



Glass Informational Bulletin

GANA PGC 07-0114

Security Glazing for Schools

The objective of this document is to provide information on security glazing options for windows and doors installed in schools. Before the glazing is specified, it is important to determine the assets, threat/hazard, vulnerability, and risk associated with each school. The Federal Emergency Management Agency (FEMA) has updated its publication: “Primer to Design Safe School Projects in Case of Terrorist Attacks and School Shootings” (December 2012) with an appendix that provides a checklist for use in these assessments.

Types of Security Glazing

Forced-entry resistant laminated glazing can be a deterrent to smash-and-grab crimes and may also resist penetration from hand-held or hand-thrown objects such as hammers, crowbars, bats, knives, bricks, and rocks. Laminated glass can be tested according to Underwriters Laboratories (UL) Standard 972 *Standard for Safety for Burglary Resisting Glazing Materials* and/or to ASTM F 1233 *Standard Test Method for Security Glazing Materials and Systems*.

Bullet resistant laminated glazing is designed to resist penetration from medium-to-super-power small arms and high-power rifles. There are numerous types of bullet resistant laminated glazing, including all-glass laminates, glass clad polycarbonate laminates and laminated polycarbonates. Laminated glazing must be tested in accordance with standard procedures to demonstrate their ability to resist a specific ballistic threat level. Bullet-resistant laminates provide an improved safety barrier against bullets and related flying glass or plastic fragments (spall). All-glass laminates typically do not provide prolonged attack resistance. Testing is done according to Underwriters Laboratories (UL) Standard 752 *Standard for Bullet Resisting Equipment*; ASTM F 1233 and National Institute of Justice (NIJ) Standard 0108.1 - *Ballistic Resistant Protective Materials*

Blast resistant laminated glazing can substantially reduce injury from flying glass resulting from direct blast shock waves (over-pressures). When properly designed, framed, and anchored, blast resistant laminates are capable of maintaining the integrity of the building envelope following an explosion and reducing interior damage. ASTM F 2912 *Standard Specification for Glazing and Glazing Systems Subject to Airblast Loadings* and ASTM F 1642 *Test Method for Glazing and Glazing Systems Subject to Airblast Loadings* can give guidance to specifiers. Blast resistant

laminated glazing may offer some level of forced entry resistance, but typically are not bullet resistant without further specification of a ballistic threat level.

Hurricane resistant laminated glazings reduce the effects of windstorms on buildings by preserving the integrity of the building and preventing glass particle fallout. Laminates are typically tested in systems according to ASTM E 1886 *Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missiles and Exposed to Cyclic Pressure Differentials*. The accompanying specification is ASTM E1996 *Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors and Impact Protective Systems Impacted by Windborne Debris in Hurricanes*. Hurricane resistant laminated glazing may offer some level of forced entry resistance, but typically are not bullet resistant without further specification of a ballistic threat level.

Laminate Constructions

Forced entry resistant laminated glass typically consists of two layers of annealed, heat strengthened or tempered glass bonded together by a .060 in. (1.52 mm) or thicker interlayer. The glass can be installed into insulating glass units for improved thermal performance.

Bullet resistant laminated glazing typically consists of multiple layers of glass, interlayers, resins, and/or plastic materials such as polycarbonate or acrylic. Glass layers are intended to deform projectiles and slow their velocity. Plastic layers are designed to capture the deformed projectile, and interlayers act to hold all layers together through the assault. The layer on the protected or witness side may have mar-resistant polycarbonate or film for spall protection. Overall thickness of the glazing may range from 0.5 in to 2.25 in. (12 mm – 57 mm).

Blast resistant laminated glazing typically consists of two layers of glass bonded together by a .030 in. (0.76 mm) or thicker interlayer. The glass can be annealed, heat strengthened or fully tempered. The glass can be installed into insulating glass units for improved thermal performance.

Hurricane resistant laminated glazings typically consist of two layers of glass bonded together by an interlayer. The interlayer thickness is typically 0.060 (1.52 mm) or thicker based on the intended use of the glazing in the building and the expected missile size for the elevation of the building. Many hurricane resistant systems have also been successfully tested for blast resistance. These systems may provide a level of forced entry resistance as well.

Emergency Egress

Security laminates are designed to remain intact after breakage. This may increase the amount of time and effort required for firefighters and first responders to vent and clear the building during an emergency. The U.S. General Services Administration (GSA) has developed a training program that addresses emergency egress through security glazing. Architects and schools installing security windows need to be aware of the potential time needed to get through security glazing. The proper tools, education and training should be in place for any school installing



security glazing. Other possible means of emergency egress for teachers and students should be clearly identified.

Sources of Security Glazing Systems

Many window, door, curtain wall manufacturers have systems that have been tested with security glazing. More information is available from these manufacturers.

Reference Section

Primer to Design Safe School Projects in Case of Terrorist Attacks and School Shootings” (December 2012) <http://www.dhs.gov/bips-07-primer-design-safe-school-projects-case-terrorist-attacks-and-school-shootings-2nd-edition>

Documents to consider as additional resources are the GANA PGC 01-0707 *Bullet Resistant Glazing*, *GANA/PGCI Protective Glazing Manual*, and *GANA Laminated Glazing Reference Manual*. Consult the *TechCenter* section of the Glass Association of North America (GANA) website (www.glasswebsite.com) for additional Glass Informational Bulletins and flat glass industry reference resources.

The Glass Association of North America (GANA) has produced this Glass Informational Bulletin solely to provide information regarding security glazing for schools. This bulletin makes no attempt to provide all information or considerations in the use of security glazing for schools. The user of this Bulletin has the responsibility to ensure their awareness of the use of security glazing for schools. GANA disclaims any responsibility for any specific results related 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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