Different Types of Subfloor Material Require Different Types of Fasteners In Order to Exceed the Provinces & Territories' Guardrail Load Requirements**

### FASTENER SPECIFICATIONS FOR VARIOUS TYPES OF SUBFLOOR MATERIAL APPLICATIONS

#### **SOLID 2X WOOD APPLICATIONS**

for solid wood applications use:

- ◆ 4 - Hex-Head Lag Screws,  $\frac{3}{8}$  X 2 inch and;
- ◆ 4 -  $\frac{3}{8}$  X 1- $\frac{1}{2}$  Inch Fender Washers  
**(Fender Washers supplied with all orders)**
- ◆ Anchor directly into solid 2X lumber using the four primary corner holes
- ◆ Place fasteners at a minimum distance of 9/16" from the edge and 1- $\frac{1}{2}$ " from the end of the 2X lumber. (CSA 086-14)\*

#### **PLYWOOD (LESS THAN 1- $\frac{1}{8}$ INCH THICK) OR OSB APPLICATIONS**

for plywood (less than 1- $\frac{1}{8}$  inch thick) or OSB applications use:

- ◆ 4 - Hex-Head Lag Screws,  $\frac{3}{8}$  X 3 inch and;
- ◆ 4 -  $\frac{3}{8}$  X 1- $\frac{1}{2}$  Inch Fender Washers  
**(Fender Washers supplied with all orders)**
- ◆ Anchor through the plywood or OSB into floor joists or solid 2X lumber blocking on the underside of subfloor using the four primary corner holes.
- ◆ Place fasteners at a minimum distance of 9/16" from the edge and 1  $\frac{1}{2}$ " from the end of the 2X or joists. (CSA 086-14)\*

#### **(1- $\frac{1}{8}$ INCH THICK) PLYWOOD**

(1- $\frac{1}{8}$  inch thick) plywood applications use:

- ◆ 5 - Hex-Head Lag Screws,  $\frac{3}{8}$  X 2 inch and;
- ◆ 5 -  $\frac{3}{8}$  X 1- $\frac{1}{2}$  Inch Fender Washers  
**(Fender Washers supplied with all orders)**
- ◆ Anchor directly into 1- $\frac{1}{8}$  inch thick plywood using the four primary corner holes and by adding a 5th screw on the inside of the guardrail or stair rail system in the secondary hole provided.
- ◆ Place fasteners at a minimum distance of 9/16" from the edge and 1- $\frac{1}{2}$ " from the end of the substrate (CSA 086-14)\*

#### **CONCRETE APPLICATIONS**

for concrete applications use:

- ◆ 4 - Common Masonry Fasteners or Similar Concrete Anchors and;
- ◆ 4 -  $\frac{3}{8}$  X 1- $\frac{1}{2}$  Inch Fender Washers  
**(Fender Washers supplied with all orders)**
- ◆ Anchor using the four primary corner holes.
- ◆ Place fasteners at the minimum edge distance specified by the fastener manufacturer.

#### **FOR OTHER SAFETY BOOT APPLICATIONS**

The Safety Boot® Guardrail System must always be installed according to the manufacturers installation instructions. Any modifications, additions or alterations to the Safety Boot Guardrail System installation, as stated in these instructions is not recommended without the close supervision of a Certified Safety Professional or Safety Engineer. Always verify through a Certified Safety Professional or Safety Engineer that your completed system will support the required load as needed for your specific applications.

#### **ADDITIONAL CONCRETE INFORMATION**

Due to the variances in concrete mixtures and applications (such as concrete mixture type, psi strength, slab thickness, cure time, etc.), concrete fasteners used to secure the Safety Boot **MUST** be evaluated on a case by case basis by a qualified competent person. They should verify that the selected fastener specifications for average ultimate pullout and shear values are in compliance with the local OHS required strength standards. Most concrete fasteners are packaged to include a product specification chart that denotes the average ultimate pullout and shear values in concrete and/or hollow block applications.

**CHECK YOUR LOCAL OHS CODE & REGULATIONS**

# Safety Boot® Guardrail System

## ◆ IMPORTANT INFORMATION ◆

### ◆ SAFETY BOOT GUARDRAIL SYSTEM ◆

enables the builder to easily construct freestanding guardrail and stair rail systems that meet and exceed OHS Regulations on every job-site, even when using different employees or subcontractors.

**OHS STANDARDS REQUIRE THAT ENGINEERING TEST DATA CERTIFICATION MUST BE AVAILABLE for the OHS Compliance Officer on all temporary guardrail systems (including job-built railings).**

**SEE INSIDE FOR DETAILED ILLUSTRATIONS AND STRESS ENGINEERING REPORT SUMMARY**

### IMPORTANT WARNINGS DURING INSTALLATION

**ALWAYS MAKE SURE** that each individual installing this guardrail system is fully protected and wearing proper fall protection gear while working near an open edge. **NEVER CO-MINGLE** or use the Safety Boot Guardrail System with other similar guardrail base products. While another guardrail base product may look similar, it may not provide the superior strength that is provided by this system. The Safety Boot Guardrail System has been verified by a third-party engineer firm as exceeding all provinces & territories' OHS guardrail strength regulations with a 2:1 safety factor (400 pounds). **TWICE THE OHS STANDARD** of 200 pounds.

