Fenestration Security for Educational, Religious, Commercial, and Retail Applications

RIOT GLASS

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Fenestration Security for Educational, Religious, Commercial, and Retail Applications

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The American Institute of Architects
Course No. XXX
This program qualifies for 1.5 LU/HSW Hour
Course Expiry Date: MM/DD/YYYY

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Purpose and Learning Objectives

Purpose:

The importance of keeping an intruder out of a building cannot be underestimated. Examined here are fenestration security risks, considerations, and solutions for educational, religious, commercial, and retail applications, as well as applicable performance testing and standards. The course provides an in-depth discussion on new, retrofit access-denial glazing systems that provide maximum protection against forced entry and ballistic threats.

Learning Objectives:

At the end of this program, participants will be able to:

- summarize the threat posed by active shooter situations and the steps that can be taken by professionals and civilians to either deter attacks or mitigate the severity of their outcomes
- identify fenestration security risks that leave building occupants susceptible to attack and describe traditional and new fenestration security solutions for impact (forced entry, smash and grab) resistance and bullet resistance
- reference the UL ballistic ratings chart and the tests and standards applicable to fenestration security to specify the appropriate level of protection for a project, and
- explain how improved glazing safety and fire-egress panic hardware for commercial building design have left vulnerabilities in fenestration security and can lead to catastrophic consequences.

What Is Fenestration Security?

What Is Fenestration Security?

Fenestration Security Considerations

Perform a threat assessment

Review the range of products

Assess

Consider how the solution fits

Verify

Threat Assessment

Threats to Educational, Religious, and Commercial Institutions

Active shooter

as “an individual actively engaged in killing or attempting to kill people in a populated area.”

