Thomas E. Hammond, P.E., Inc.
13727 NE 74th Street
Redmond, WA 98052-4037

July 13, 2012

Mr. Jack Junell
GLASRAIL, INC.
4215-ArUSSELL Road
Mukilteo, WA 98275

Subject: GLASRAIL Pultrusion Guardrail Systems Load Testing
Cascade Testing Laboratory Cert. #0605-21

Dear Sir:

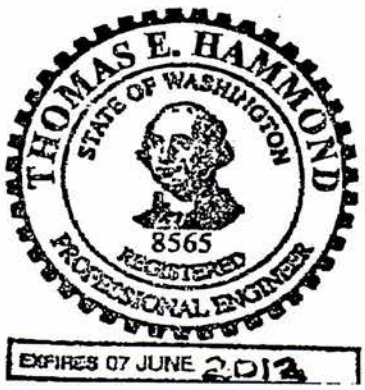
Per your request, I have reviewed the results of the 2006 testing performed by Cascade Testing Laboratory and reported to you by my firm, and find that the results meet and even exceed the requirements of ASCE 7-95, ASCE 7-05, and ASCE 7-10.

I assume this statement by me will be adequate for your current need for proof as to the adequacy of your guardrail systems to meet this specification.

Please feel free to call me regarding this statement if further questions arise.

THOMAS E. HAMMOND, P.E., INC.

By: Thomas E. Hammond, P.E., S.E.
President



Thomas E. Hammond, P.E., Inc.
13727 NE 74th Street
Redmond, WA 98052-4037

May 5, 2006

Mr. Jack Junell
GLASRAIL, INC.
4215-A Russell Road
Mukilteo, WA 98275

Reference: GLASRAIL Pultrusion Guardrail Systems Load Testing
Cascade Testing Laboratory Cert. No. 0605-21

Dear Sir:

In accordance with your request, Ken Foot of Cascade Testing Laboratory, Inc. and I visited your office/warehouse at the above referenced site to perform load tests on your fiberglass guardrail products.

Two configurations of guardrail systems were tested:

Test #1	Horizontal point loads at mid-span of the Shadow profile top rail spanning 10'-0"
Test #2	Horizontal point loads at mid-span of the Bread loaf profile top rail spanning 10'-0"
Test #3	Horizontal loads on a 12" by 12" piece of plywood on three 39" long vertical pickets

The guardrail systems were attached to sheet metal doorjambs, 10' apart, using the standard GLASRAIL bracket having four screws for each attachment. Test #3 tested the pickets of the Shadow profile assembly. An on-site forklift connected to a dynamometer and the guardrail by chains and ropes provided the load. Deflections were recorded at mid-span of the rail, measuring from a straight rail to a dot on the rail.

The International Building Code requires that guardrail systems be capable of supporting a live load of 50 pounds per lineal foot or a concentrated load of 200 pounds in any direction, and have sufficient reserve capacity to provide a factor of safety against collapse. The pickets are required to resist a 50-pound load distributed over a one square foot area and to have enough reserve capacity to provide a factor of safety against collapse.

Deflections at midspan of the top rail were measured at zero load and at each increment of loading. Following is a summary of the readings taken on site:

LOAD TEST #1	DEFLECTION	RATIO
No load	zero	------
100 pounds	1.1825"	L/101
200 pounds	2.0000"	L/60
300 pounds	2.5625"	L/47
430 pounds	3.6250"	L/33
500 pounds	4.4375"	L/27

LOAD TEST #2	DEFLECTION	RATIO
No load	zero	------
125 pounds	1.1250"	L/107
200 pounds	2.2500"	L/53
300 pounds	3.1875"	L/38

LOAD TEST #3	DEFLECTION	RATIO
No load	zero	------
100 pounds	1.25"	L/31
200 pounds	2.75"	L/14

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Thomas E. Hammond, P.E., Inc.
13727 NE 74th Street
Redmond, WA 98052-4037

In all three load tests, the guardrail system being tested, did not reach failure. In all cases, the member(s) being loaded returned to their original alignment, showing no signs of damage.

For Tests #1 and #2, the 200# point load met a portion of the building code requirement. A point load of 250# is equivalent to the other code requirement of 50#/ft for the 10' spans used in the tests. Test #3 reached four times the 50# code requirement before testing was terminated.

