



Glass Informational Bulletin

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Emergency Egress through Laminated Glazing Materials

Building codes often require, and/or modern architectural designs specify, glazing materials that provide enhanced performance levels of security and safety. These performance properties include: resistance to ballistics, blast, hurricane/cyclic wind pressures and physical attack. Glazing applications may also specify such properties as sound reduction, fade resistance, and solar and thermal control. Because laminated glazing materials are able to meet such requirements and design criteria, they are finding application in a broader range of installations than ever before. The use of laminated glazing in residential and commercial installations has led to inquiries by design professionals and specifiers regarding the reaction of public safety officials to these products. This Glass Information Bulletin is intended to inform building owners, design professionals, and specifiers about emergency ingress and egress considerations when using these products.

Laminated Glazing Fabrication

Laminated glazing materials consist of multiple layers of glass, interlayers, resins and/or plastic glazing materials which are often complex in nature. The interlayers can be any one of several thermoplastic layers such as polyvinyl butyral (PVB), polyurethane (PU), ethyl vinyl acetate (EVA), ionomer interlayers or other individual or combinations of thermoplastic polymers. These layers are usually bonded to the glazing system base (glass, acrylic, polycarbonate, etc.) using heat and/or pressure systems that create a glazing lite. Laminated glazing can also be fabricated using cured resins between the layers of glass. In each construction, the resulting glazing product is designed to provide the specified level of performance for the required application.

Performance Characteristics

Laminated glazing materials have performance properties that add value to architectural structures, automobiles, and aircraft. In addition to effectively reducing solar gain for energy control and sound transmittance in acoustically engineered structures, a beneficial property of laminated glass is that it provides a barrier to penetration. This transparent yet resistant glazing system helps protect against a range of man made and naturally occurring situations that would cause the structural envelope to be breached if laminated glass were not used. Such situations include security requirements to protect against forced entry, ballistic, or even blast attack.

Laminated glazing provides protection and safety in such naturally occurring situations as earthquakes, windstorms, or hurricanes. In such situations laminated glazing tends to remain in place if broken, thereby reducing the likelihood of glass-related injury. Requirements that glass remain in the window opening during and following these events make laminated architectural glazing attractive for use in hurricane zones, earthquake-prone areas and those buildings potentially subject to the threat of a blast.

Emergency Egress

An often asked question regarding the installation of laminated glazing systems is how the glazing will affect the ability of an occupant to use the window as an emergency egress. In residential applications, doors are utilized for emergency egress, and in those instances where windows are used for egress, the windows can be opened using the standard locking / latching mechanism prior to egress. If a resident must leave a burning building through a window, typically they open the window to escape. “Normally, it is not somebody’s first response to break a window,” said Mike Forgy of the International Association of Fire Chiefs.

In office buildings, the installation of laminated glazing in non-operable windows would not affect their use for points of egress since these windows are usually installed in multi-level (high rise) buildings where such windows are not the designated point of egress. According to Reginald Penny, president of the Fire Marshall’s Association of North America and Chief and District Commander for the Palm Beach County Fire Department, “Windows are only to be used as a secondary means of escape according to standard building code requirements.”

Emergency Ingress

Often of greater concern than the issue of emergency egress is the perceived deterrence that laminated glazings pose to fire and rescue personnel attempting to enter a building. “We really don’t like to break windows because the sharp glass shards that remain can cause injury and cut through fire hoses,” Penny said. “Windows are removed as a last resort because there is too much room for error and injury.” According to Mr. Penny, the ability of laminated glazing to resist penetration does not pose a significant risk to inhabitants during a fire. “We use windows as a last resort in rescue operations because open windows feed oxygen to a fire and often times when utilized, windows do more harm than good because they have a tendency to blow out when punctured under pressure.” said Mr. Penny.