The Shooter

Deliberate

Focused

Detached

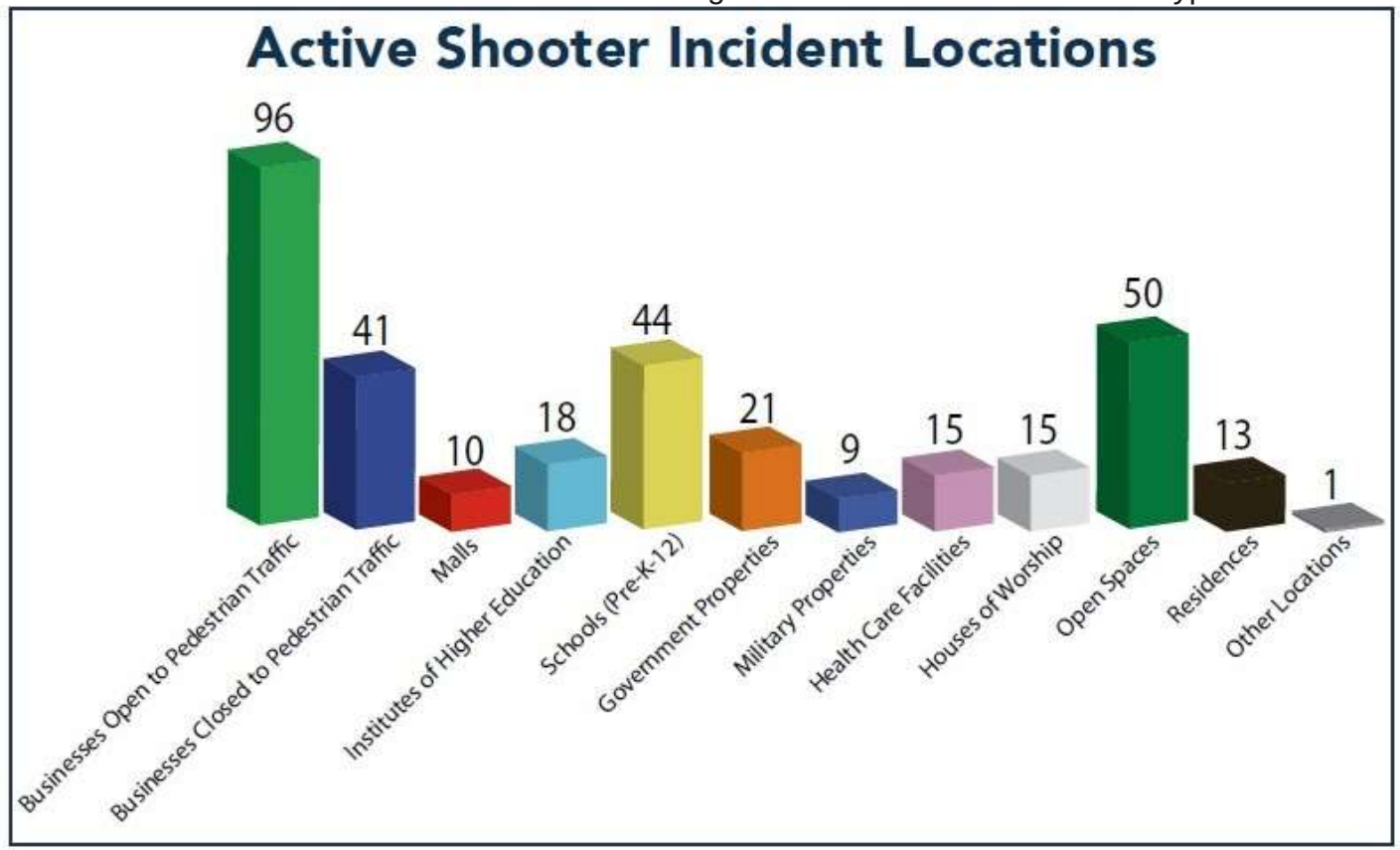
Bully

Suicidal

The Event

Total Active Shooter Incidents and Locations

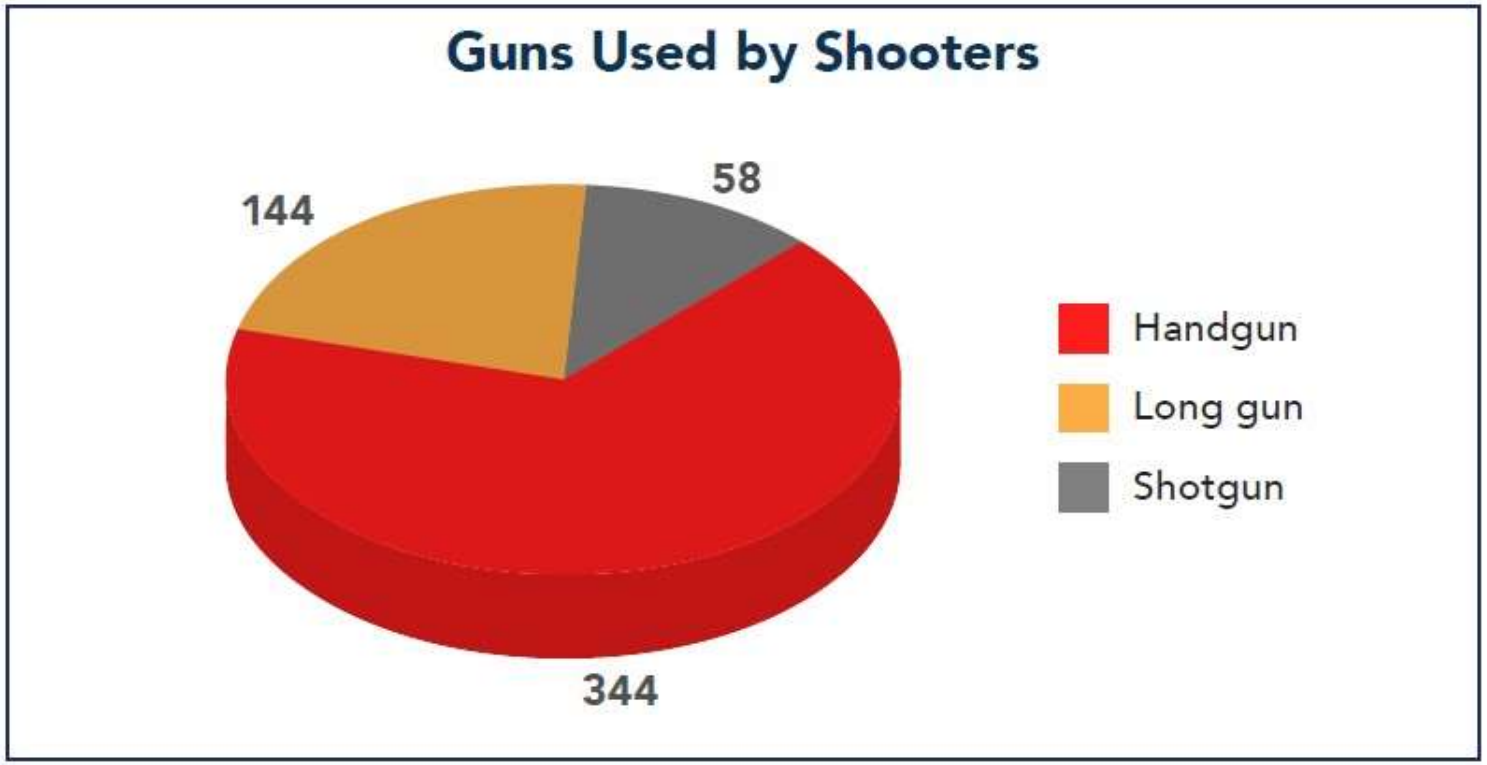
The 333 active shooter incidents are categorized into 12 different location types.



