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EVALUATION OF RAILING BASE SHOE WITH GROUTED GLASS PANEL

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DESCRIPTION AND PURPOSE

The following report is based on Stork Technimet Report No. 0803-23313, dated April 15, 2008, which was revised to include metric dimensions.

R & B Wagner, Inc. requested Stork Technimet to evaluate a base shoe used in commercial railings. The base shoe was a 4 inch (101.6 mm) tall, 2.5 inch (63.5 mm) wide aluminum channel. Each base shoe was four feet (1,219 mm) long, and had four countersunk holes through the bottom, spaced 12 inches (304.8 mm) apart. This base shoe is designed to be used with a half-inch (12.7 mm) thick, tempered glass panel as an infill. The infill can be secured to the base shoe using plastic isolators and Panel Grips™, or can be grouted in place.

The base shoes were tested according to ASTM E 935, "Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings." The deflection was measured at the top of the rail, and evaluated against the criteria in ASTM E 985, Standard Specifications for Permanent Railing Systems and Rails for Buildings. Previously, Stork Technimet evaluated these base shoes Panel Grips™ in Stork Technimet Report No. 0710-21490, dated October 16, 2007.

CONCLUSIONS

Three grouted base shoes were tested with an appropriate tempered glass infill. Three samples were tested according to ASTM E 935 with a load applied at the top-center of the panel. Deflections ranged from 1.328 to 1.530 inches (33.73 to 38.86 mm) at 365 pounds (1,624 N). These were less than the maximum allowable.

The residual deflections after the four tests ranged from 0.022 to 0.057 inches (0.556 to 1.448 mm) and were less than the maximum allowable residual deflection for each test.

After the ASTM E 935 tests were completed, the samples were over loaded to 550 pounds (2,446 N). The deflections ranged from 2.283 to 2.345 inches (58.00 to 59.56 mm).

PROCEDURE AND RESULTS

Three grouted aluminum base shoes were tested in accordance with ASTM E935.
R & B Wagner, Inc. provided the fully assembled test samples. A half-inch (12.7 mm) thick tempered glass panel measuring 42 inches by 48 inches (1,067 by 1,219 mm) was installed in each base shoe using plastic spacers and grout. The base shoes were bolted to a half-inch (12.7 mm) thick steel plate, which was clamped to a steel bedplate.

For each test, load was applied to the glass panel using a winch, and the load was measured with a load cell. The displacement was measured as near as practical to the load application point with a "String Pot" or Linear Displacement Transducer (LDT). The load was applied and the deflection was measured at a height of approximately 42.75 inches (1,085 mm), corresponding to the top of a typical railing. To prevent the glass panel from breaking at the load application point, short blocks of wood were used with c-clamps to distribute the clamping pressure. Photographs of the test setups are provided as Figures 1 through 3.

At the start of each test, a preload of 180 pounds (800 N) was applied and held for two minutes. The preload was then released to half, or 90 pounds (400 N). This was considered to be the zero point per ASTM E 935. The load was then applied in increments of approximately 50 pounds (222 N) using the winch until the desired load was achieved. Each load was held for approximately 30 seconds. The samples were loaded to a maximum of 365 pounds (1,624 N) according to ASTM E 935, and then the load was reduced to 90 pounds (400 N) determine the residual displacement. In addition to the requirements of ASTM E 935, the samples were also overloaded to a maximum of 550 pounds (2,446 N). The first sample was tested with a single C-clamp. However, this C-clamp bent when overloading, and was unable to apply 550 pounds (2,446 N). The bent clamp is shown in Figure 4. The remaining samples were tested with two C-clamps.

Load and displacement data were recorded continuously with an eDAQ portable data acquisition system. The load-displacement plots for each sample are included as Figures 5 through 7. The displacements at 365 pounds (1,624 N) varied from 1.328 to 1.530 inches (33.73 to 38.86 mm), and the residual deflections ranged from 0.022 to 0.057 inches (0.556 to 1.448 mm) for the samples. These values were within the allowable range for an applied load at the top center of the railing. The results of the tests and the deflection criteria defined in ASTM E 985 are listed in Table 1.

