

Seismic Glass

Introduction

The growing use of glass in curtain wall systems in modern high-rise buildings has increased the potential for hazards from flying and falling glass shards during an earthquake.

Glass shards have the potential to cause peripheral damage and personal injury in an earthquake

occurring in an urban area. Extensive documentation of this hazard is available from studies of glass damage in earthquakes that occurred in Mexico City (1985), in San Francisco, CA (1989) and in Northridge, CA (1994).

Description

Two major factors need to be examined in any consideration of earthquake-induced glass damage:

1. How the glass system performs and responds to racking-type earthquake-induced building deflections such as interstory drift;
2. How the glass performs after it has been cracked by frame movements.

The frame is, therefore, an integral part of an earthquake-resistant glazing system. Frames prone to racking during earthquake-induced building movements can cause glass components to crack, and, for some types of glass, to fall in fragments from the building.

New building code provisions for the seismic designs of architectural glass are here, along with new, industry-accepted laboratory test methods. For example, the 2003 edition of the International Building Code (IBC) refers to the new seismic

design provisions for architectural glass contained in ASCE 7-02 *Minimum Design Loads for Buildings and Other Structures*. ASCE 7-02, in turn, refers to AAMA 501.6-01 *Recommended Dynamic Test Method for Determining the Seismic Drift Causing Glass Fallout from a Wall System*.

Some important design considerations include the use of:

- flexible frame or displacement accommodating wall-to-building connections, to accommodate racking without damage to glass systems or loss of serviceability;
- adequate glass-to-frame clearances;
- laminated glass in annealed or heat-strengthened constructions, either single pane or in an insulating glass unit;
- appropriate bottom and side blocking;
- silicone glazing.

Capabilities

Laminated glass performs very well in seismic applications because the plastic interlayer holds most of the glass fragments following cracking, which significantly reduces the potential of glass falling to the ground. In addition, the complete

glass unit tends to be retained in the frame. These attributes of laminated glass help the building envelope remain intact, which prevents further damage from weather and looting.

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Applications

Earthquake-resistant glass should be used in all fenestration used in seismic-prone areas. Applications include storefronts, curtain walls and other commercial glazing. It is particularly well suited to applications where glass can fall and potentially create a life safety issue. Consideration should also be given to

using this type of glass in internal applications, particularly where large areas of glass are used, such as in malls and atriums. Earthquake-resistant glass is also beneficial when maintaining maximum building functionality, in the aftermath of a moderate or severe earthquake, is required/desired.

Characteristics

The following constructions of laminated glass are most commonly specified in earthquake-prone regions. As with all laminated glazing, the glass can be supplied tinted or reflective for light and solar control purposes. The lites of glass can be either

annealed or heat-strengthened. Oldcastle Glass® does not recommend tempered glass be laminated for seismic applications because of “wet blanket” fallout concerns.

Designation	Construction	Thickness		Weight	
	Glass - PVB - Glass	inches	mm	lbs/ft ²	kg/m ²
110100	1/8"–0.060"–1/8"	5/16	8	3.58	17.5
110110	3/16"–0.060"–3/16"	7/16	11	5.21	25.4
110120	1/4"–0.060"–1/4"	9/16	14	6.83	33.3

When insulating glass is required for thermal performance in earthquake-prone regions, Oldcastle Glass® recommends that both lites of

the IG unit be laminated to provide maximum glass retention both inside and outside the building envelope.

Additional Important Information

Design Criteria

Details on the following important topics can be found in the Black Design Criteria Tab: Glazing Instructions, Thermal Stress, Deflection, Glass Design Loads, Glass Thickness Selection, Spontaneous Breakage of Tempered Glass, Roller Wave Distortion in Heat-treated Glass, Mock-ups, and Warranties.

Specifications

A sample Section 08800 Specification for North America can be found in the Black Specifications Tab. Information specific to two-ply (two lites of glass) laminated glass can be found in Part 2 Products, 2.02 Materials.

For specifications on other laminated glass makeups, call 1-866-OLDCASTLE(653-2278) or log on to www.oldcastleglass.com and click on

“Need Assistance with a Project,” click on “General Inquiry” and enter your request.

Contact Us

For any additional information, including details, technical data, specifications, technical assistance and samples, or to speak with an architectural specialist, call 1-866-OLDCASTLE(653-2278).

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