The Weapon

Shooters' Weapons

In the 333 active shooter incidents, handguns accounted for 67% of the weapons used, 38% of the 345 shooters had multiple weapons, 5% wore body armor, and 4% had access to or deployed additional devices.



Preparedness Resources

DHS Resources:

- Active Shooter Emergency Action Plan Video and Emergency Action Plan Guide: Active Shooter Preparedness
- K–12 School Security: A Guide for Preventing and Protecting Against Gun Violence
- Enhancing School Safety Using a Threat Assessment Model: An Operational Guide for Preventing Targeted School Violence

Preparedness Resources

DHS

RUN | HIDE | FIGHT

RUN if there is an accessible escape path and attempt to evacuate the premises.

- Have an escape route and plan in mind; help others escape, if possible
- Do not move wounded people

HIDE if evacuation is not possible.

- Keep distance between you and the source
- Create barriers to block or slow down a threat; lock doors
- Turn the lights off; silence phone; remain out of sight, calm, and quiet

FIGHT as a last resort when your life is in imminent danger; attempt to disrupt and/or incapacitate the threat.

- Act as aggressively as possible against him/her
- Throw items, yell, and improvise weapons
- Commit to your actions

MORE DETAILS: "Active Shooter: How to Respond" (see resources)

ALERRT™

AVOID | DENY | DEFEND™

AVOID starts with your state of mind.

- Pay attention to surroundings
- Have an exit plan
- Quickly move away from the source of the threat

DENY when getting away is difficult or impossible.

- Keep distance between you and the source
- Create barriers to block or slow down a threat
- Turn the lights off and silence phone
- Remain out of sight and quiet

DEFEND because you have the right to protect yourself.

- If you cannot avoid or deny, be prepared to defend yourself
- Be aggressive and committed to your actions
- Do not fight fairly—this is about survival

MORE DETAILS: Avoid | Deny | Defend™ (see resources)

Facility Preparedness

- Perimeter landscaping for visibility
- Single entrance point
- Door locking systems that don’t violate building/fire codes
- Black-out shades for classroom door windows
- Privacy window film
- Forced-entry and ballistic-resistant door and window systems

Fenestration Security Risks

Security risks for educational, religious, and commercial applications:

- Clear glazing
- Breakable glazing

The challenge: need for sightlines and daylight but avoid an overly defensive-looking environment

Security risks for retail applications:

- Large expanses of ground-level glazing
- No allowance for bars or scissor gates

The challenge: balance need for branding and advertising with merchandise loss and repair costs