### PLACEMENT OF GUARDRAIL SYSTEM

Check your **LOCAL OHS** for the maximum allowed distance between guardrail system and unprotected edge.

### FASTENER MINIMUM EDGE DISTANCE FOR WOOD & CONCRETE

**\*CSA 086-14** allows near-edge installation of lag screws in wood at a minimum distance from the edge of the timber of 1.5 times the fastener's diameter and 4 times the fastener's diameter from the end of the timber.

For Concrete, you **MUST** follow the fastener's manufacturer specified minimum edge distance as it varies with the different types of concrete fasteners.

Following the minimum edge distance requirement prevents splitting/cracking of timber or concrete; therefore, allowing the fastener to develop its full strength to achieve guardrail system load requirement compliance.

### ADDITIONAL WARNINGS FOR STEEL DECKING

**DO NOT** use sheet metal screws to anchor the Safety Boot Guardrail System directly into steel decking (e.g., 18 - 22 gauge B-Deck, F-Deck or similar corrugated steel decking). Sheet metal screws, self starting screws or similar are **NOT** capable of withstanding a 200 pound load in corrugated steel decking and **DO NOT** meet the provinces & territories' OHS guardrail regulations.

### ADDITIONAL WARNINGS FOR HOIST AREAS

Each employee in a hoist area shall be protected from falling 4 feet (122 cm) or more to lower levels by guardrail systems or personal fall arrest systems. If guardrail systems, or portions thereof, are removed to facilitate the hoisting operation (e.g., during landing of materials), and an employee must lean through the access opening (e.g., to receive or guide materials), that employee shall be protected from fall hazards by a personal fall arrest system. **CHECK LOCAL OHS FOR SPECIFIC CASES AND FALL HEIGHTS.**

## FAILURE TO OBSERVE WARNINGS COULD RESULT IN SERIOUS INJURY OR DEATH

### THE GENERAL / PRIME CONTRACTOR IS RESPONSIBLE

for assembling to OHS standards, all of the various temporary railing systems mandated for different workplace situations.

### FOR TECHNICAL SUPPORT OR TO REORDER

Call Toll Free 1-866-902-4041

[www.safetyfirstcanada.com](http://www.safetyfirstcanada.com)

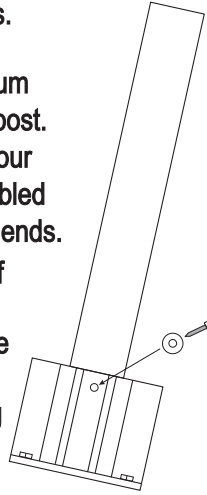
email [info@safetyfirstcanada.com](mailto:info@safetyfirstcanada.com)

### CHECK YOUR LOCAL OHS CODE & REGULATIONS

## ◆ STEP ONE ◆ Assemble Posts

**Assemble Guardrails Using No 2 Grade or Better Lumber that is free of sharp objects such as splinters and protruding nails**

- ◆ Cut 2X4 lumber into two 42 inch lengths. **DO NOT** use wet or oversized lumber.
- ◆ Fasten the lengths together with minimum Three (3) #8 x 3 inch screws to form a post. Place One (1) screw at no more than Four (4) inches from **both ends** of the assembled post and One (1) **half way** between the ends.
- ◆ Place one end of the post into the top of the Safety Boot and tap until the bottom of the post is flush with the bottom of the Safety Boot.
- ◆ **Attach the Safety Boot to the post** using one Hex-Head Lag Screw, 3/8 X 2 inch with provided washer.



## ◆ STEP TWO ◆ Placement of Posts

**Placement of Posts Should be Along Unprotected Sides or Edges**

- ◆ Place Safety Boot Posts in line along all edges of unprotected walking/working surfaces of stairways, balconies, landings, roofs, on parapets, elevator shafts, bridges, etc.
- ◆ Space between the Posts **MUST NOT** exceed Eight (8) feet on centre according to OHS guidelines.
- ◆ Place Safety Boot Posts at a maximum of Eighteen (18) inches on center away from all permanent wall structures. **(Always leave ample room for drywall installation, if required).**

### NOTE

Maximum Distance  
of 8 Feet  
Between the Posts

## ◆ STEP THREE ◆ Anchor Posts to Surface

**Anchor Posts to Subfloor Surface**

- ◆ Securely fasten Safety Boots to surface using specified fasteners (see previous page) and provided washers.
- ◆ Follow minimum edge and end distances for fasteners
- ◆ You **MUST** always use the correct fasteners for different types of flooring — To meet OHS strength requirements refer to the **Fastener Specifications Section** in this instruction booklet for your specific subfloor application.
- ◆ **DO NOT USE NAILS TO ANCHOR THE BOOTS!**  
**ALWAYS USE THE CORRECT FASTENERS!**

### \*IMPORTANT\*

\*Follow the minimum edge distance requirement for your fastener\*

\*Verify that the distance of the guardrail system from the edge does not exceed the maximum requirement of your local OHS\*

