PICCO
ENGINEERING

December 11, 2015

Zlatko Maric
**Residential Framing Contractors Association**
160 Applewood Crescent, Suite 31
Concord, ON
Canada

**Re: RFCA Guardrail Test**

Picco Engineering has completed our review of the test performed by Infrastructure Health & Safety Association for the temporary guardrail strength.

The railing tested is the assembly that has been generally accepted in the industry and by the Ministry of Labour. The reason for the test was to get actual values of the as built railing used on sites today.

In reviewing the test results, we can see that the values vary considerably. This is not surprising given the variability of wood and the installer nailing methods and spacing. A series of 8 tests were performed with the values varying from a minimum value of 256lbs (1138 Newton) to a maximum of 804 lbs (3,575 Newton) with an average resistance load of 531lbs (2359 Newton). Section 26.3(5)1 of Cost Reg 213/91 regarding guardrails requires a minimum lateral load of resistance of 150lbs (675Newton). We can see that even at worst failure (256lbs) we are exceeding the code requirement by 106lbs and the average by 381 lbs. More the double the required load.

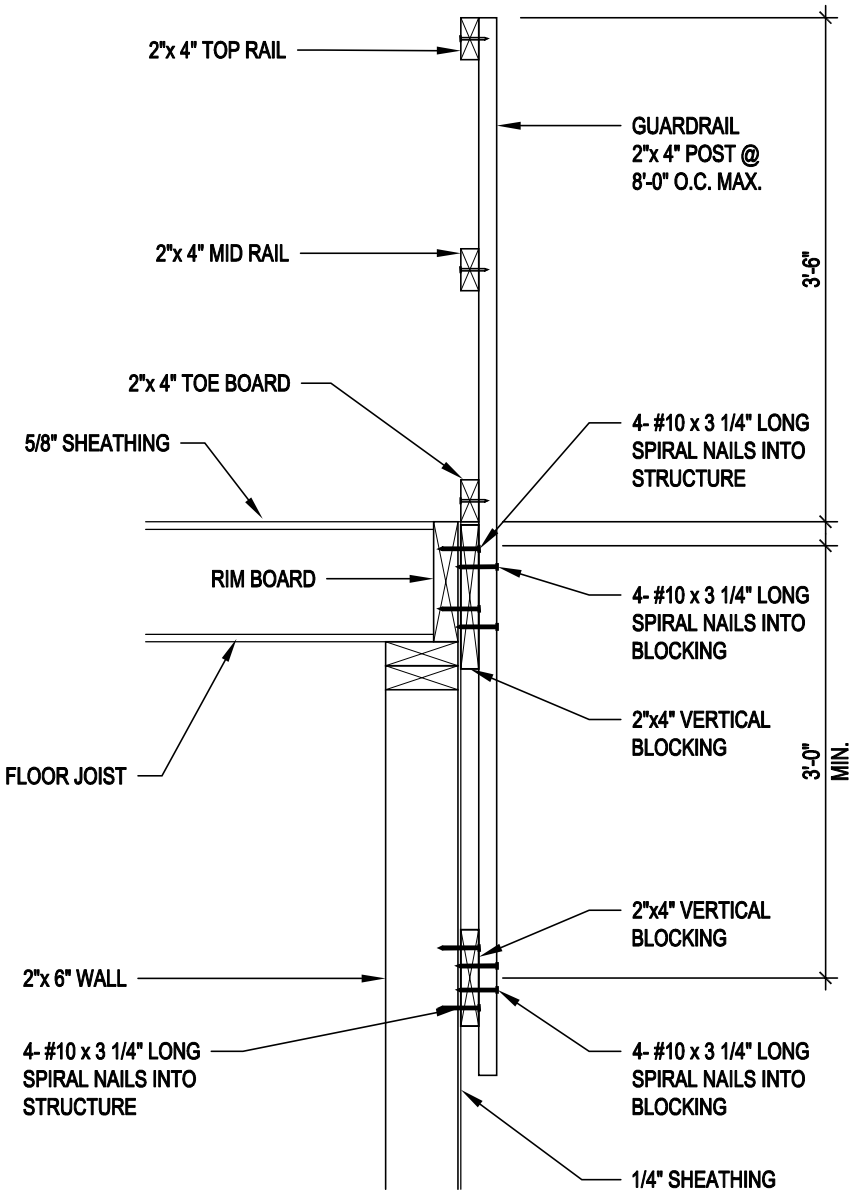
Based on the results of this testing and the successful historic use of these railings, it is our opinion that the temporary railing is acceptable. This acceptance is contingent that the installation on site meets or exceeds the requirements of the details provided in SK-7a by Picco Engineering dated December 11, 2015 and the assembly tested. The guardrail must be constructed in strict conformance to the detail provided.

