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Certified glazing assemblies provide reliable performance under attack. ASTM F3561 sets the baseline for school security glazing after simulated active shooter events—critical for architects and designers to specify.

Security Glass and Glazing Systems

Effective deterrent solutions during active shooter events

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Trigger Warning: This article discusses school security in the context of active shooter events and forced-entry scenarios. It includes references to violence and security measures that may be distressing. Reader discretion is advised.

Active shooter events have increased in frequency in the past two decades, placing renewed focus on strategies that delay entry and provide critical response time. In school buildings, one of the most vulnerable access points is doors and windows. Security glazing systems designed to resist forced entry play a pivotal role in slowing down an intruder, enabling administrators to activate emergency protocols and giving law enforcement time to respond. Unlike standard glass, tested and certified glazing assemblies offer more reliable and predictable performance under duress. ASTM F3561 provides the industry's baseline for evaluating fenestration systems subjected to forced-entry attacks following a simulated

active shooter event. This standard is now recognized as the minimum requirement for school security glazing, and it is critical that architects and designers understand the importance of specifying window and door assemblies that meet the standard. This article will examine the evolution of active shooter incidents in U.S. schools and offer guidance on selecting appropriate glazing systems that align with both performance standards and architectural intent, ensuring a layered, reliable defense against intrusions.

THE RISING TIDE OF ACTIVE SHOOTER EVENTS IN PUBLIC EDUCATION

Over the past two decades, school shootings in the United States have transitioned from rare tragedies to a far more alarming and frequent national crisis. Between the 2000–01 and 2021–22 school years, there were 1,375 recorded shootings at public and private K–12 schools, resulting in 515 deaths and 1,161 injuries, meaning roughly 70 percent of these incidents caused casualties.

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Learning Objectives

After completing this course, you should be able to:

1. Discuss the history and frequency of active shooter events, specifically in school buildings.
2. List common myths associated with the specification of modern glass and glazing and the limitations of previous security glazing standards.
3. Explain how appropriately specified security glazing systems serve as a valuable and effective deterrent during active shooter events.
4. Identify key components of ASTM F3561 *Standard Test Method for Forced-Entry-Resistance of Fenestration Systems After Simulated Active Shooter Attack* that address design and performance requirements for security glass window and door assemblies.

To receive AIA credit, you are required to read the entire article and pass the quiz. Visit ce.architecturalrecord.com for the complete text and to take the quiz for free.



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The 2021–22 academic year marked an all-time high, with 327 shootings, 81 fatalities, and 269 injuries, far exceeding previous records.¹

By 2022, public discourse on this issue was dominated by the year's grim statistics: 51 shootings that caused injury or death, resulting in 18 school-associated fatalities and at least 77 injuries.² This sharply contrasts with 2021, which saw 35 incidents, and 2020—the beginning of the pandemic—when school shootings dropped to just 10.³

The trend has not reversed. Education Week tracking shows 38 such shootings in 2023, with 21 people killed and 42 injured, making it the second-highest incident year since 2018. Through all of 2024, there were 39 incidents resulting in 18 deaths and 59 injuries. While the number of people shot remained lower than in 2022, incidents remained historically high.

According to the National Center for Education Statistics, active-shooter events at elementary and secondary schools claimed 328 casualties—131 fatalities and 197 injuries—from 2000 through 2022. Notably, there were 52 casualties in 2022 alone, making it the second-highest year in recorded data.⁴

Teachers, students, and communities feel the reverberations of this violence far beyond the classroom. Violent incidents in public schools—including shootings, fights, or threats—are reported at a rate of roughly 19 per 1,000 students annually, with about 5 per 1,000 incidents reaching law enforcement. What this suggests is that while we can collect information about events that rise to the level of alerting authorities to the risk, the actual risk to students, staff, and visitors of public schools is significantly higher.

The past four years—2021 through 2024—represent the peak period in recorded history, with a surge in incidents coinciding with increased student exposure and casualties. There are many causes—rising firearm prevalence, social stressors, and the contagion or copycat effect acknowledged in academic studies—yet the facts are clear: violence is escalating in public educational environments. The year 2025 is statistically on track to continue this trend of violence,



Research shows attackers often exploit perceived weak points like glass to enter schools—by-passing locks by simply shooting through standard glazing.

with at least 7 shootings with injuries or deaths, involving 2 fatalities and 12 injuries.

These statistics show no signs of a downward trend.