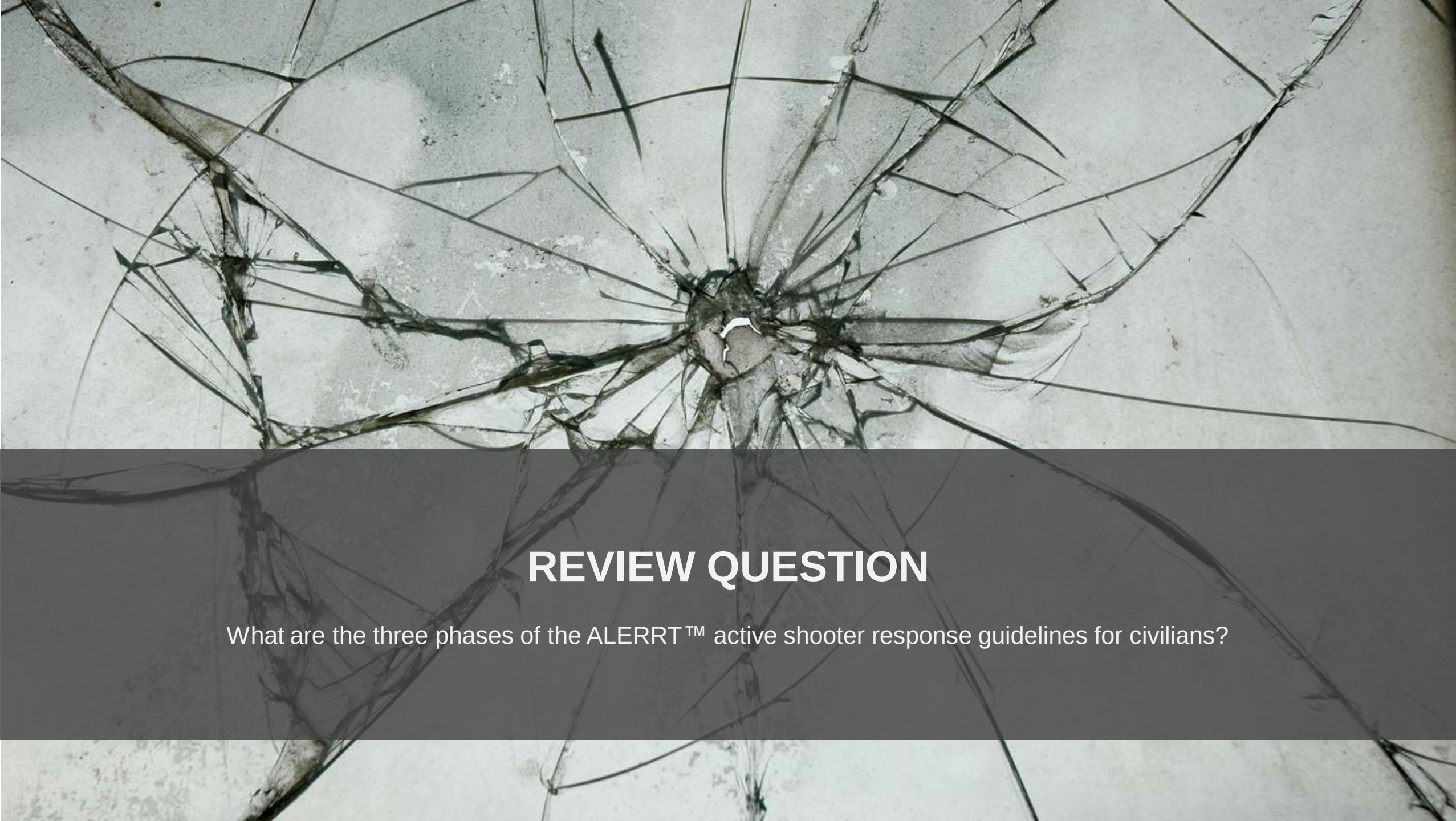
The Problem

armed intruder entry options

fire-egress panic hardware

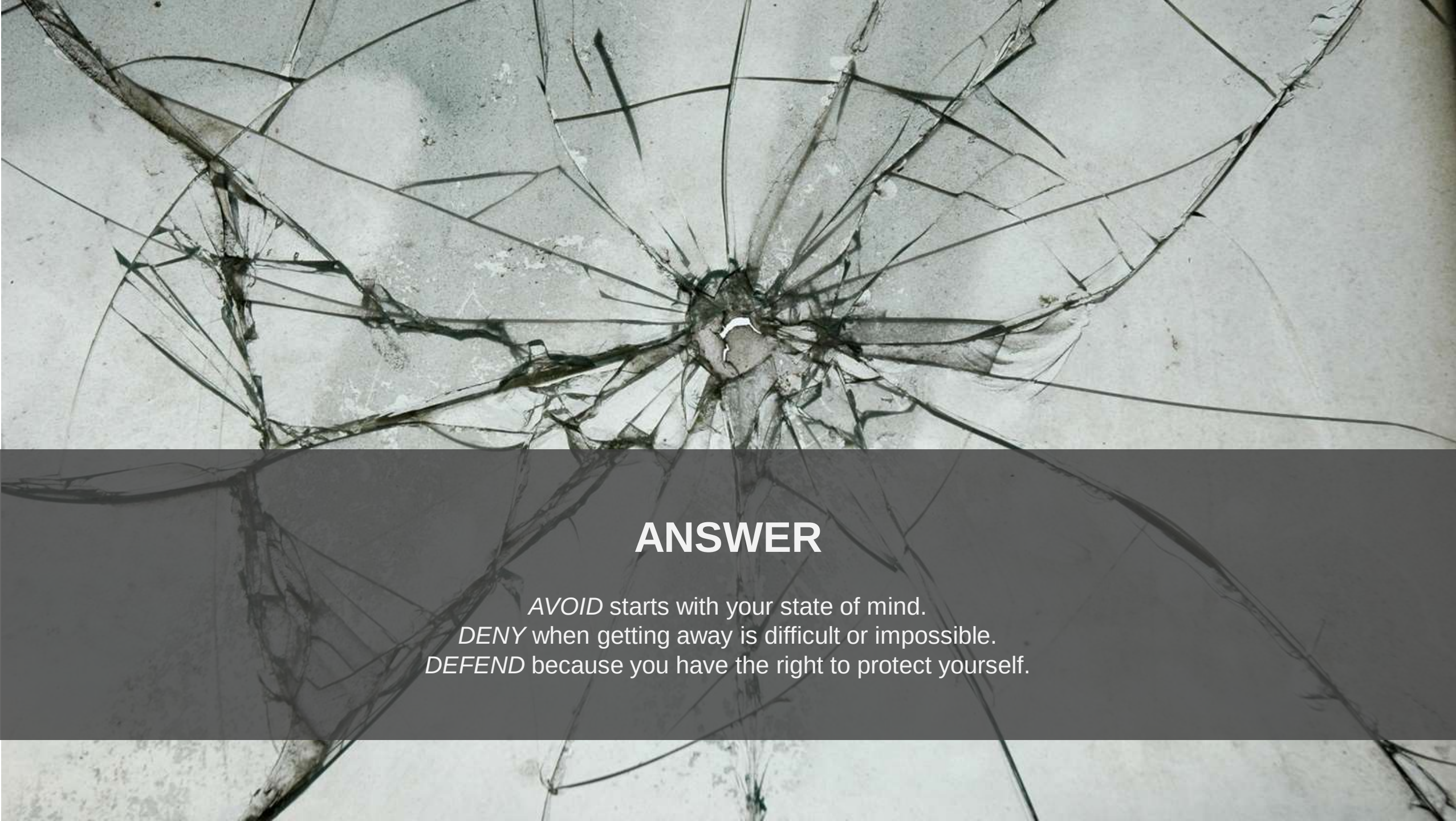
tempered entrance glass doors and windows

A Solution



REVIEW QUESTION

What are the three phases of the ALERRT™ active shooter response guidelines for civilians?



ANSWER

AVOID starts with your state of mind.
DENY when getting away is difficult or impossible.
DEFEND because you have the right to protect yourself.