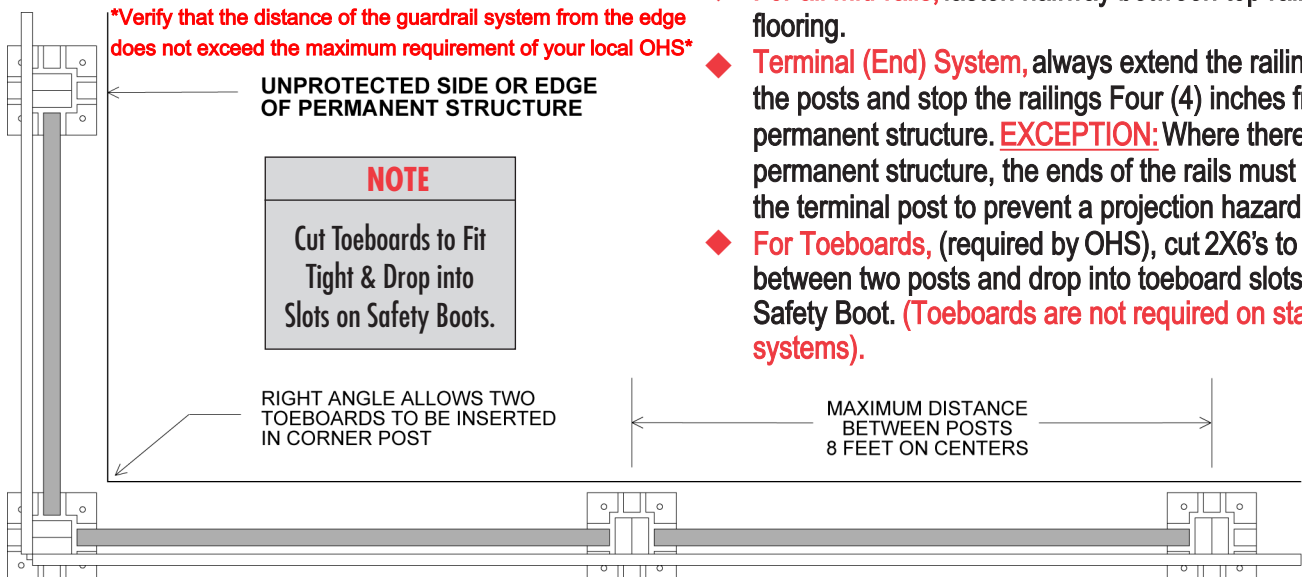
UNPROTECTED SIDE OR EDGE  
OF PERMANENT STRUCTURE

### NOTE

Cut Toeboards to Fit  
Tight & Drop into  
Slots on Safety Boots.

RIGHT ANGLE ALLOWS TWO  
TOEBOARDS TO BE INSERTED  
IN CORNER POST

MAXIMUM DISTANCE  
BETWEEN POSTS  
8 FEET ON CENTERS



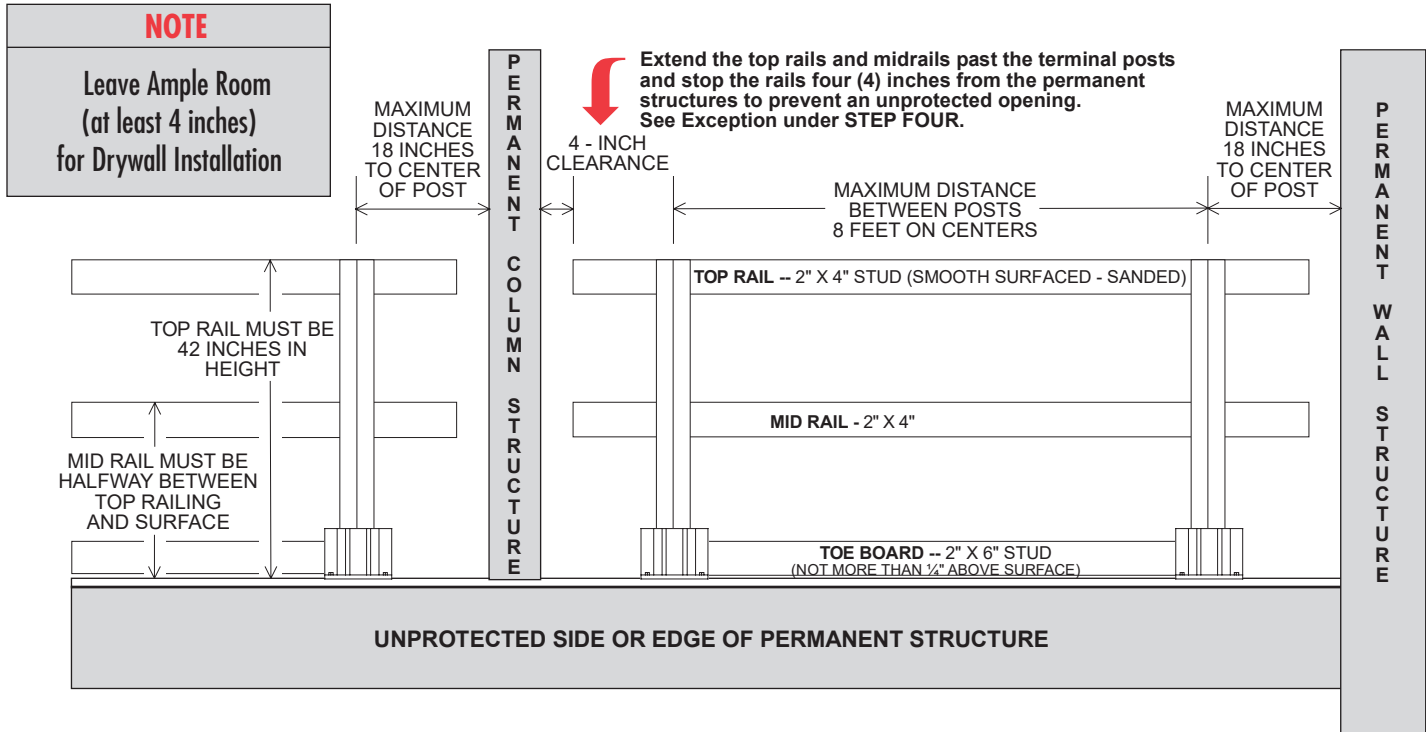
## ◆ STEP FOUR ◆ Fasten Rails to Posts & Insert Toeboard