If you have any questions concerning the contents of this report, please contact me. It should be noted that it is our policy to retain components and sample remnants for 30 days from April 15, 2008, after which time they will be discarded. If you would like to make alternate arrangements for disposition of the material, please let me know. This project shall be governed exclusively by the General Terms and Conditions of Sale and Performance of Testing Services by Stork Technimet, Inc. a Wisconsin business corporation d.d. March 22, 2004. In no event shall Stork Technimet, Inc. be liable for any consequential, special or indirect loss or any damages above the cost of the work.

Respectfully submitted,

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Table 1

Load-Deflection Test Results

Test	Infill	Load Point	Deflections (inches) [mm]				
			At 365 lbs. (1,624 N)	Allowable at 365 lbs. (1,624 N)	Residual at 90 lbs. (400 N)	Allowable Residual	At 550 lbs. (2,446 N)
1	Glass	Middle	1.53 [38.86]	2.28 [57.91]	0.057 [1.448]	0.456 [11.58]	N/A [1]
2	Glass	Middle	1.369 [34.77]	2.28 [57.91]	0.022 [0.559]	0.456 [11.58]	2.345 [59.56]
3	Glass	Middle	1.328 [33.73]	2.28 [57.91]	0.03 [0.762]	0.456 [11.58]	2.283 [57.99]

[1] Due to bending of the C-clamp, this data was not valid.

Fig. 1 - An overall view of the first test setup is shown. The load was applied at the center of the top edge of the glass panel. Wood blocks were used to distribute the clamping pressure and prevent fracture of the glass.

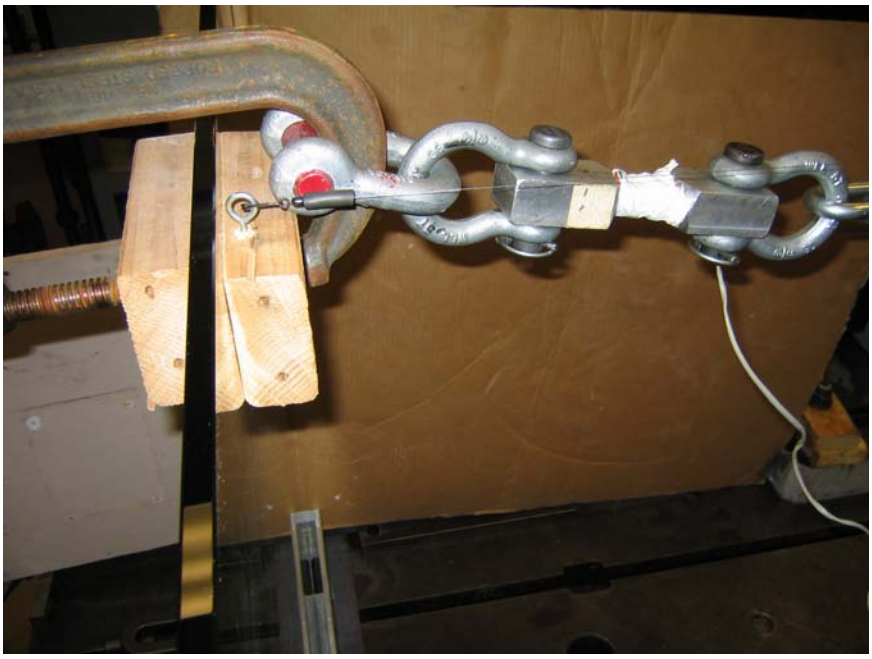

Fig. 2 - A close-up view of the load and deflection measurement point is shown. The height of loading and measuring displacement was approximately 42.75 inches (1,086 mm).

Fig. 3 - The deflected glass panel is shown with 550 pounds (2,446 N) applied.

Fig. 4 - Initially, a single C-clamp was used, but the clamp bent during testing as shown. Two clamps had to be used for the remaining tests.