In some severe cases it may be necessary for a fire fighter to enter through a window. With the implementation of building codes that have made laminated glazings more prevalent, fire and rescue personnel are being targeted for awareness of, and response training toward, these products. GANA is aware of several training programs which instruct fire and rescue personnel to quickly identify the presence of, and respond to, penetration deterrent glazings. Fire and rescue personnel are equipped to penetrate these glazings with the available tools they bring with them in an emergency situation. These tools vary from a common fire ax or fire hook to saws



and cutting devices. Mr. Penny feels that “If firefighters can cut a car in half to rescue its occupants, then they can cut through a piece of glass without a problem.”

Government and Industry Research

Federal and local governments have reacted to concerns about emergency access through laminated glazing materials. The U.S. General Services Administration (GSA) in conjunction with the Office of Homeland Security commissioned a study by Hinman Consulting Engineers in May, 2003, that tested emergency personnel access through penetration deterrent windows (such as those specified for blast resistant glazings in GSA facilities).

Working with the San Jose (CA) Fire Department and the Protective Glazing Council, twenty-seven different protective glazing constructions were studied, ranging from standard glass to blast resistant glazing. Fire and rescue personnel utilized the standard forcible entry tools and operating procedures of the San Jose Fire Department and the International Fire Service Training Association. As stated in the report’s conclusions, “The Firefighters were able to enter all of the window mock-ups with conventional firefighting tools such as axes, hooligans’ tools, and pike poles. Though conventional tools were equal to the job, updated techniques were required to efficiently break and clear the windows.” The complete study, along with videos of the entry tests can be found at the internet site of the National Institute of Building Sciences (NIBS) <http://www.wbdg.org/ccb/GSAMAN/fullforc.pdf>

Additional comments from this report are:

“All tools used in the tests are commonly carried on fire apparatus or by firefighters throughout the United States. Entry was restricted to gaining access through the glass itself and not by prying the window framing from the wall. If the firefighters did not gain access with these limitations, provisions were made for the use of more sophisticated tools. In this set of demonstrations, more sophisticated tools were not required.”

“Films and lamination tend to hold glass shards together, which can allow firefighters to more easily move the glass away from the operational area and may decrease the likelihood of injuries associated with stepping on glass shards (slip, trip, and fall type injuries). It can also reduce the hazard from falling glass to those working outside the building.”

Like the U.S. Government, private industry is also working to inform and educate emergency rescue personnel. Manufacturers of penetration deterrent windows have conducted training demonstrations and produced educational videotapes which they make available to fire and rescue personnel. In one such demonstration, using windows supplied by a local manufacturer, the Sarasota, FL Fire Department produced a video that shows the effective means of breaching hurricane building code compliant windows using tools ranging from the pick head ax and Denver tool to powered reciprocating and rotary saws.



Summary

Among its conclusions, the Hinman report suggests that “The transfer of information on [these] window systems should be made a priority by entities involved in the installation of these window systems. ... To assist local fire departments in assessing the demands on their operations...the following information should be offered:

- A summary paper of this report
- Five-minute video, showing highlights of the demonstrations
- Full-length video, showing all demonstrations”

This Glass Information Bulletin has been issued by GANA toward fulfilling the Hinman report’s recommendations and with the goal of expanding the understanding that laminated glazing materials do not pose increased risk against emergency entrance by properly informed and trained rescue personnel or against emergency exit by building occupants.

For additional information on laminated glazing materials consult the GANA *Laminated Glazing Reference Manual* and the GANA website: www.glasswebsite.com.

The Glass Association of North America (GANA) has produced this Glass Information Bulletin solely to provide general information to building owners, design professionals, and glass specifiers concerning the effect of laminating glazing materials upon emergency ingress and egress capabilities of glazed structures. The Bulletin does not purport to state that any one particular type of glass or laminated glazing material should be used in any specific application. The user of this Bulletin has the responsibility to secure instructions from the glass supplier concerning the performance characteristics of the laminated glazing materials to be specified, including the risk, if any, they may pose to emergency entrance or exit by rescue personnel or building occupants. GANA disclaims any responsibilities for any specific results relating to the use of this Bulletin, for any errors or omissions contained in the Bulletin, and for any liability for loss or damage of any kind arising out of the use of this Bulletin.

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