**Fasten Top Rails and Mid Rails to Posts and Insert Toeboards Between Posts**

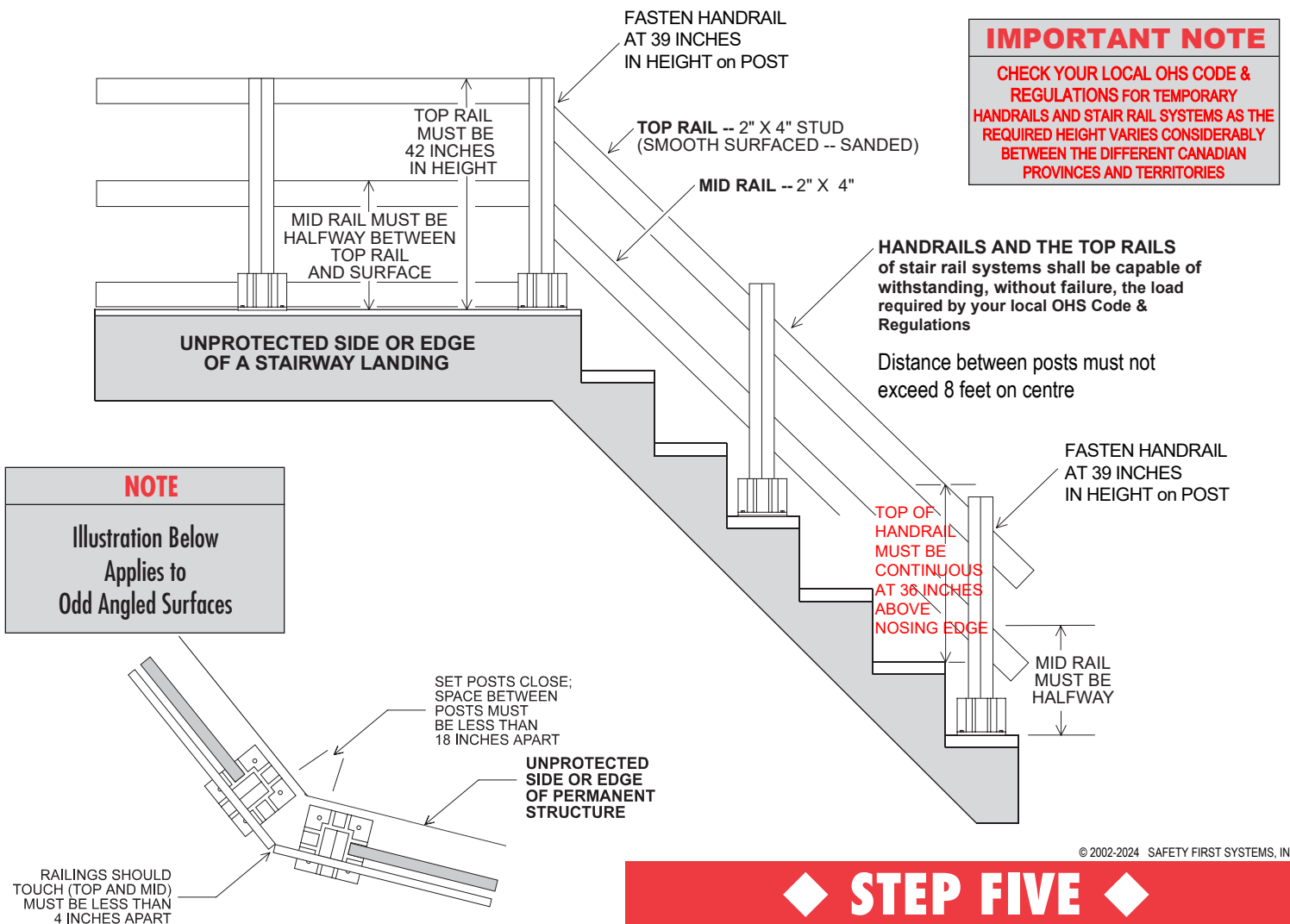
- ◆ Fasten rails to post using Two (2) standard #8 x 3 inch wood screws or Four (4) 3 inch common nails.
- ◆ **For Stair Rails, including Handrails**, the top of a handrail must be 36 inches above the stair tread, measured vertically from the nose of the tread, and the height must not vary on any flight or succession of flights of stairs. Check your **local OHS** for specific height & requirements.
- ◆ **For Guardrails, including Landings**, top railings must be flush with top of posts (42 inches).
- ◆ **For all Mid-rails**, fasten halfway between top railing and flooring.
- ◆ **Terminal (End) System**, always extend the railings past the posts and stop the railings Four (4) inches from any permanent structure. **EXCEPTION:** Where there is no permanent structure, the ends of the rails must stop at the terminal post to prevent a projection hazard.
- ◆ **For Toeboards**, (required by OHS), cut 2X6's to fit tight between two posts and drop into toeboard slots on each Safety Boot. **(Toeboards are not required on stair rail systems).**