Active-Shooter Incidents

Once the act of violence is instigated, how it will transpire or escalate is unknown. That is to say, gun violence on public school grounds may start for a number of reasons, including personal rivalries, drug and crime violence, or mental health issues. After the conflict has begun, it can be difficult to predict the path or outcome of these random and likely not well-planned events. However, there is a distinction to be made between solitary acts of violence and premeditated mass shootings.

For the purposes of this article, we will focus on preventative measures to thwart, frustrate, or minimize the lethal impact of active-shooter incidents. Active shooter incidents refer to events in which someone is actively discharging a weapon with the intent to harm.

From 2000 through 2022, the National

Center for Education Statistics reported a total of 50 active-shooter incidents at elementary and secondary schools across the U.S. Since the first highly publicized case at Columbine High School in April 1999, the incidents represent the known events where an individual actively engaged in firearm violence on school grounds. These NCES figures include both public and private K–12 institutions.

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Easy Access for the Attacker

While active shooter situations in public schools vary greatly, some of the most devastating have very similar characteristics. Through a forensic examination of the crime, we, as a society, have an opportunity to learn, adapt, and improve our ability to alter the outcome of active-shooter situations.

What research has discovered is that attackers often exploit architectural and surveillance vulnerabilities to gain access to school buildings—and traditional glazing is frequently among the weakest links. In numerous active-shooter situations, shooters bypassed entry controls not by forcing locked doors or blasting through walls, but by simply shooting through ordinary glass to easily pass through the resulting opening. Within seconds, they sliced into communal spaces where students and staff felt safe. By isolating these cases, we can clearly see how glazed openings enabled predatory movement.

The following list of active shooter instances in public schools illustrates the underlying connection of glass as an easy point of entry for attackers.

- **Columbine High School, Littleton, Colorado (April 20, 1999)**
During the Columbine High School massacre, attackers fired through multiple standard windows and glass-panel exterior doors to enter buildings and tunnel toward central gathering areas. They killed 13 people—12 students and one teacher—and wounded 24 others before taking their lives. Shooting through glass gave attackers rapid, otherwise blocked lines of sight and congregation zones like the library and cafeteria. In corridors, shattered glass eliminated barriers, allowing full access without physically opening doors.
- **Sandy Hook Elementary, Newtown, Connecticut (December 14, 2012)**
At around 9:35 a.m., the shooter forced entry into Sandy Hook Elementary by breaking the standard glass in the front door. Reports indicate that after finding the door locked, he used a projectile to shoot through the glass panel before entering the vestibule. Inside the school, he killed 20 first-graders (ages 6–7) and six adult staff in under five minutes before taking his own life. The rapid penetration of glazing allowed the attacker immediate entry without managing door hardware.
- **Marjory Stoneman Douglas High School, Parkland, Florida (February 14, 2018)**

The Parkland attacker was able to enter through standard windows and doors—shooting out glass to breach the school’s “1200 building” freshman classroom wing. He murdered 14 students and three staff members and wounded 17 others.

Investigators noted the presence of bullet-scarred glass throughout hallways and classrooms, underlining how easy access via glazing facilitated the shooter’s movement before police could intervene.

- **Robb Elementary School, Uvalde, Texas (May 24, 2022)**

Nineteen fourth-grade students and two teachers were killed after the attacker entered through the main door, later found to have remained unlocked. Once inside, the shooter penetrated classroom door sidelights and vestibule windows with gunfire, creating openings that permitted continued access without breaching door hardware. Standard glazing allowed shots between hallways and classrooms, offering a fast, direct route to victims. While structural and procedural failures played their part, glass served as a tactical conduit for rapid movement and harm.

- **The Covenant School, Nashville, Tennessee (March 27, 2023)**

At approximately 10:10 a.m., the perpetrator employed an AR-style pistol to shoot through a set of glass side-entrance doors, shatter the panels, and hunched under the safety egress bar to enter through the resulting opening. Security footage revealed that the standard tempered glass yielded in seconds, permitting direct access to staff and students. In less than a minute, the shooter had removed nearly all barriers—leaving custodians and children minimal opportunity to react. Six people were killed, including three 9-year-old children, and two others were wounded. Subsequent analysis called out glass as “a weak point,” with experts noting that hardened glazing could have delayed the breach by several minutes—enough for law enforcement to arrive. It should be noted that at the time of this attack, ASTM F3561 was a fully published and referenceable standard.

- **Apalachee High School, Winder, Georgia (September 4, 2024)**

In this tragedy, four were killed and seven were wounded. Though still under investigation, preliminary findings showed that the shooter accessed classrooms through glazed corridor segments and glass-enhanced doors. Windows adjacent

to entry paths provided visual awareness and pre-entry shots that disoriented staff. The threat could navigate hallways using those glazing lines of sight—again without having to breach sturdy door hardware—underscoring a recurring design vulnerability.

