

May 17, 2006

Department of Community Affairs
Florida Building Code
Codes and Standards
C/o Code Supervisor
2555 Shumard Oak Blvd
Tallahassee, FL 32399-2100

Re: Hurricane Screens on Concrete Balconies

Dear Code Supervisor,

As a result of our work on high-rise condominiums in the South Florida area, we have recently become aware of a potential safety hazard regarding Hurricane Screens. We would like to alert your member engineers to this new problem. Hurricane screens are relatively new, sold for and intended for large missile impact resistance, same as shutters. Not intended, but as a consequence, they also catch wind, and must be safely attached to the building. There is the possibility of very high applied loads from screens, the applied loads being very different than loads from shutters.

Hurricane screen products have been approved by the Florida product approval system. The Florida product approval engineering did not include consideration of these new vertical forces that will be applied to the structures. Screens to protect openings is similar to shutters in that the screens resist horizontal wind loads. The horizontal loads applied to the building during hurricane force winds will be the same as from shutters. However, screens will add significant new vertical loads to the structure that would not be added by shutters. The vertical loads during hurricane force winds can be very high, higher in magnitude than the horizontal loads. These vertical loads were not considered in original building design. These vertical loads can easily be double or triple the original vertical loads considered in the original building design. Depending upon the location this could cause significant problems for some structural elements.

For tension only structural elements, the total reaction force at the screen connections must be linear with the element orientation. The analysis can be done based on a circular shape and the angle of attachment. The analysis can be done based on a parabolic shape, including an off angle installation. The analysis can be done based on dimensions from scale drawings. The results are essentially the same either method. At a typical 70 PSF wind pressure, 16 inches of screen deflection shows 600 PLF vertical loads along the top and bottom attachment points. At 12 inches deflection, the result is 850 PLF vertical loads. These loads are very high. Typical balcony design LL is 60 PSF downward. 600 PLF vertical load would use ALL of the design LL for a 10 ft strip inward from the edge. Pulling down on an upper concrete balcony could cause an overload of the top rebars. Pulling up on a lower concrete balcony could exceed the dead load of the slab, resulting in new tension cracks on it's underside or worse. Many cantilever slabs have no bottom reinforcing.

Screens are typically installed as tight as possible by the resident with strapping. Screen company representatives report typical deflection of the screens during hurricane force winds is 8 inches from the pre-hurricane installation line. If the screen is installed very tight, the deflection during hurricane force winds will be less, resulting in significantly higher vertical loads. If the screen is installed loose, the vertical loads will be lower, but the deflection during hurricane force winds will be greater. The screen needs to be installed tight to reduce dangerous flopping around and impact loading of fasteners during storms. The installation drawings may not control the installation tightness.

Additionally, there is a concern if the screens are installed near, just behind, or in front of the balcony railing, the screens can bear against the railing causing failure to the railing system. The horizontal wind force direction can be either way, towards the building or away from the building.

There is also a concern about fasteners going into post tension reinforced concrete slabs. PT cables would need to be located so that the fastener holes do not penetrate the cables. In some locations, the depth of the fasteners holes would need to be critically controlled. There is also the concern of waterproofing fastener holes.

We recommend that each installation be accompanied by a site specific engineering assessment of the reaction loads on the specific building structures. If there are any questions, please do not hesitate to contact me.

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