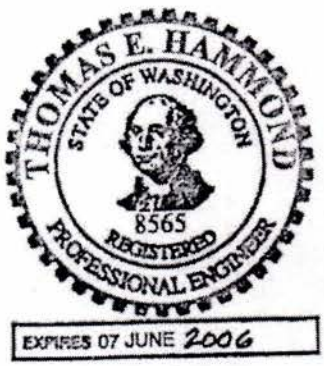
We trust that this information will be adequate for your needs. Please call if you have any questions.

Respectfully,

THOMAS E. HAMMOND, P.E., INC.

Thomas E. Hammond

By: Thomas E. Hammond, P.E., S.E.
President



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CASCADE TESTING LABORATORY, INC.
TESTING & INSPECTION / ENGINEERS
12919 N.E. 126TH PLACE
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September 20, 2001
Cert No. 0108-29

Glasrail
4215 - A Russell Road
Mukilteo, Washington 98275

Attention: Jeff Norman

Reference: Load Testing - Glasrail
Deck Rail Post Systems

Gentlemen;

The following represents the results of Load Proof Tests as performed on Rail Post which were attached by various anchorage systems to timber and concrete substrates.

The following is a summary of the anchorage system type and related information of the total load applied and type of failure occurring.

Test No. One

This test was performed on a post which was installed on a concrete slab. The attachment to the concrete consisted of installing three (3) 3/8" by 3 1/2" Wedge Anchors through the post base plate. The post was placed over the base plate #12 screws. The reaction load was applied at a height of forty-three (43) inches up from the slab surface.

A total load of 325 pounds was applied until failure occurred.

The failure was found to be at the location of the wedge anchors which pulled out from the concrete slab.

Test No. Two

This test was performed on a post which was installed on a concrete slab. The attachment to the concrete consisted of installing two (2) epoxy embedded #4 reinforcing steel bars into the concrete slab. The post was then placed over the reinforcing steel and filled to a height of 43 inches with concrete. The reaction load was applied at a height of forty-three (43) inches up from the slab surface.

A total load of 425 pounds was applied until failure occurred.

The failure was at the area of the concrete slab to post attachment where the reinforcing steel bent and at the bond section between the post concrete to slab.

Test No. Three

This test was performed on a post which was installed at the side of timber deck framing. The attachment utilized two (2) 3/8 " x 3" long lag bolts through side of the post at the lower end of the post into the double sill 2" x 10" timber. The reaction load was applied at a height of forty-three (43) inches up from the decking level, with the load applied toward the outside face of the deck.

A total load of 350 pounds was applied until failure occurred.

The failure of this system was found at the top bolt which pull out from the framing timbers.

Test No. Four

This test was performed on a post which was installed at the side of timber deck framing. The attachment utilized two (2) 3/8 " through-bolts through side of the post at the lower end of the post into the double sill 2" x 10" timber. The reaction load was applied at a height of forty-three (43) inches up from the decking level, with the load applied toward the outside face of the deck.

A total load of 425 pounds was applied until failure occurred.

The failure of this system was found along the post which split at the center at the locations of the anchors.

Test No. Five

This test was performed on a post which was installed on the top surface of the deck The post base attachment utilized three (2) 3/8 " x 3 1/2" lag bolts through the top side of the deck plywood surface. The post was then attached to the base bracket utilizing #12 screws. The reaction load was applied at a height of forty-three (43) inches up from the decking level, with the load applied toward the outside face of the deck.

A total load of 125 pounds was applied until failure occurred.

The failure of this system was found at the area of the lag bolts which pulled out from the decking materials.

Test No. Six

This test was performed on a post which was installed on the top surface of the deck The post base attachment utilized three (3) 3/8 " x 3 1/2" lag bolts through the top side of the deck plywood surface into a 2" x 8" backing timber below the plywood which was nailed to the deck joists. The post was then attached to the base bracket utilizing #12 screws. The reaction load was applied at a height of forty-three (43) inches up from the decking level, with the load applied toward the outside face of the deck.

A total load of 225 pounds was applied until failure occurred.

The failure of this system was found at the lower portion of the post attachment which "punched" through the plywood and into the backing timber. The backing timber also failed with further loading to the post.