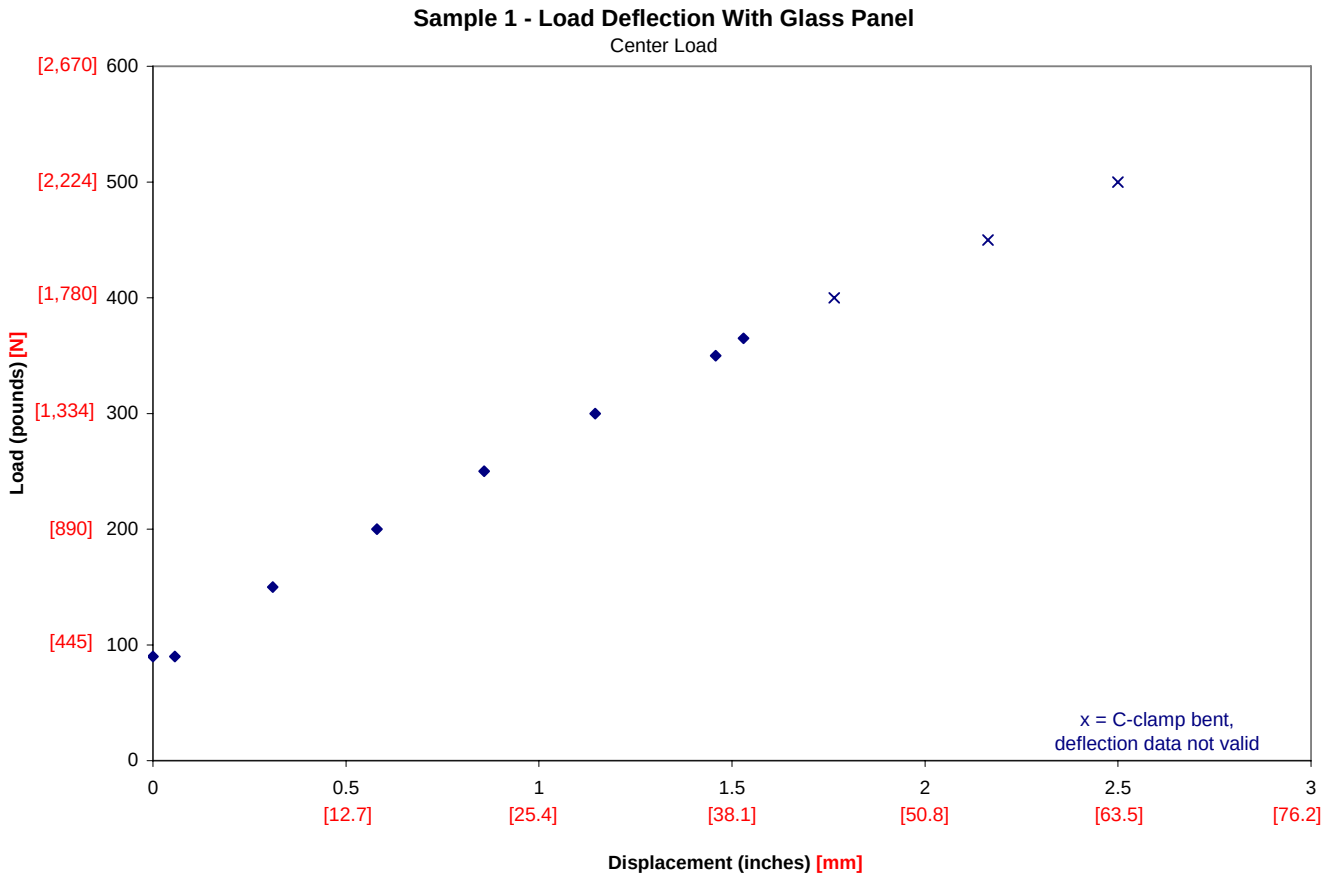

Fig. 5 - A plot of load versus deflection for glass panel sample one. The load was applied to the upper center and the displacement measured from the front.