Please see appendix for the test performed by Infrastructure Health & Safety Association dated March 11 and April 23, 2015 and copy of detail Sk-7a provided by Picco Engineering.

Should you have any questions or require any further information, please feel free to call.

Sincerely,


Michael Picco P. Eng.
President




THIS SKETCH IS BASED ON INFORMATION PROVIDED BY RESIDENTIAL FRAMING CONTRACTORS ASSOCIATION. THIS CONFIGURATION IS WHAT IS BEING USED AND ACCEPTED BY MINISTRY OF LABOUR INSPECTORS.

LICENSED PROFESSIONAL ENGINEER
DEC. 11, 2015
MICHAEL PICCO
PROVINCE OF ONTARIO

DWG. TITLE: TEMPORARY FLOOR GUARD DETAIL

| | | |
|---|---|---|
| 1 | 11/12/2015 | ISSUED FOR CONSTRUCTION |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|---|---|---|---|
| DATE: DEC. 2015 | DRAWN BY: DS | DWG. NO. | |
| SCALE: AS NOTED | CHECKED BY: AK | SK-7a | |
| JOB NO.: 08-107T | | | |

# Residential Temporary Floor Guardrail Testing

- Peter Vi, email: pvi@ihsa.ca -

## Purpose

To determine the maximum strength of Picco Engineering'sguardrail design fastened using spiral nails. See Appendix A for detail sketch of the temporary floor guardrail design.

## Procedure

A temporary floor guardrail system was assembled onto the outside walls of a framed house at LIUNA Local 183. The guardrail system was assembled on one corner of the house; expanding eight feet on each side of the corner (see Figure 1). The guardrail was assembled according to Picco Engineering's design by two Local 183 instructors with over 30 years of industry experience. Four spiral nails were used to fasten the guardrail posts instead of three nails as indicated by the Picco Engineering designed (Figure 2).All tests were applied at the second post next to the corner end of the guardrail system.

To apply pulling loads against the outside end of the guardrail system, a chain hoist was attached to a beam, and a line was fixed to the mid-point of the top- and mid-rail of the guardrail post (see Figure 3).To measure the instantaneous and peak forces applied to the guardrail system, a 5000 lb force cell was attached horizontally between the chain hoist and the guardrail post (see Figure 4). The peak force was used to indicate the maximum force of the guardrail system before the attachment points failed such as visibly damage or pull-out of the nail attachment points.

## Results

Four guardrail post tests were conducted on March 11, 2015. The maximum forces before the guardrail failed were measured and the results are summarized on Table 1. In all four tests, the top rail pulled out first, follow by the mid-rail (see Figure 5). The attachment point at the bottom failed last, and in all cases the 2x4 post broken in half (sees Figure 6).

Table 1: Peak forces before the guardrail failed.

| Trial Number | Peak Force (lbs) |
|---|---|
| Trial 1 | 481 |
| Trail 2 | 804 |
| Trail 3 | 642 |
| Trail 4 | 663 |

Figure 1: Guardrail setup at Local 183.

Figure 2: Four (4) spiral nails were used to attach the guardrail post to the frame of the house.

Figure 3: A line was attached to the mid-point of the top- and mid-rail to generate pulling forces on the guardrail.