- **Perry High School, Perry, Iowa (January 4, 2024)**

Following the winter break, a 17-year-old shooter opened fire with a shotgun. Investigative notes emphasize that glass in internal doors and sidelights allowed rapid interior movement. Even without high-velocity weapons, glass panels were effective conduits for line-of-sight shots into occupied spaces. Once breached or shattered, the shooter exploited visual access to target victims down corridors.

- **St. Louis Central Visual and Performing Arts High School (October 2022)**

Though not among the top four in fatalities, this incident followed a familiar pattern: an AR-style rifle was fired through a glass door, permitting the shooter to enter and kill two individuals, injure seven others, and evade immediate containment.

Across all of these events, glazed openings—whether sidelights, transoms, windows, or full-glass doors—were exploited by shooters using firearms, allowing penetration into the building or interior spaces in seconds. In Nashville, entry was achieved within seconds simply by shooting through glass. In other cases, even low-velocity weapons accessed interior sightlines to devastating effect using similar tactics.

Each example exposes a design flaw: glazing assumed to be benign or conducive to supervision became an unintentional conduit for violence. The glazing systems were likely code compliant with safety glazing regulations; however, security is a different matter and thus has different requirements and performance standards that must be specified and utilized. These are not one-off concerns but show a persistent pattern: attackers study or know building layouts and target glazed openings first because they offer both transparency and vulnerability. Glass free of ballistic or forced-entry resistance properties provides attackers with visibility, access, and psychological intimidation.

A CALL TO ACTION – UPGRADING THE SECURITY OF SCHOOL BUILDINGS

The threat of violence and the possibility, or probability, of an active shooter incident at

Photo courtesy of the National Glass Association



Historically, window design in schools prioritized daylighting, ventilation, and occupant comfort; however, safety concerns now require the addition of security glass.

public schools has moved many communities to action. While a national conversation about mental health and access to weapons is beyond the scope and control of smaller towns, across the United States, school boards, city governments, and local code officials are taking a broader, more integrated approach to mitigating the risk of active shooter events.

In many jurisdictions, new policies focus on securing the entire school perimeter, limiting access points, and ensuring that building layouts support rapid lockdown procedures. Secure vestibules, controlled entry systems with intercoms or video surveillance, and badge-based access for staff are becoming standard features in both new construction and retrofits. These enhancements aim to deter unauthorized entry and allow school staff to verify visitors before granting access.

Local building codes and municipal ordinances are also beginning to reflect these priorities. Some cities have adopted regulations requiring school entrances to include delayed-access mechanisms, forced-entry and impact-resistant doors, and upgraded locking systems. Others are mandating coordination between school design teams and law enforcement to incorporate Crime Prevention Through Environmental Design (CPTED) principles—such as clear sightlines, defensible spaces, and strategically located safe rooms. Emergency communication

systems, including silent alarms and mass notification platforms, are increasingly included in school safety plans. It is not uncommon to see armed police or private security details positioned outside public schools.

In parallel, school boards are revising emergency preparedness protocols to address active shooter scenarios directly. Regular drills, classroom hardening strategies, staff training programs, and behavioral threat assessments are becoming part of a systemic response to violence prevention. These efforts are often supported by grant funding at the state or federal level, which encourages investment in holistic safety measures rather than focusing on a single material or design feature.

In this evolving landscape, glazing upgrades are increasingly becoming a critical element. Specifically, schools are asking the question of how windows and doors perform in active shooter situations and how these necessary building components can be part of the overall comprehensive defensive plan.

The Necessity of Windows and Doors

Historically, window and door design in schools prioritized daylighting, ventilation, and occupant comfort. Security was a secondary consideration, often limited to basic laminated glazing or safety film applications intended to reduce injury from accidental human impact. These solutions, while useful

in low-threat environments, have proven inadequate when subjected to deliberate, targeted attacks intended to breach a building envelope. What analysis of previous active shooter incidents has taught us is that the ability of a glazing system to delay forced entry, even briefly, can buy life-saving time for lockdown procedures and law enforcement intervention.

One of the persistent challenges in adopting advanced window and door technologies is balancing security with the educational environment. Schools are not fortresses; they are learning spaces. Natural light, views to the outside, and a sense of openness are all essential to student well-being and cognitive function, and teacher/staff retention. Overly opaque or institutional building designs risk undermining the very purpose of the school itself. Fortunately, modern security glazing products offer a variety of aesthetic options that allow security to be integrated seamlessly. Laminated glass, insulating glass units with security interlayers, and finishes that match adjacent non-security windows are all available. These solutions ensure that classrooms and corridors remain welcoming while still meeting stringent performance criteria.