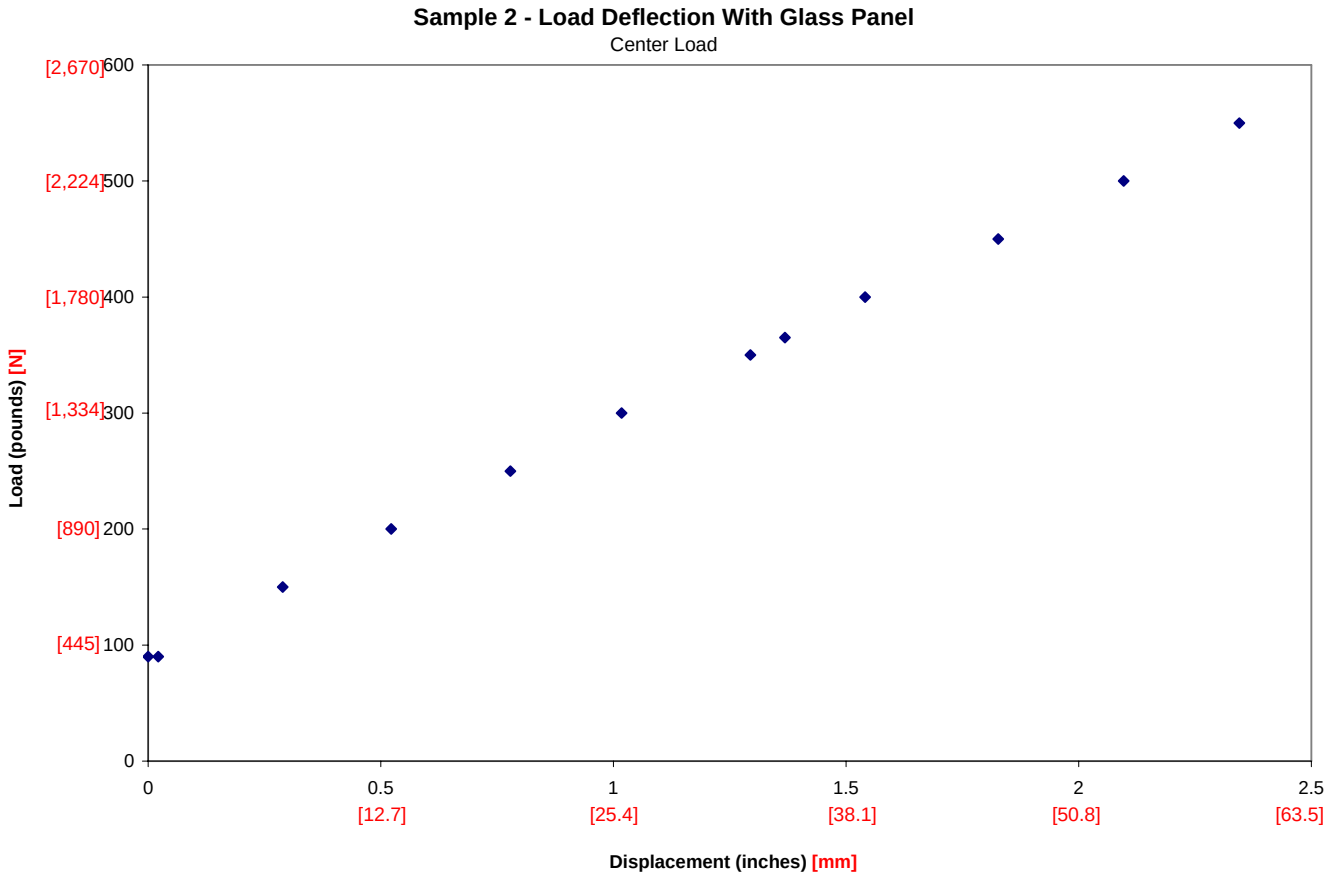

Fig. 6 - A plot of load versus deflection for glass panel sample two. The load was applied to the upper center and the displacement measured from the front.