Test No. Seven

This test was performed on a post which was installed on the top surface of the deck The post base attachment utilized three (3) 3/8 " through bolts from the top of the bracket through the 2" x 8" backing timber below the plywood which was nailed to the deck joists. The post was then attached to the base bracket utilizing #12 screws. The reaction load was applied at a height of forty-three (43) inches up from the decking level, with the load applied toward the outside face of the deck.

A total load of 425 pounds was applied until failure occurred.

The failure of this system was found at the lower post bracket which snapped at the location of the through bolts.

Test No. Eight

This test was performed on a post which was installed on a concrete slab. The attachment to the concrete consisted of installing two (2) epoxy embedded #4 reinforcing steel bars into the concrete slab. The post was then placed over the reinforcing steel and filled to a height of 1 1/2 feet with concrete. The reaction load was applied at a height of forty-three (43) inches up from the slab surface.

A total load of 400 pounds was applied until failure occurred.

The failure was at the area of the concrete slab to post attachment where the reinforcing steel bent and at the bond section between the post concrete to slab.

Test No. Nine - Bread Loaf - Rail System

This test consisted of applying an horizontal load to the center portion of a twelve (12) foot rail section. The rail section was attached utilizing rail end caps anchored with #12 screws into vertical wall posts. The rail was attached into the end rail caps with one (1) #12 screw at each end. The lateral load was applied at the center twelve (12) inch portion of the span top rail.

A total load of 550 pounds was applied until failure occurred.

The failure was due to the flexing of the top rail span. The screws attached along the top rail and at the end caps failed causing the rail to separate from the cap system. The lower rail portion of the span cracked due to the over-turning from the top surface.

We hope this will answer any questions you may have, if any should arise or we can be of further assistance please do not hesitate to give us a call.

Respectfully;

CASCADE TESTING LABORATORY, INC.

Kenneth B. Foot
Vice President

CASCADE TESTING LABORATORY, INC.
TESTING & INSPECTION / ENGINEERS
12919 N.E. 126TH PLACE
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August 4, 2000
Cert. No. 0007-49

GLASRAIL, INC.
4215-A Russell Road
Mukilteo, WA 98275

Attention: Jeff Norman

Reference: Deck System Load Testing
Avalon Bay Apartments
110th Avenue NE & NE 10th Street
Bellevue, Washington

Gentlemen:

In accordance with your request, we visited the above referenced job site to perform a load test on the fiberglass plank, supplied by Glasrail, that is a portion of a narrow balcony in this apartment complex. The plank is 11" wide by 1-7/8" thick and spans 8'-0" as a simple span. A urethane shim was placed under each end of the plank to raise it to the elevation required by the contract drawings.

The Uniform Building Code requires that balconies be capable of supporting a live load of 60 psf, and have sufficient reserve capacity to provide a factor of safety against collapse. For this test we loaded the plank with 80-pound sacks of premix concrete in increments of the 60-psf live load, i.e., 60 psf, 120 psf and 150 psf. The 150 psf represents 2.5 times the code load and provides an adequate factor of safety against failure.

Deflections at midspan of the plank were measured at zero load and at each increment of loading, as well as at 10-minute intervals following completion of the loadings. Following is a summary of the readings on site:

LOAD	DEFLECTION	RATIO
No load	zero	
60 psf	0.375"	L/256
120 psf	0.875"	L/110
150 psf	1.125"	L/85
150 psf +10 minutes	1.250"	L/77
150 psf +20 minutes	1.250"	L/77
150 psf +30 minutes	1.250"	L/77
No load	0.125" residual	L/768

The residual deflection is likely due to crushing of the urethane shim placed under each end of the plank in order to elevate the plank to the proper elevation.

We trust that this information will be adequate for your needs. Please call if you have any questions.

Respectfully,

CASCADE TESTING LABORATORY, INC.

Thomas E. Hammond

Thomas E. Hammond, P.E., S.E.

THOMAS E. HAMMOND
STATE OF WASHINGTON
8565
REGISTERED
PROFESSIONAL ENGINEER

EXPIRES 07 JUNE 2002

ARCHITECTURAL TESTING INC.