In some cases, large-format windows are being designed with concealed security features. For instance, windows might appear as single panes but are actually multi-layered laminated glass assemblies, some with internal polycarbonate layers or embedded metal mesh, invisible to the casual observer. Similarly, hardware reinforcements such as tamper-resistant fasteners, mullion stiffeners, or anchored perimeter channels can be integrated behind trim to preserve a clean architectural appearance. These innovations allow architects to meet the needs of both administrators and educators—providing defensible space without visually signaling fear or vulnerability.

School districts seeking to upgrade window and door technologies must also navigate code requirements, funding constraints, and stakeholder consensus. Security glazing must coexist with fire egress codes, energy efficiency mandates, and accessibility standards. In some cases, a glazing that performs well for security may fail to meet thermal or daylighting benchmarks, and vice versa. Interdisciplinary coordination is therefore essential. The solution must work for all parties, including teachers, staff, and students.

Budget also remains a critical

BALANCING FIRE PROTECTION AND SECURITY IN GLAZING SYSTEMS

While active-shooter threats demand attention, designing for overall life safety, including maintaining fire protection at schools, must be addressed concurrently. According to the International Association of Fire Chiefs, there are approximately 3,230 fires in educational buildings each year. A potentially overlooked challenge in school security design is how to ensure that glazing systems designed for security do not inadvertently compromise fire safety.

This intersection creates a complex dilemma. Security-rated glazing assemblies may incorporate plastic-based materials, such as polycarbonate interlayers or coatings, which can burn rapidly under fire exposure. When these components are added to doors or walls that are otherwise fire-rated, they may undermine the assembly's ability to maintain integrity during a fire event. This creates a trade-off that building professionals must navigate carefully. A product that performs well during an intruder attack may fail to meet the performance expectations of NFPA 80 *Standard for Fire Doors and Other Opening Protectives* or other applicable fire protection codes.

The consequences of incompatible

systems can be serious. If a security glazing product burns through prematurely, it could allow smoke and flames to travel quickly through the building, negating the benefits of compartmentalization and safe egress pathways. Moreover, alterations to listed fire-rated door or window assemblies without appropriate testing or certification—such as substituting laminated security glass for standard fire-rated glass—can invalidate their code compliance entirely.

To address these risks, manufacturers and specifiers are increasingly turning to system-level solutions that have been tested and listed for both security and fire resistance. This dual-rating approach ensures that the glazing system performs as intended in both emergencies, whether the threat is human or environmental. Coordination between design teams, code officials, and product manufacturers is essential.

In some retrofit scenarios, facility managers have attempted to improve security by adding security films or secondary glazing layers to existing fire-rated windows or doors. While these efforts are well-intentioned, they may alter the

heat transfer characteristics or combustion profile of the assembly, resulting in failure during fire exposure. Even minor modifications to fire-rated systems must be evaluated for code compliance. This often involves consulting with the original manufacturer or undergoing additional testing to verify performance.

An effective strategy is to adopt a system-based design approach where all glazing components—glass, frame, sealants, and hardware—are considered a full assembled unit. Each part must be compatible not only from a structural and security standpoint but also in terms of flame spread, thermal resistance, and regulatory compliance. In some cases, dual-layer systems may be used, where an outer security-rated glazing pane is paired with an inner fire-rated lite, separated by a controlled air gap and engineered framing.

Ultimately, balancing security and fire protection is not about choosing one life safety priority over another—it's about ensuring that one layer of protection does not compromise another. A building cannot be designed for security without regard to fire safety. The minimum building codes require fire protection.

consideration. While advanced glazing systems are more expensive than standard commercial windows, their cost must be weighed against the broader security infrastructure. A security glass assembly that delays an intruder by 60 to 120 seconds may provide enough time for classrooms to be locked down or for police to respond. In districts where full-scale hardening of the building is not feasible, targeted investments in high-risk locations can offer meaningful protection. Many state governments have introduced grant programs to support these upgrades, particularly when systems are tested to recognized national consensus standards.

The role of glazing technologies in comprehensive security planning extends beyond intrusion prevention. Modern glazing assemblies can also support lock-down protocols, surveillance strategies, and emergency egress. In entry vestibules, for example, windows may be designed to allow administrative staff to assess visitors before granting access. Glazing that resists forced

entry but permits visibility enables real-time evaluation of potential threats. Similarly, internal windows in classroom doors or corridor intersections can be protected with security glazing to prevent intruders from targeting occupants while still allowing staff to monitor the situation.