Fenestration
Security
Solutions

Security Needs

1. Forced-entry resistance
2. Bullet resistance
3. Blast resistance
4. Seismic/windstorm resistance

Access Control

Good access-control system:

- locked doors that someone must have authorized access to unlock via key, card reader, facial recognition or similar
- fortified glass and doors

Bars and Grilles

Bars and Grilles

Safety and Security Film

Sun protection

Temperature control

Privacy, safety

Security

Glass holds together under attack

No ballistic protection

Safety and Security Film

Nonentry glazing

Most effective on annealed glass

Prevents spall on tempered and laminated glass

Two-way mirror effect

Safety and Security Film: Testing

Test/Standard	Description
ASTM F1642, “Standard Test Method for Glazing and Glazing Systems Subject to Airblast Loadings”	Provides a structured procedure to establish the hazard rating of glazing, glazing systems, and glazing retrofit systems subjected to an airblast loading. Knowing the hazard rating provides the ability to assess risk of personal injury and facility damage.
ASTM F2912, “Standard Specification for Glazing and Glazing Systems Subject to Airblast Loadings”	Covers exterior windows, glazing panels, glazed curtain walls, and other glazed protective systems used in buildings that may be subjected to intentional and accidental explosions.
GSA-TS01, “U.S. General Services Administration Standard Test Method for Glazing and Window Systems Subject to Dynamic Overpressure Loadings”	Sole test protocol by which blast-resistant windows and related hazard mitigation technology and products shall be evaluated for facilities under the control and responsibility of the U.S. General Services Administration.
ASTM E1996, “Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes”	Covers exterior windows, glazed curtain walls, doors, and impact protective systems used in buildings located in geographic regions that are prone to hurricanes.
ANSI Z97.1, “Safety Glazing Materials Used in Buildings – Safety Performance Specifications and Methods of Test”	Establishes the specifications and methods of test for the safety properties of safety glazing materials as used for all building and architectural purposes.
16 CFR 1201, “Safety Standard for Architectural Glazing Materials” (Code of Federal Regulations)	Architectural glazing products shall be tested in accordance with all the applicable test provisions of ANSI Z97.1.
UL 972, “Standard for Burglary-Resisting Glazing Material” (does not include framing)	Covers clear, translucent, or opaque glazing material intended for indoor and outdoor use, principally as a substitute for plate glass show windows or show case panels.

Safety and Security Film: Installation

Daylight installation

Edge-to-edge installation

Anchored installation

Containment-Grade Laminated Glazing

Two layers } annealed, heat-strengthened, or tempered glass

Bonded by vinyl film-type interlayer

Containment-Grade Laminated Glazing

Level of protection is determined by:

- thickness and type of interlayer and the framing detail
- thickness and number of plies of glass
- size and strength of the glass
- method of installation

Containment-Grade Laminated Glazing: Testing

Test/Standard	Description
UL 972, “Standard for Burglary-Resisting Glazing Material” (does not include framing)	Covers clear, translucent, or opaque glazing material intended for indoor and outdoor use, principally as a substitute for plate glass show windows or show case panels.
ASTM E2395, “Standard Specification for Voluntary Security Performance of Window and Door Assemblies with Glazing Impact”	Covers performance requirements and methods of test for the resistance to forced entry of window and door assemblies.
HP White HPW-TP-0500.03, “Transparent Materials for Use in Forced Entry or Containment Barriers”	Specification sets forth tests whose purpose is limited to the evaluation of the resistance of transparent materials to ballistic impacts (optional), blunt tool impacts, sharp tool impacts, thermal stress, and chemical deterioration.
ASTM F1233, “Standard Test Method for Security Glazing Materials and Systems”	Sets forth procedures whose purpose is limited to the evaluation of the resistance of security glazing materials and systems against ballistic impacts, blunt tool impacts, sharp tool impacts, thermal stress, and chemical deterioration.
ASTM F1915, “Standard Test Methods for Glazing for Detention Facilities”	These test methods aid in assigning a level of physical security to glazing used in window and door assemblies based upon objective tests that can be consistently duplicated.

