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November 17, 2020

Mr. John Ruprecht  
Clear View Glass Railings  
737 Quentin Avenue South  
Lakeland, MN 55043

Re: Florida Wind Load Requirements for Wind-Borne Debris Regions, and Considerations for  
“Hercules” Glass Guardrail Panel  
AET Project #: 05-20608

Dear Mr. Ruprecht,

This letter reports the findings of our review of the Florida Building Code (FBC) wind requirements for Wind-Borne Regions, as defined by the FBC. We compare these requirements to the published and tested strength of the Hercules Glass Guardrail Panel, model CVGR 1001 FWP, and provide conclusions regarding panel design requirements to meet specific portions of the FBC code.

The Florida Building Code (FBC) Section 2407 addresses glass used in handrails and guards; it specifies materials, loads, support conditions and wind-borne debris regions. According to the FBC and in compliance with Category II of the Consumer Product Safety Commission (CPSC) and Class A of ANSI Z97.1, glass used in guardrails must be laminated glass constructed of fully tempered or heat strengthened glass and tested for its water penetration resistance, wind loading, impact, durability, thermal properties, and mechanical performance. It is our understanding that the panel is laminated and fully tempered. Our analysis addresses only the wind loading and impact requirements.

The FBC follows the International Building Code (IBC) requirements for wind loads, with ultimate (factored) wind speeds up to 180 mph; this is significantly higher than most areas within the United States. See the attached reference maps for determining the nominal ground wind speed from the Florida Building Code.

Our analysis converted the 180 mph required factored wind speed into a stress, using accepted analysis techniques, then compared this to the published (and tested) capacity of the panels. The American Society of Civil Engineers (ASCE) Standard 7-10, Chapter 29, provides the analysis method to convert wind speed (in mph) to pressure (in psf). Using Exposure Category C (open terrain) and a height of 100 feet above ground, a 180 mph factored wind produces a calculated pressure of 54 psf. This was plugged into a finite element model (FEM), using Risa-3D software (version 10.0.1), that models the 60" x 39" x 13mm tempered and laminated panels, supported on three “spigot” supports. The model generated a 5,500 psi principal axis stress ( $\sigma$ ) in the panel.

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The glass used in the panels has a published capacity of 10,000 psi tensile strength. Using the FEM, the pressure was increased until the capacity was reached, which was 100 psf. Plugging this into the ASCE 7-10 equations yields a service wind speed of 155 mph, or 250 mph factored wind speed. This is higher than the FBC's 180 mph factored wind speed requirement.

For building envelope glazing in wind-borne debris regions, glass that is part of a building envelope must be tested for impact resistance in accordance with American Society for Testing and Materials (ASTM) E1996. This requirement protects a closed building envelope from being penetrated and prevents high wind pressures from filling the building, potentially blowing out windows and lifting the roof off the building. Because these panels are not part of the building enclosure, damage from wind-borne debris would not penetrate the enclosure and its structural elements. Therefore, this test is not required for the panels used as a guardrail system.

FBC Section 2407.1.2 requires that all panels “shall be supported by a minimum of three glass balusters or shall be otherwise supported to remain in place should one baluster panel fail”. We interpret this to mean that the panels will require three spigot supports, which is an increase from two supports in your standard panels. FBC Section 2407.1.2 also includes an exception that states, “A top rail shall not be required where the glass balusters are laminated glass with two or more glass plies of equal thickness and the same glass type when approved by the building official”. We understand the panel meets this exception, so a top rail is not required.

In summary, based on our understanding of the FBC requirements, our conclusions are as follows:

1. Wind pressure – previous testing confirms that the panels meet the 180 mph factored wind speed requirement.
2. The panels do not require wind debris projectile testing.
3. Each panel requires three support points to the structure.
4. A top rail is not required for these panels.

Our calculations and computer model information and output is available upon request. Please call or e-mail us to discuss this analysis or any portion of the project to evaluate your panels.

Sincerely,

American Engineering Testing, Inc.



Chris Hartnett, PE\*

Principal Engineer

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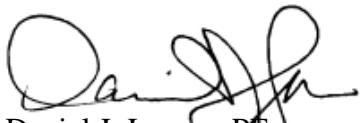
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Attachment: FBC Section 1609.3 - Ultimate Design Wind Speed Map