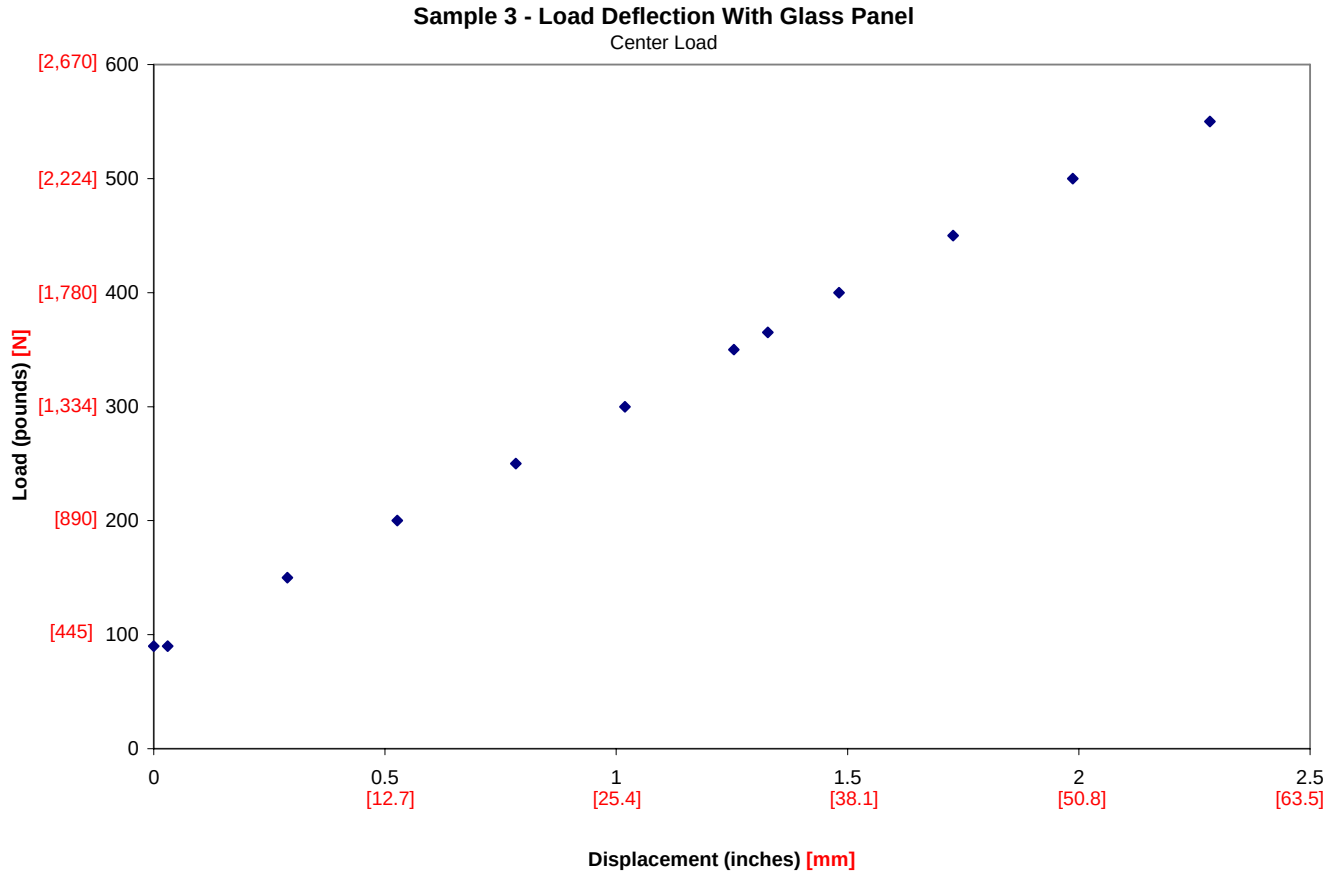

Fig. 7 - A plot of load versus deflection for glass panel sample three. The load was applied to the upper center and the displacement measured from the front.