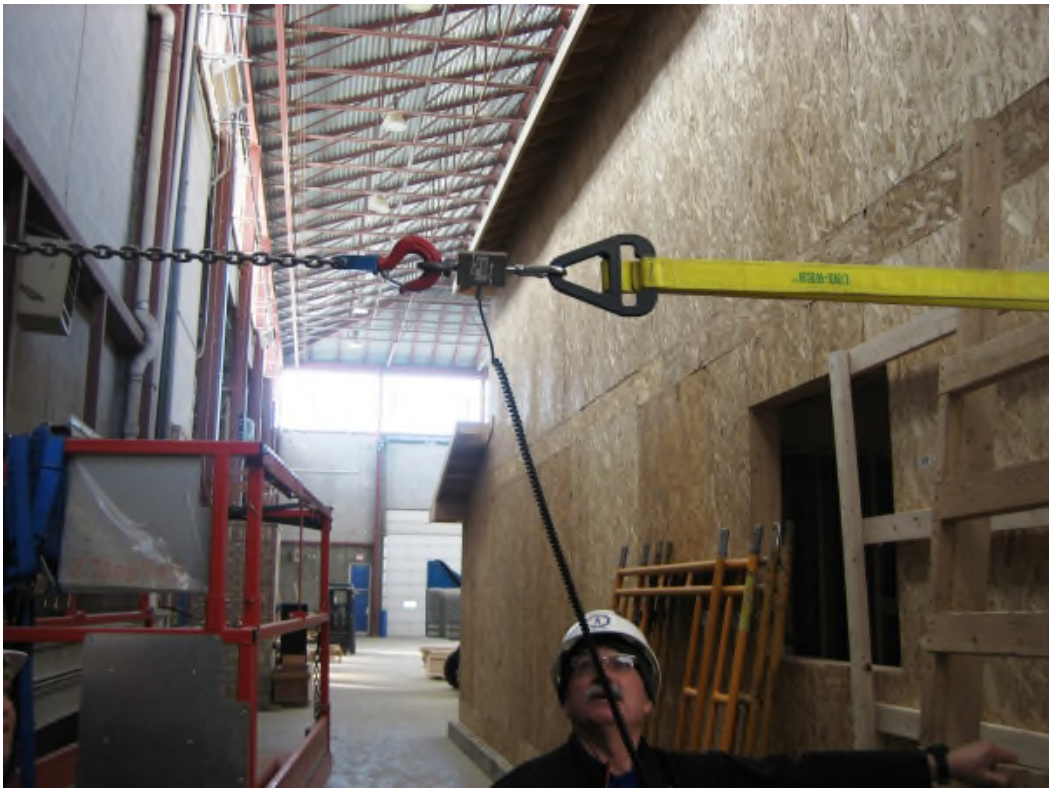

Figure 4: A 5000 lb force cell was used to measure the peak forces.

Figure 5: The top rail failed first, follow by the mid-rail.

Figure 6: The bottom attachment point failed last.

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- Peter Vi, email: pvi@ihsa.ca -

## Purpose

To determine the maximum strength of Picco Engineering'sguardrail design fastened using spiral nails. See Appendix A for detail sketch of the temporary floor guardrail design.

## Procedure

A temporary floor guardrail system was assembled onto the outside walls of a framed house at LIUNA Local 183. The guardrail system was assembled on one corner of the house; expanding eight feet on each side of the corner (see Figure 1). The guardrail was assembled according to Picco Engineering's design by two Local 183 instructors with over 30 years of industry experience. Four 3¼ inches spiral nails were used to fasten the guardrail posts instead of three nails as indicated by the Picco Engineering designed (Figure 2).All tests were applied at the mid-point of the top guardrail post next to the corner end of the guardrail system.

To apply pulling loads against the outside end of the guardrail system, a chain hoist was attached to a beam, and a line was fixed to the mid-point of the top guardrail post (see Figure 3).To measure the instantaneous and peak forces applied to the guardrail system, a 5000 lb force cell was attached horizontally between the chain hoist and the guardrail post (see Figure 4). The peak force was used to indicate the maximum force of the guardrail system before the attachment points failed such as visibly damage or pull-out of the nail attachment points.

## Results

Four guardrail post tests were conducted on April 23, 2015. The maximum forces before the guardrail failed were measured and the results are summarized on Table 1.One of the tests the nail failed to hold at the base attachment points (see Figure 5) – the post pulled out. The other three tests, the post broke at the attachment point (see Figure 6 and 7).

Table 1: Peak forces before the guardrail failed.

| Trial Number | Peak Force (lbs) | Comments |
|---|---|---|
| Trial 1 | 306 | • Post pulled out of the attachment points – nail failed to hold the post (see Figure 5). |
| Trail 2 | 256 | • Post broke at the bottom attachment point. The lower peak force was due to repeat use of the 2x4 post. |
| Trail 3 | 516 | • Post broke at the bottom attachment point. |
| Trail 4 | 579 | • Post broke at the bottom attachment point. |

Figure 1: Guardrail setup at Local 183.

Figure 2: Four (4) 3¼ inches spiral nails were used to attach the guardrail post to the frame of the house with foam insulation.

Figure 3: A line was attached to the mid-point of the toprail to generate pulling forces on the guardrail.

Figure 4: A 5000 lb force cell was used to measure the peak forces.

Figure 5: First trail - the post pulled out of the attachment point. Note the wrong installation of a 2x4 block at the bottom of the post. The maximum force was 306 lb.

Figure 6: Second trial – the post broke at the attachment. The maximum pull force was 256 lb.

Figure 7: Third and Fourth trials – the post broke at the attachment and the guardrail pulled out fromthe corners after the post failed. The maximum pull force was over 510 lb.