As design professionals continue to adapt to the reality of school-based threats, the expectation is that security glass will increasingly become a standard design component—no longer a specialized upgrade but an integral part of baseline specifications for new and renovated school buildings. Just as fire sprinklers, seismic bracing, and ADA-compliant paths of travel have become embedded in code and culture, so too will fenestration systems that reflect our current understanding of risk.

Threats from active shooter incidents have evolved, and so has the technology of glazing to protect students. However, not all security glass is created equal. As the industry matures in terms of how to manufacture advanced security glazing, so have standards that measure

and validate the effectiveness of products.

Understanding the evolution of standards and especially the current applicable testing methodologies is a critical element in designing schools to minimize the risk of active shooter incidents.

EVOLUTION OF GLAZING STANDARDS

The development of security glass technologies has largely mirrored the evolution of security glazing standards in the United States. Along with acknowledgement of glazing as an important and necessary component in delaying and thwarting active shooters, the industry has responded with improved materials and systems.

Validating the effectiveness of these new technologies is critical to ensuring that materials and glazing assemblies perform as expected. For decades, most protective glazing specifications centered around protection from accidents, natural disasters, or forced-entry attempts under specific, limited conditions. Window and door assemblies have long been tested for hurricane impact,

blast resistance, and burglary deterrence; however, the testing methodologies and performance classifications often failed to reflect the behaviors of armed assailants or the operational realities of schools, health-care facilities, and civic buildings.

ASTM F1233

One of the earliest widely adopted security glazing benchmarks was ASTM F1233 *Standard Test Method for Security Glazing Materials and Systems*, first released in 1989. Designed primarily to assess resistance to attack with common tools and blunt force instruments, F1233 subjects glass to an array of assaults—ranging from sledgehammers and chisels to propane burners and gasoline exposure. It covers a spectrum of classification levels, including pre-weakening with ballistics and forced-entry tests. The standard offers extensive coverage of mechanical and thermal threats, but in practice, it lacks real-world applicability for active-shooter scenarios, especially in the way testing is executed and results interpreted. For instance, test procedures in the standard call for “six males, muscular (180 to 250 lbs), in good health, who carry out an enthusiastic assault.” This ambiguous wording—combined with test sequences that could vary widely from lab to lab—raised questions about consistency and relevance.

ASTM E1996

Originally published in 1999, ASTM E1996 *Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes* was developed to evaluate glazing systems against windborne debris impacts during hurricanes. While not a security standard per se, it became a point of reference for early attempts to assess forced-entry resistance through high-velocity missile testing. Some earlier school safety specifications mistakenly equated hurricane-rated glass with security glazing, despite the fundamental differences in threat behavior and structural response. In the Parkland shooting, the impact-resistant rated glazing helped save lives because the assailant could not see through the laminated glass after impact. Though the laminated glass did not stop the bullets, it did stay in place, creating a visual barrier that allowed people to escape the building.

ASTM E2395

Another early and influential standard, ASTM E2395 *Standard Specification for*



Standards have changed over the years to address the need for windows and natural light in educational settings.

Voluntary Security Performance of Window and Door Assemblies with Glazing Impact, introduced a hybridized approach by requiring glazing systems to withstand hurricane missile impact tests per ASTM E1996. Its five-tier classification relied on predefined missile types (Missiles A through C), representative of windborne debris impact conditions, with higher levels adding forced-entry requirements from ASTM F1233.

Introduced in 2005, this standard seemed a logical convergence of safety and security objectives; however, questions about how applicable the standard was in real-world scenarios soon surfaced. The main issue with the standard was the question of whether hurricane impact resistance is truly applicable to ballistic or tactical forced entry. Also scrutinized was the concept that the test measured hurricane missile impact, but not resistance to a determined intruder with a firearm and breaching tools.

Test 5-aa1

An unfortunate outlier on the path of valid security glass standards was Test 5-aa1 *Certification Standards for Retrofitting and Reinforcing of Standard Commercial Entry Systems, Windows, and Glazing*. Developed

by an independent testing lab to promote alternative methodology and protocols for testing, Test 5-aa1 was a procedure that involved an eclectic combination of shotgun rounds, bricks, kicks, tool sets, and timed assaults with a sledgehammer. Though referenced in marketing materials and occasionally bid specifications, Test 5-aa1 offered no framework for repeatability or independent verification. The test was considered “proprietary” and lacked validation by any standards development organization, and was never developed under a consensus-based, transparent process. The very existence of such non-consensus tests planted confusion among designers, specifiers, and school districts attempting to make informed decisions about glazing systems.