**Applies to Walking / Working Surfaces and Stairway Landings**

## Applies to Unprotected Sides or Edges



## Applies to Stairways, Handrails, Stair Rail Systems and Stairway Landings - Check Your Local OHS & Regulations



◆ STEP FIVE ◆  
Remove & Reuse Posts at Next Job Site

Four (4) 3/8 x 3 lag screws with 1-1/2 washers were used to fasten the “Safety Boot<sup>®</sup>” bases through the 23/32 plywood and the 2x10 beam (Figure 9). The sample was then pre-conditioned in a small chamber at specified temperature on the installation for 60 to 90 minutes before the test performed. Part of the floor top surface and the lower portion of the post were also subjected to the test temperature (Figures 10 and 11).

The following temperatures were applied:

- Test #10 @ -20 °C for 60 minutes prior to test
- Test #11 @ -30 °C for 80 minutes prior to test
- Test #12 @ -35 °C for 90 minutes prior to test

A 152 lb. proof load test followed by ultimate strength test was performed on each sample.

Test # 14 to 15: Additional single post horizontal load test on solid 2x10 sub-floor material.

These two additional tests were performed with the base installed on a batch of separately purchased 2x10 beams in order to understand the property variation between the solid wood materials.

Test # 16 to 18: Single post horizontal load test on 1-1/8 Surd-I-Floor plywood.

Since the 1-1/8 Surd-I-Floor plywood was not available in Canada, a 6/17 plywood board and a 23/32 plywood board were stacked together to make up a 1-1/8 thickness, as agreed by the client. The boards were fastened together with deck screws to simulate a single piece material. Five (5) 3/8 x 2 lag screws with 1-1/2 washers were used to fasten the “Safety Boot<sup>®</sup>” bases on the floor material (Figures 12). A 152 lb. proof load test followed by ultimate strength test was performed on each sample.

### 3.0 RESULTS

The guardrail system with “Safety Boot<sup>®</sup>” bases passed all proof load tests without showing any failures. The summary of the guardrail system test is listed in Table 1 below:

Table 1: Summary of Guardrail System Test

Test No	Temp.	Test load case	Sub-floor	Fastener	No of Fasteners	Proof load	Result
1	Room	Horizontal on top rail mid-point	23/32 plywood with 2x10	3/8 x 2	4	152 lb. 200 lb.	Pass Pass
2		Horizontal on toe board mid-point				51 lb. 102 lb.	Pass Pass
3		Vertical on top rail mid-point				101 lb. 202 lb.	Pass Pass

The summary of single post test results is listed in Table 2 below. All tests passed proof load testing without showing any failures. For 2x10 solid floor or 1-1/8 plywood floor installations, the lag screws were pulled out from the sub-floor materials at ultimate load. For the typical 23/32 plywood with 2x10 under blocking, the “Safety Boot®” samples were permanently deformed under the ultimate load. Crack development was also observed on the base top portion when the base deformed. Based on the failure mode, the “Safety Boot®” base itself has an average ultimate strength of 645 lb. when a horizontal load applied at 43 inches above the floor on the post.

Table 2: Summary of Single Post Test

Test No	Temp.	Subfloor	Fastener	No of Fasteners	Proof load	Result	Max. load	Failure mode
4	Room	2 x 10 Spruce	3/8 x 2	4	152 lb.	Pass	250	Lag screws were pulled out
5						Pass	315	Lag screws were pulled out
6						Pass	226	Lag screws were pulled out
7	Room	23/32 plywood with 2x10	3/8 x 2	4	152 lb.	Pass	651	Base deformed
8						Pass	641	Base deformed
9						Pass	644	Base deformed
10	-20 °C	23/32 plywood with 2x10	3/8 x 2	4	152 lb.	Pass	832	Lag screws were pulled out
11	-30 °C					Pass	737	Base broke
12	-35 °C					Pass	744	Lag screws were pulled out
14	Room	2 x 10 Spruce	3/8 x 2	4	152 lb.	Pass	439	Lag screws were pulled out
15						Pass	466	Lag screws were pulled out
16	Room	1-1/8 plywood	3/8 x 2	5	152 lb.	Pass	337	Lag screws were pulled out
17						Pass	366	Floor fractured
18						Pass	358	Lag screws were pulled out

Note: Test #13 (for R&D purpose only) was not performed on any of the above floor materials, and the result is not covered in this report.

Figures 13 to 16 demonstrate four (4) different types of failures from the tests.

#### 4.0 CONCLUSIONS

With proper installation following Installation Instruction provided by Safety First System Inc., the guardrail system using “Safety Boot®” temporary railing base has met the requirements of Ontario Regulation 213/91, section 26.