2524 East Jensen Avenue • Fresno, California 93706
web www.testati.com • Facsimile 559-233-8360 • Telephone 559-233-8705

STRUCTURAL TEST REPORT

Rendered to

Sentry Rail Inc

12521 Evergreen Dr. Suite D

Mukilteo, Washington 98275

Report No: 03-30456.02
Test Date: 08-11-99
Report Date: 09-07-99
Expiration Date: 08-11-03

Series: GLASRAIL®

Configuration: 1-7/16" by 2-13/16" Pultrusion rails 3 Ft. long containing 1" diameter hollow pickets

Project Summary: Architectural Testing, Inc. (ATI) was contracted by Sentry Rail Inc. to conduct hand rail load testing of a 36" wide by 43" high Pultrusion hand rail system. The railing system complied with the performance requirements of the following reference building standards.

1996 BOCA - Building Officials and Code Administrators (References ASCE-7-95)

1997 ICBO (UBC) - International Conference of Building Officials

1997 SBCCI (SBC) - Southern Building Code Conference International

1995 CABO - Conference of American Building Officials

Testing was conducted with rigidly supported end posts, test data applies to the railing systems and attachments only.

Test Procedure: The following is a summary of performance guidelines and design loads referenced in the various code bodies.

ICBO

- 50 lb/ft at top horizontally
- 25 psf over entire infill area
- Height - Not less than 42"
- 4" sphere shall not pass through any opening

SBCCI

- Height - Not less than 42"
- 4" sphere shall not pass through any opening
- 2" sphere shall not pass under the bottom rail

ASCE 7-95

- 50 lb/ft at top in any direction
- 200 lb load any where along top rail
- 50 psf over 1 ft^2 of infill area

BOCA

- Per ASCE 7-95

CABO

- 4" sphere shall not pass through any opening
- Height - Not less than 36"

Sample Description: The top and bottom rails were anchored at one end to a rigid nominal 4" by 4" wood post support using 3-3/8" x 3-1/2" fiberglass reinforced plastic brackets with a receptor opening of 1-1/2" x 2-7/8". The opposite end of the rail was secured via the fiberglass reinforced plastic brackets to a 4" x 4" pultrusion post with 0.125" thick walls. Each bracket was secured to the post with four # 10 by 2" panhead square drive screws. The rails were inserted into the brackets. The top and bottom railing measured 1-7/16" by 2-13/16" and consisted of hollow rectangular pultrusions. 41" long by 1" diameter hollow pickets were inserted into the rails. The deck post mounting bracket was attached to the concrete base with 3/8" x 3" long sleeve concrete anchors. The deck post was fitted over the mounting bracket.

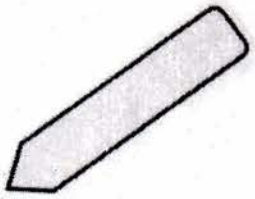
Test results:

Dimensional Requirements

Description	Measurement	Requirement
Nominal railing width	36"	
Nominal railing height	43"	Not <42
Clearance between floor and railing	1-7/8"	<4 (SBCCI <2")
Maximum opening	3-7/8"	<4

Concentrated load anywhere along top rail

Description	Measurement
Design load 200 lbs	
Center span, horizontal 200 lbs	1/2"
End of railing at post 200 lbs	2-3/4"
2.5 times design load @ 500 lbs	
Center span, horizontal 500 lbs	3-1/2"
End of railing at post 500 lbs	Concrete spalled



Observations upon completion of testing. Permanent set of top rail; no disengagement of balusters or other damage impairing function.

Horizontal load on 1 ft^2 of infill area

Description	Measurement
Design load at 50 psf	1/4"
2.5 times design load at 125 psf	1-1/8"

Observations upon completion of testing. No disengagement of balusters or permanent damage impairing function.

Test results:

Uniform horizontal load along top rail

Description	Measurement
Design load at 50 lb/ft (150 lbs total)	5/8"
2 times design load at 100 lb/ft (300 lbs total)	1"
2.5 times design load at 125 lb/ft (375 lbs total)	1-3/8"

Observations upon completion of testing. No other permanent damage impairing function.

Uniform load of infill area

Description	Measurement
Design load at 25 psf (268 lbs total)	1-1/2"
2 times design load at 50 lb/ft (537 lbs total)	3-1/2"

Observations upon completion of testing. No disengagement of balusters; no permanent damage impairing function.

A copy of this report will be retained by ATI for a period of four years. This report is the exclusive property of the client so named herein and is applicable to the sample tested. Results obtained are tested values and do not constitute an opinion nor endorsement by this laboratory.