These early standards laid the groundwork for evaluating glazing performance; however, as school shootings became more frequent and deadly in the 2010s, the glazing industry began reevaluating the adequacy of its test standards. Stakeholders recognized that current methods fell short of simulating a realistic active shooter event, particularly in terms of sequential attacks on glass and locking mechanisms. It became increasingly clear that new testing protocols were needed

COMMON MYTHS AND MISCONCEPTIONS

There are several common and closely held misconceptions and myths related to security glass.

One common myth, marketed as a quick and low-cost solution for retrofit projects, is that surface-applied window film can make existing windows “bullet-proof”. The International Window Film Association (IWFA) has explicitly cautioned that window films do not offer bullet resistance to ordinary windows. Safety and security films can be used with tested bullet-resistant glazing as a spall shield to contain fragments of glass caused by a bullet’s impact. Security film has a proven role in delaying the entry of aggressors. While security film can be used as part of a tested forced-entry resistant glazing system, ASTM F3561 is not intended to cover aftermarket film applications. Factors such as glass type, frame integrity,

and attachment systems introduce variables that are not applicable to the current test standard. This distinction is critical if the project has specifically noted that window and door assemblies must comply with ASTM F3561.

Another misconception lies in the assumption that performance claims from a single test translate to universal applicability. A product that passes a Level 1 forced-entry test may not perform similarly under more intense conditions or after ballistic damage. Moreover, tests conducted on isolated glass specimens are often confused with whole-system performance. The distinction is critical: security glazing is only as effective as its weakest component, whether glass, frame, hardware, or anchoring method. Specifiers who focus solely on the glass type, without

evaluating the system as a whole, risk overlooking failure points that could undermine security.

A final lingering misconception is that security glass alone can prevent or stop an attack. While it plays a vital role in delaying entry and creating time for emergency response, it must be part of a layered and integrated security approach. Access control, door hardware, camera systems, and building layout all contribute to the effectiveness of a security strategy. Schools and public buildings benefit most when security glazing is used in concert with robust entry protocols, trained staff, and law enforcement coordination. Misplaced reliance on glazing—especially if it’s poorly specified or untested—can lead to vulnerabilities that had been ignored elsewhere in the security chain.

that could capture the dynamic nature of attacks that begin with ballistic weakening of glass and are immediately followed by forceful attempts to gain entry.

This recognition culminated in 2020 when the National Glass Association initiated the formation of a dedicated School Security Task Group. The group began developing what would become ASTM F3561, the first consensus-based standard specifically designed to evaluate the forced-entry resistance of fenestration systems after a simulated active shooter attack. The goal was to produce a rigorous, repeatable, mechanical, and scenario-driven standard that reflected the way real-world attacks unfold.

ASTM F3561 – PURPOSE, SCOPE, AND TESTING OVERVIEW

The release of ASTM F3561 in 2022 marked a pivotal moment in the development of fenestration standards. For the first time, the glazing industry had a comprehensive, consensus-based standard specifically designed to address the threat of forced-entry—a testing scenario directly relevant to active shooter events in schools and similar public spaces. Unlike its predecessors, which were often adapted from hurricane protocols, burglary deterrence standards, or military blast tests, ASTM F3561 was purpose-built to replicate the sequence of events likely to unfold in a modern assault. It is not simply a revision of older protocols but rather a

fundamental rethinking of how glazing systems must perform under the stress of armed and determined intrusion.

The scope of ASTM F3561 is narrowly focused but widely applicable. It evaluates the forced-entry resistance of full fenestration systems—windows, doors, storefronts, modular wall panels, and other glazed openings—after those systems have first been subjected to simulated ballistic weakening. In this context, “ballistic weakening” refers to fully penetrating bullet impacts and/or damage inflicted by firearm projectiles that degrade the structural integrity of the glazing, thereby setting the stage for manual breaching attempts.

This scenario has played out in multiple real-world school shootings, most notably at Sandy Hook Elementary School in 2012. In that event, the attacker fired at and shattered the tempered glass adjacent to the locked front entry doors. Although the glass was not penetrated by the bullets themselves in the conventional sense, the impact shattered the panels and compromised their ability to serve as a barrier. The attacker then reached through the broken glazing and manually opened the door, gaining immediate access to the building. This sequence—shooting followed by physical entry—is a textbook example of ballistic weakening followed by forced entry, and it highlights the critical limitations of traditional tempered safety glass that was never intended to resist such

combined threats.