Based on test data, the analysis results of the “Safety Boot®” base side-load resistance capacities on different floor materials and temperatures are calculated and listed in Table 3 as following:

Table 3: “Safety Boot®” Average Strength

Temperature	Sub-floor	No of Fasteners	Average failure load
Room	2 x 10 Spruce	4	339 lb.
Room	23/32 Plywood with 2x10 Spruce	4	645 lb.
Room	1-1/8 Plywood	5	354 lb.
-20 °C	23/32 Plywood with 2x10 Spruce	4	832 lb.
-30 °C	23/32 Plywood with 2x10 Spruce	4	737 lb.
-35 °C	23/32 Plywood with 2x10 Spruce	4	744 lb.

The side-load resistance capacities of the guardrail posts using “Safety Boot®” temporary railing base exceed the requirement of Ontario Regulation 213/91, section 26, when tested on three types of specified sub-floor materials.

Reported by:

  
 David Wang, P.Eng.



*This report refers only to the particular samples provided, and is limited by the test and/or analysis performed. Similar articles may not be of like quality, and other testing and/or analysis methods might give different results.*



## 1. Overview

As part of our work, we have reviewed the provincial occupational health and safety requirements for temporary guardrails. We have appended a summary table to this letter for Alberta, British Columbia, and Ontario. We have also included the criteria stipulated in CSA Z797 referenced by the Canadian Centre for Occupational Health and Safety (CCOHS).

Table 1 summarizes the required top rail loading for the guardrails relative to the appropriate province. A review of these requirements finds the CSA Z797 vertical or lateral load of 900 N (200 lbs) to be the maximum load required relative to Alberta, British Columbia, and Ontario. In other words, if this guardrail satisfies this loading, the three provinces' requirements are also met.

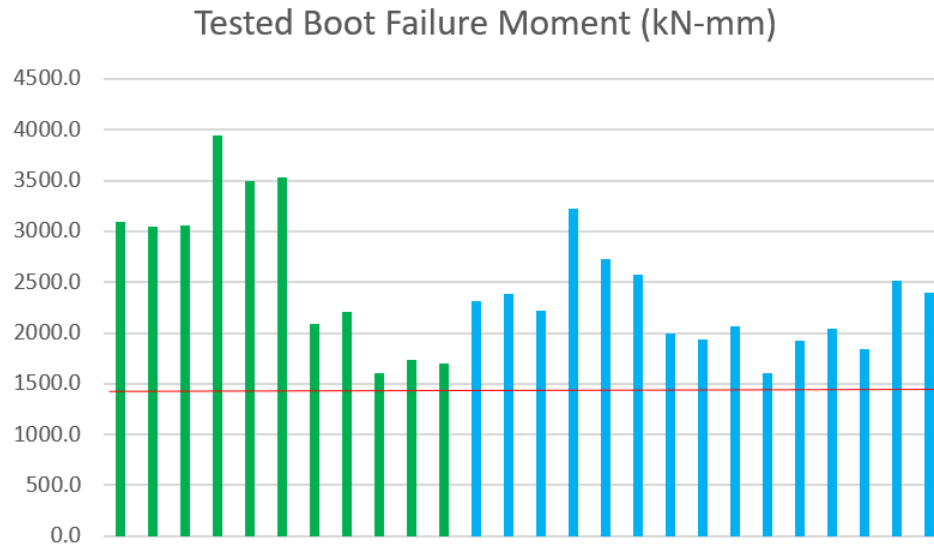
**Table 1: Top Rail Loading Comparison for Guardrails**

<i>Provincial OH&amp;S</i>	<i>Vertical Loading</i>	<i>Lateral Loading</i>
Alberta	890 N (200 lbs)	890 N (200 lbs)
British Columbia	560 N (125 lbs)	560 N (125 lbs)
Ontario	450 N (100 lbs)	675 N (150 lbs)
CSA Z797	900 N (200 lbs)	900 N (200 lbs)

Based on this review, a 900 N (200 lb) loading of the top rail will satisfy the loading requirements for the three stated provinces.

## 2. Previous Test Data

As a part of our work, we have also reviewed some of the test results provided by Stress Engineering Services, Inc. (SES) in Houston that were incorporated into the Safety Boot Guardrail System US documentation. We have combined these test results with the testing carried out by Infinity Testing Solutions (ITS) of Mississauga, Ontario (Report No. 08010055). From these reports, we have prepared a plot of the calculated ultimate bending capacity of the Safety Boot receiver, as shown in Figure 1.



**Figure 1: Summary of Reviewed Safety Boot Tests  
(Green: ITS, Blue: SES)**

A top rail lateral load of 900 N (200 lbs) and a dynamic load factor of 1.5 represents a factored bending moment of 1,400 kN-mm and the red horizontal line denotes this limit. The previous strength tests on the boot are more than this factored bending moment. The Safety Boot assembly, as tested, is acceptable for the stated loading, provided the substrate anchoring is sufficient.