ARCHITECTURAL TESTING, INC.

Leaton Kirk
Regional Manager

ARCHITECTURAL TESTING, INC.

Anthony Avalos
Technician

03-30456.02
LK:lg

ARCHITECTURAL TESTING INC.

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STRUCTURAL TEST REPORT

Rendered to:

Sentry Rail Inc.
4215-A Russell Raod
Mukilteo, Washington 98275

Report No: 03-30456.01
Test Date: 08-11-99
Report Date: 09-07-99
Expiration Date: 08-11-03

Series: GLASRAIL®

Configuration: 1-7/16" by 2-13/16" Pultrusion rails 12 Ft. long containing 1" diameter hollow pickets

Project Summary: Architectural Testing, Inc. (ATI) was contracted by Sentry Rail Inc. to conduct hand rail load testing of a 144" wide by 43" high Pultrusion hand rail system. The railing system complied with the performance requirements of the following reference building standards.

1996 BOCA - Building Officials and Code Administrators (References ASCE-7-95)

1997 ICBO (UBC) - International Conference of Building Officials

1997 SBCCI (SBC) - Southern Building Code Conference International

1995 CABO - Conference of American Building Officials

Testing was conducted with rigidly supported end posts, test data applies to the railing systems and attachments only.

Test Procedure: The following is a summary of performance guidelines and design loads referenced in the various code bodies.

ICBO

- 50 lb/ft at top horizontally
- 25 psf over entire infill area
- Height - Not less than 42"
- 4" sphere shall not pass through any opening

SBCCI

- Height - Not less than 42"
- 4" sphere shall not pass through any opening
- 2" sphere shall not pass under the bottom rail

ASCE 7-95

- 50 lb/ft at top in any direction
- 200 lb load any where along top rail
- 50 psf over 1 ft^2 of infill area

BOCA

- Per ASCE 7-95

CABO

- 4" sphere shall not pass through any opening
- Height - Not less than 36"

Sample Description: The top and bottom rails were anchored at each end to a rigid nominal 4" by 4" wood post supports using 3-3/8" x 3-1/2" fiberglass reinforced plastic brackets with a receptor opening of 1-1/2" x 2-7/8". Each bracket was secured to the post with four # 10 by 2" panhead square drive screws. The rails were inserted into the brackets. The top and bottom railing measured 1-7/16" by 2-13/16" and consisted of hollow rectangular Pultrusions. 41" long by 1" diameter hollow pickets were inserted into the rails.

Test results:

Dimensional Requirements

Description	Measurement	Requirement
Nominal railing width	144"	
Nominal railing height	43"	Not <42
Clearance between floor and railing	1-7/8"	<4 (SBCCI <2")
Maximum opening	3-7/8"	<4

Concentrated load anywhere along top rail

Description	Measurement
Design load 200 lbs	
Center span, horizontal 200 lbs	2-5/16"
End of railing at post 200 lbs	1/8"
2.5 times design load @ 500 lbs	
Center span, horizontal 500 lbs	3-1/2"
End of railing at post 500 lbs	1/2"

Observations upon completion of testing. No disengagement of balusters or other damage impairing function.

Horizontal load on 1 ft^2 of infill area

Description	Measurement
Design load at 50 psf	1-5/8"
2.5 times design load at 125 psf	2-11/16"

Observations upon completion of testing. No disengagement of balusters or permanent damage impairing function.

Test results:

Uniform horizontal load along top rail

Description	Measurement
Design load at 50 lb/ft (600 lbs total)	1-1/4"
2 times design load at 100 lb/ft (1200 lbs total)	2-3/8"
2.5 times design load at 125 lb/ft (1500 lbs total)	4-1/2"

Observations upon completion of testing. Slight permanent deformation of top rail; no other permanent damage impairing function.

Uniform load of infill area

Description	Measurement
Design load at 25 psf (1075 lbs total)	3-3/8"
2 times design load at 50 lb/ft (2150 lbs total)	9"

Observations upon completion of testing. No disengagement of balusters; no permanent damage impairing function.

NOTE

A copy of this report will be retained by ATI for a period of four years. This report is the exclusive property of the client so named herein and is applicable to the sample tested. Results obtained are tested values and do not constitute an opinion nor endorsement by this laboratory.

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LK:lg
03-30456.01