Ballistic weakening represents a transitional phase in an active shooter assault, where the initial act of shooting serves both to inflict harm and to disable security barriers. In many schools, sidelights or door vision panels are made of tempered glass that may remain intact for a moment post-impact, but without proper forced-entry resistance, the glazing can be dislodged or breached manually within seconds. ASTM F3561 replicates this dual-threat sequence in its testing methodology by first simulating the ballistic damage using standardized rounds (such as those from an AR-15), then transitioning immediately to a forced-entry phase using a mechanical impactor to simulate attacker behavior.

Ballistic weakening does not always involve a hole large enough for a person to pass through initially—but it alters the condition of the glazing enough to make physical defeat possible. ASTM F3561 takes this into account by requiring that full assemblies be tested for their ability to resist a forced entry attack after this initial weakening phase. In many cases, the difference between a life-saving delay and an immediate breach is a matter of how the frame, hardware, and glass respond in the critical seconds following ballistic impact.

To achieve a passing test under ASTM F3561, a manufacturer must test complete, full-size systems that reflect

production-quality construction. The testing program requires a minimum of three identical specimens per product type, tested under strictly controlled procedures. For instance, in the case of a single door system, two units are subjected to glass or panel weakening and then forced entry, while a third is tested specifically for lock hardware weakening, followed by forced entry. If multiple sizes are offered in a product line, both the smallest and largest sizes must be tested; intermediate sizes may be considered qualified if the book-end sizes pass. This approach helps ensure that performance data is both representative and scalable.

The standard distinguishes between system-level tests and pre-evaluation tests. System tests, which involve a complete assembly including frame, glass, hardware, and anchoring, are required for product qualification. Glass-only tests are outlined in the appendix as pre-evaluation tools but are not considered sufficient for product certification. This distinction reinforces the importance of viewing glazing performance as part of a holistic system and not merely a function of glass strength. The key concept is that the parts of the system work together to create a more secure and durable assembly than the individual materials, frame design, and fastening methods.

The testing protocol itself is intensive and replicates realistic attack behavior. After the glass is damaged by gunfire using specified rounds to simulate commonly used firearms, the weakened assembly is then subjected to impact with a steel cylinder, swung as a pendulum into the assembly. This forced entry phase is where the performance of the entire system is evaluated. Success is defined not by the absence of damage but by the inability to create a breach with the impactor.

ASTM F3561 includes multiple performance levels, reflecting the amount of impact force required to breach the system after ballistic weakening. Higher levels indicate greater resistance, delays in forced entry, and increased protection for occupants and responders. As of this writing, Level 8 is considered a high bar for school applications, requiring systems to withstand prolonged and aggressive forced entry without yielding access. These levels give specifiers a way to match security requirements with product performance, tailoring solutions to the threat level appropriate for the facility.

One of the core innovations of the standard is its acknowledgment of the glass and the locking mechanism as dual points of

Photo courtesy of National Glass Association



Modern glazing standards have been upgraded to protect occupants against scenarios like Sandy Hook Elementary School, where the attacker fired at and shattered the tempered glass adjacent to the locked front entry doors.

A BIT OF GOOD NEWS

The Federal Bureau of Investigation (FBI) recently released a report on active shooter incidents in the United States for 2024. Findings show that active shooter events are down almost 50% in 2024 compared to recent years. Even more encouraging, there was a 57% decrease in casualties from 2023.

This report shows that with careful specification of security glass, there is the opportunity for fewer incidents and more lives saved. However, with over 106 casualties (23 killed and 83 wounded) in 2024, the importance of specifying forced-entry-resistant glass to slow and frustrate attackers remains critical.⁵

Importantly, ASTM F3561 is not a test of ballistic resistance. It does not evaluate whether a glass assembly stops a bullet, nor does it substitute for industry-consensus standards in ballistic applications. Instead, it begins where those tests end—assuming the attacker has already discharged a weapon and then moves to gain entry through the now-weakened assembly. The standard is built on the premise that ballistic glass alone is not sufficient if the system as a whole cannot prevent or delay entry following impact.

vulnerability. While many glazing systems emphasize glass resistance, ASTM F3561 requires that locks, hinges, and door frames be tested as well. This requirement addresses a common failure mode in active shooter scenarios—where attackers do not always attempt to break through the glass but rather

use it to reach and defeat the lock. Therefore, a system can only pass the standard if both the glazing and the locking hardware maintain their integrity under attack.