### 3. B.C. Vertical Load Requirement

The reference of 100 lbs. vertical top load from the Infinity Testing Solutions report (No: 08010055) is not the load to failure, but instead a proof load. In their testing, they proof tested the top rail with a vertical 200 lbs. in the center of the span to demonstrate compliance to a 100 lb. requirement at any point along the top rail. The 100 lbs. therefore does not reflect the strength of the top rail and connections, but merely proof that it will satisfy a 100 lbs. vertical requirement.

From Table 1, the maximum required vertical load is provided as 200 lbs. applied anywhere along the top rail. Assuming a 1.5 live load safety factor, a vertical factored load of 1,350 N (300 lbs) must be transferred to the post from the top rail via the top rail fasteners. To confirm this connection capacity, we have used the wood fastener resistance as stipulated by the Canadian wood design code O86.1.

For ease of installation, we have assumed standard #8 x 3-inch wood screws will be used for this purpose. With a calculated shear capacity of 0.914 N/screw, the connection will require two #8 x 3-inch screws to achieve a satisfactory connection resistance of 1.8 kN (410 lbs.). This resistance is also obtained by the connection using four (4) 3-inch common nails at 1.6 kN (360 lbs). With either of these fasteners, the connection will meet all vertical load requirements provided in Table 1.

Under vertical loading, the compressive capacity of the post and boot is substantial. This compressive capacity would far exceed a required factored resistance of  $1.5 \times 900 \text{ N} = 1,350 \text{ N}$  (300 lbs) for any typical substrate floor material. The post can readily accept nominal vertical loading equal to this required vertical resistance. On this basis, the vertical capacity of the top rail is considered satisfactory.

## 4. Fastener Recommendations

We recommend the standard attachment of the top and mid-rail to the posts be accomplished with two (2) #8 x 3-inch-long wood screws at each location or four (4) 3-inch common nails.

## 5. Conclusions

We have found the Alberta, British Columbia, and Ontario top rail load requirements are met by the Safety Boot Guard Rail System (as tested), provided:

- The material and dimensional requirements of the appropriate OH&S codes for temporary guardrails are followed. and
- The top and mid rail locations are attached to the posts using either two #8 x 3-inch wood screws (four at splice locations), or four 3-inch common nails at each connection location.

Province	Posts	Top	Mid-Rail	Toe-Board
<b>Alberta</b>	<ul style="list-style-type: none"> <li>Minimum 38 x 89 mm (2 x 4)</li> <li>No greater than 3m (10 ft) apart</li> </ul>	<ul style="list-style-type: none"> <li>920 – 1070 mm (36 – 42 inches) above base</li> <li>890 N (200 lbs) applied within 5 cm (2 inches) of the top edge (outward or downward direction). Can bend but not break or separate.</li> </ul>	<ul style="list-style-type: none"> <li>Midway between top and base</li> </ul>	<ul style="list-style-type: none"> <li>Not less than 140 mm (5.5 inches) high</li> </ul>
<b>British Columbia</b>	<ul style="list-style-type: none"> <li>At least 38 x 89 mm 2 x 4 (narrow dimension facing open edge)</li> <li>Less than 2.4 m (8 feet) apart</li> </ul>	<ul style="list-style-type: none"> <li>38 x 89 mm (2 x 4) up to 2.4 m (8 foot) span.</li> <li>38 x 140 mm (2 x 6) up to 3.0 m (10 ft) span</li> <li>560 N (125 lbs) lateral or vertical.</li> <li>Loads not simultaneously applied</li> </ul>	<ul style="list-style-type: none"> <li>19 x 140 (1 x 6) or 38 x 89 mm (2 x 4)</li> <li>Top or inner side of post</li> </ul>	<ul style="list-style-type: none"> <li>100 mm (4 inches) tall</li> <li>less than 12 mm (½ inch) gap</li> </ul>
<b>Ontario</b>	<ul style="list-style-type: none"> <li>At least 38 x 89 (s x 4)</li> <li>Not greater than 2.4 m (8 feet)</li> <li>Edge to guardrail not greater than 300 mm (12 inches)</li> <li>S-P-F Construction Grade or better</li> <li>No visible defects affecting load carrying ability, free of sharp protrusions (splinter/nails).</li> </ul>	<ul style="list-style-type: none"> <li>0.9 to 1.1 m (36 to 43 inches) above surface</li> <li>At least 38 x 89 (2 x 4)</li> <li>Without exceeding allowable unit stress:                             <ul style="list-style-type: none"> <li>675 N (150 lbs) Lateral</li> <li>450 N (100 lbs) Vertical Down</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Point load of 450N (100 lbs) lateral or vertical</li> </ul>	<ul style="list-style-type: none"> <li>225N (50 lbs) lateral for toe board</li> </ul>
<b>CSA 2797-19</b>	<ul style="list-style-type: none"> <li>Single point load of 900 N (300 lbs) at level of top rail (in any direction or span)</li> </ul>	<ul style="list-style-type: none"> <li>1.0 m ± 75 mm (39 inches ± 3 inches) above the platform level</li> <li>Single point load of 900 N (200 lb) in any direction at level of top rail.</li> </ul>		<ul style="list-style-type: none"> <li>Single point load of 225 N (50 lb) (in any direction or span)</li> </ul>

## SUMMARY OF TESTS PERFORMED ON THE SAFETY BOOT®

PERFORMED FOR  
SAFETY MAKER, INC.

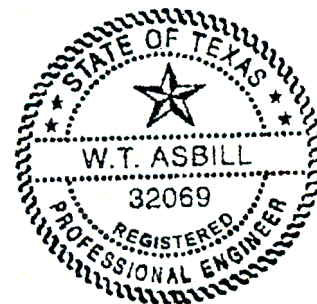
PERFORMED BY  
STRESS ENGINEERING SERVICES  
HOUSTON, TEXAS

*W. T. Asbill*

W. T. Asbill, P.E.

JULY 15, 2002

Revised April 11, 2003



STRESS ENGINEERING SERVICES (SES) IS A MULTI-DISCIPLINE ENGINEERING COMPANY THAT SERVES A VARIETY OF INDUSTRIES. ONE OF THE SERVICES PROVIDED BY SES IS A TEST FACILITY IN WHICH A VARIETY OF PRODUCTS ARE TESTED.

A SERIES OF TESTS WERE PERFORMED FOR SAFETY MAKER ON THEIR SAFETY BOOT®. THE PURPOSE OF THE TESTS WERE TO DETERMINE THE MAXIMUM LOAD THE BOOT AND FLOOR ASSEMBLY COULD WITHSTAND. THE TESTS WERE PERFORMED ACCORDING TO OSHA 1926.502 WHICH IS A CONSTRUCTION REGULATORY GUIDE FOR FALL PROTECTION GUARDRAIL SYSTEMS. THIS GUIDE REQUIRES THAT THE GUARDRAIL SYSTEM MUST BE ABLE TO WITHSTAND A FORCE OF 200 POUNDS AT A HEIGHT OF 42" ABOVE THE FLOOR.

A NUMBER OF TESTS WERE PERFORMED USING A VARIETY OF BOLTS AND SUBFLOORS. BELOW IS A TABLE AND PLOT THAT SUMMARIZES SOME OF THE TEST RESULTS. IN ALL TESTS SHOWN, THE SAFETY BOOT ASSEMBLY EXCEEDED THE OSHA REQUIREMENT OF 200 POUNDS FORCE. THE TESTS HAVE SHOWN THAT IT IS IMPORTANT TO HAVE THE CORRECT COMBINATION OF LAG BOLT SIZE, WASHER SIZE, NUMBER OF LAG BOLTS AND FLOOR MATERIAL THAT THE SAFETY BOOT IS ATTACHED TO. SOME FLOOR MATERIALS, SUCH AS PLYWOOD LESS THAN 1-1/8" THICK AND OSB, ARE INSUFFICIENT BY THEMSELVES AND MUST HAVE ADDITIONAL SUPPORT (2" PINE BOARD) FOR THE BOLTS TO PENETRATE. WITH THE ATTACHMENT COMBINATIONS SUMMARIZED, THE SAFETY BOOT EASILY EXCEEDED THE OSHA MINIMUM REQUIREMENT OF 200 POUNDS FORCE.

## SUMMARY OF SELECTED SAFETY BOOT® STRESS TESTS PERFORMED BY SES

TEST NO. & TEMPERATURE	LAG BOLT	FENDER WASHER	SUBFLOOR MATERIAL	MAX. FORCE POUNDS
1 : Room	3/8" x 3"	3/8" x 1-1/4"	23/32" STURD-I-FLOOR Plywood & 2" x 10" Yellow Pine	488
2 : Room	3/8" x 3"	3/8" x 1-1/4"	23/32" STURD-I-FLOOR Plywood & 2" x 10" Yellow Pine	502
3 : Room	3/8" x 3"	3/8" x 1-1/4"	23/32" STURD-I-FLOOR Plywood & 2" x 10" Yellow Pine	467
4 : 0°F	3/8" x 3"	3/8" x 1-1/4"	23/32" STURD-I-FLOOR Plywood & 2" x 10" Yellow Pine	680
5 : -13°F	3/8" x 3"	3/8" x 1-1/4"	23/32" STURD-I-FLOOR Plywood & 2" x 10" Yellow Pine	574
6 : -15°F	3/8" x 3"	3/8" x 1-1/4"	23/32" STURD-I-FLOOR Plywood & 2" x 10" Yellow Pine	542
7 : Room	3/8" x 2"	3/8" x 1-1/4"	2" x 10" Yellow Pine	420
8 : Room	3/8" x 2"	3/8" x 1-1/4"	2" x 10" Yellow Pine	407
9 : Room	3/8" x 2"	3/8" x 1-1/4"	2" x 10" Yellow Pine	435
10 : Room	3/8" x 2"	3/8" x 1-1/2"	2" x 10" Yellow Pine	337
11 : Room	3/8" x 2"	3/8" x 1-1/2"	2" x 10" Yellow Pine	405
12 : Room	3/8" x 2"	3/8" x 1-1/2"	2" x 10" Yellow Pine	430
13 : Room	3/8" x 2"	3/8" x 1-1/2"	1-1/8" STURD-I-FLOOR Plywood	387
14 : Room	3/8" x 2"	3/8" x 1-1/2"	1-1/8" STURD-I-FLOOR Plywood	530
15 : Room	3/8" x 2"	3/8" x 1-1/2"	1-1/8" STURD-I-FLOOR Plywood	504

## SAFETY BOOT® ENGINEERING STRESS TEST RESULTS