From a manufacturer's standpoint, testing to ASTM F3561 requires detailed planning and investment. Laboratories performing architectural glass testing offer certified testing services, but the process begins well before a product reaches the lab. Manufacturers must determine which system configurations to test while balancing cost, coverage, and market needs. Glass types, interlayer compositions, frame materials, hardware options, and anchoring methods must all be documented and replicated consistently. Testing multiple bays within a storefront system or combining several glass options within a composite test can reduce cost, but only if done in accordance with the standard's requirements.

Applying ASTM F2561 in Design

Incorporating ASTM F3561 into a project specification requires a clear understanding of both the threat environment and the standard's design intent. Architects and specifiers should begin by evaluating areas of vulnerability in the building layout—main entries, vestibules, classroom doors, sidelights, and ground-level windows near entrances. These areas can be prioritized for ASTM F3561-rated systems, while other openings may be addressed with alternative means depending on risk assessment. Code officials, design professionals, and owners may work together to determine what level of performance is appropriate based on the facility type, occupancy, and emergency response timeframes.

There are also compatibility concerns when integrating security-rated glazing with fire-rated components. Some high-security interlayers and plastics can undermine the fire resistance of a door or window assembly. ASTM F3561 does not evaluate fire performance, and in some cases, a product that passes the standard may fail fire testing due to material incompatibility or the use of non-fire-rated hardware. To address this, some manufacturers now offer co-rated systems that have been tested for both security and fire. Others may require a multi-product solution, where distinct but compatible components are used to meet multiple code objectives. In retrofit situations, special care must be taken to ensure that added security features do not violate the fire rating of existing systems, a concern that may

require additional testing or manufacturer consultation.

ASTM F3561 also intersects with other performance domains—thermal resistance, hurricane impact, acoustics, and aesthetics. For example, in coastal zones, projects may require dual certification to ASTM F3561 and ASTM E1996 (hurricane impact). In such cases, systems must be tested and certified for both types of impact. Similarly, energy codes may require thermally broken frames and insulating glass, which must be compatible with the interlayers and compositions used in security glazing. These overlapping demands reinforce the need for an integrated design process, where security is not an afterthought but a primary consideration from the start.

For the designer, any of these potential conflicts in design requirements is the perfect opportunity to call upon the product manufacturer to help support the procurement and specification process.

From a regulatory standpoint, ASTM F3561 is beginning to appear in legislative language and public procurement criteria. Texas has mandated that exterior doors and windows in schools must be resistant to forced entry, and the standard has been cited as a performance benchmark in proposed code amendments. Other states are following suit, either referencing ASTM F3561 explicitly or adopting similar language around forced-entry resistance. As adoption spreads, design professionals will need to become more familiar with the standard, including how to verify compliance, read test reports, and write clear bid specifications. As ASTM F3561 is an international consensus standard, it is subject to evaluation and potential modifications at least every 8 years. As such, it is able to remain evergreen and adjust to accommodate new systems and threats within the industry and society.

CONCLUSION

The evolution of security glazing in schools reflects a necessary shift from generalized safety approaches to targeted, threat-specific solutions. As active shooter events have exposed critical vulnerabilities such as entryways and glass-adjacent doors, the glazing industry has responded with system-level innovations backed by rigorous testing standards like ASTM F3561. Unlike previous standards, ASTM F3561 simulates real-world attack sequences involving ballistic weakening followed by forced entry, offering a practical framework for evaluating complete

fenestration systems.

However, security cannot exist in isolation. Glazing systems must also comply with fire safety codes, thermal performance standards, and educational design needs. Balancing these requirements requires interdisciplinary collaboration, clear specifications, and adherence to tested assemblies. While security-rated glazing is not yet mandated by model building codes, it is increasingly referenced in state legislation, procurement documents, and school safety plans.

Ultimately, security glass is not just a product—it is part of a larger strategy to delay threats, protect occupants, and enable emergency response. When properly specified, tested, and integrated, advanced glazing systems serve as a critical line of defense, enabling schools to remain open and daylit, and to serve as a healthy learning environment while being measurably more resilient in the face of modern security challenges.

END NOTES

1. <https://usafacts.org/articles/the-latest-government-data-on-school-shootings/>
2. <https://www.edweek.org/leadership/school-shootings-this-year-how-many-and-where/2024/01>
3. <https://usafacts.org/articles/the-latest-government-data-on-school-shootings/>
4. <https://nces.ed.gov/programs/coe/indicator/a01/violent-deaths-and-shootings>
5. <https://www.fbi.gov/file-repository/reports-and-publications/2024-active-shooter-report/view>