Containment-Grade Laminated Glazing: Installation

Laminated glass can be retrofitted into most existing window and door systems

Existing framing may need to be fortified

Applications: doors, panels adjacent to doors, glazed panels

Interior locations: conference rooms, doors and sidelites, entry doors

Ballistic-Grade Glazing

Safety barrier against bullets and related flying glass or plastic fragments

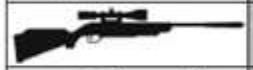
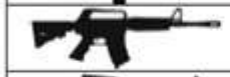
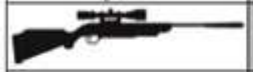
All-glass laminates do not provide prolonged attack resistance

Ballistic-Grade Glazing: Testing

Test/Standard	Description
UL 752, “Standard for Bullet-Resisting Equipment” (frame and glazing)	Used to determine the bullet resistance of building components that do not fit the definition of equipment, such as windows, walls, or barriers made out of bullet-resistant materials.
NIJ Standard 0108.01, “Ballistic-Resistant Protective Materials”	Establishes minimum performance requirements and methods of testing for ballistic-resistant protective materials.
HP White HPW-TP-0500.03, “Transparent Materials for Use in Forced Entry or Containment Barriers”	Specification sets forth tests whose purpose is limited to the evaluation of the resistance of transparent materials to ballistic impacts (optional), blunt tool impacts, sharp tool impacts, thermal stress, and chemical deterioration.
ASTM F1233, “Standard Test Method for Security Glazing Materials and Systems”	Sets forth procedures whose purpose is limited to the evaluation of the resistance of security glazing materials and systems against ballistic impacts, blunt tool impacts, sharp tool impacts, thermal stress, and chemical deterioration.
U.S. State Department – SD-STD-01.01, Revision G (Amended) – Certification Standard, “Forced Entry and Ballistic Resistance of Structural Systems”	Sets forth the requirements and testing procedures to certify forced-entry and ballistic-resistant systems specific to government facilities.
Walker McGough Foltz & Lyerla (WMFL) – 30 Minute, 60 Minute, and 60 Minutes with Ballistic Retention, “Ballistics and Forced-Entry Test Procedure”	Evaluates glazing products for 30-minute and 60-minute retention periods and is often used for applications within detention facilities.

Ballistic-Grade Glazing: Testing

UL 752 Bullet Resistant Materials Standards

Not to scale	Class Threat Level	Type of Weapon	Caliber & Weight (Grains)	Not to scale	Ammunition	No. of Shots	Min/Max FPS	Test Range
	1	Handgun	9mm 124 Grain		FMCJ LC	3	1175 1293	4.6 m
	2	Handgun	.357 Magnum 158 Grain		JLSP	3	1250 1375	4.6 m
	3	Handgun	.44 Magnum 240 Grain		LSW GC	3	1350 1485	4.6 m
	4	.30-06 Rifle	.30 Caliber 180 Grain		LCSP	1	2540 2794	4.6 m
	5	AK-47 7.62 Rifle	.308 150 Grain		LC FMCJ Military Ball	1	2750 3025	4.6 m
	6	9mm Uzi	9mm 124 Grain		LC FMCJ	5	1400 1540	4.6 m
	7	AR-15 5.56 Rifle	.223 55 Grain		LC FMCJ	5	3080 3383	4.6 m
	8	AK-47 7.62 Rifle	.308 150 Grain		LC FMCJ Military Ball	5	2750 3025	4.6 m
	9	.30-06 Rifle	.30 Caliber 166 Grain		Steel Core LPF FMJ	1	2715 2987	4.6 m
	10	.50 Caliber Rifle	.50 709.5 Grain		LC FMCJ Military Ball	1	2810 3091	4.6 m
	Shotgun	12 Gauge	Rifled Lead Slug		Loaded 28 g	3	1585 1744	4.6 m
	Shotgun	12 Gauge	00 Buckshot		Loaded 42 g	3	1200 1320	4.6 m

Ammunition Legend:

- FMCJ – Full Metal Copper Jacket
- LC – Lead Core
- JLSP – Jacketed Lead Soft Point
- LSWC – Lead Semi-Wadcutter
- GC – Gas Checked
- LCSP – Lead Core Soft Point
- LPF – Lead Point Filler
- FMJ – Full Metal Jacket
- FPS – Feet Per Second

Ballistic-Grade Glazing: Installation

A simple retrofit is not always possible because of the weight of the materials

The existing doors and windows may have to be removed and new framing added

And/or changing the hinges and door closers to accommodate the extra weight

Ballistic-Grade Glazing: Installation

Practical for highest risk areas

Building-wide installations are cost-prohibitive

REVIEW QUESTION

What aspects of a containment-grade laminated glazing system determine the level of protection it can provide?

ANSWER

The level of protection provided is determined by the thickness and type of interlayer, framing detail, and the thickness and number of plies of glass. Other determining factors are pane size and the method of installation.


Access-Denial
Glazing

Access-Denial Glazing

AR (abrasion-resistant)

UV-resistant polycarbonate sheets

Glass-like surface hardness

Impact strength of polycarbonate

Performance

Won’t break down or appreciably diminish in strength

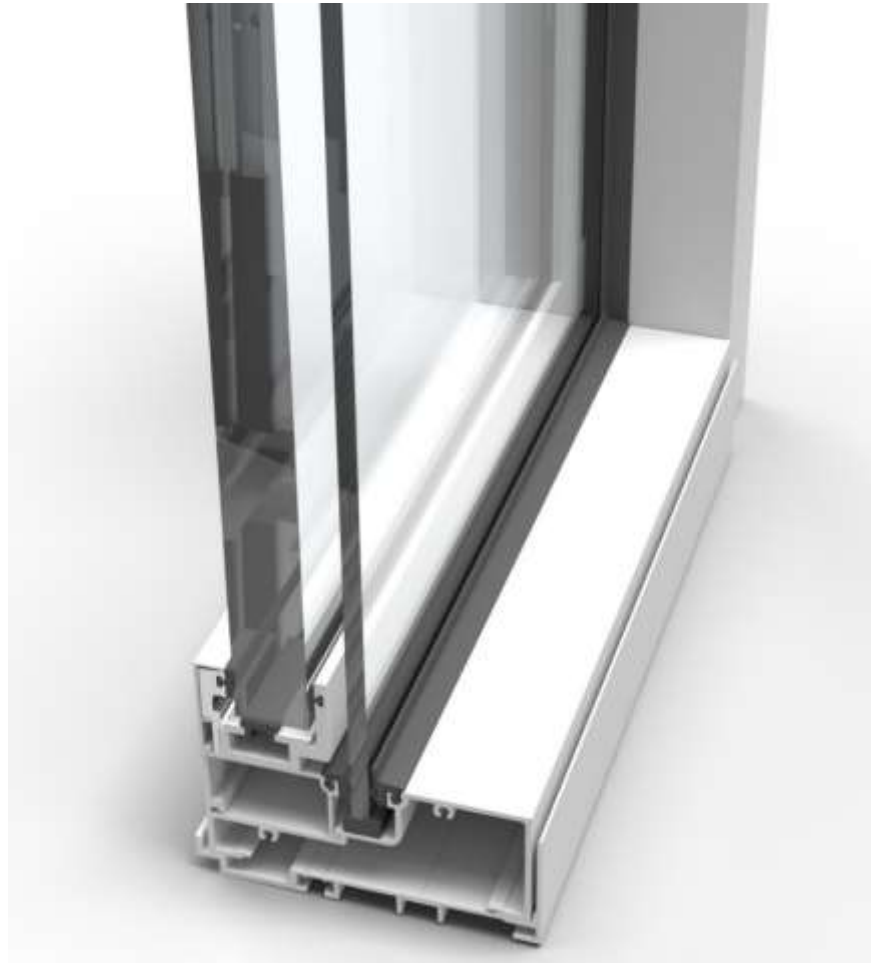
Cannot be dislodged

Keeps intruders out of the building

Installation Options

Can be installed
inside (back glazing) or outside (over glazing)

Tamper-resistant hardware is hidden
behind low-profile, protective cover



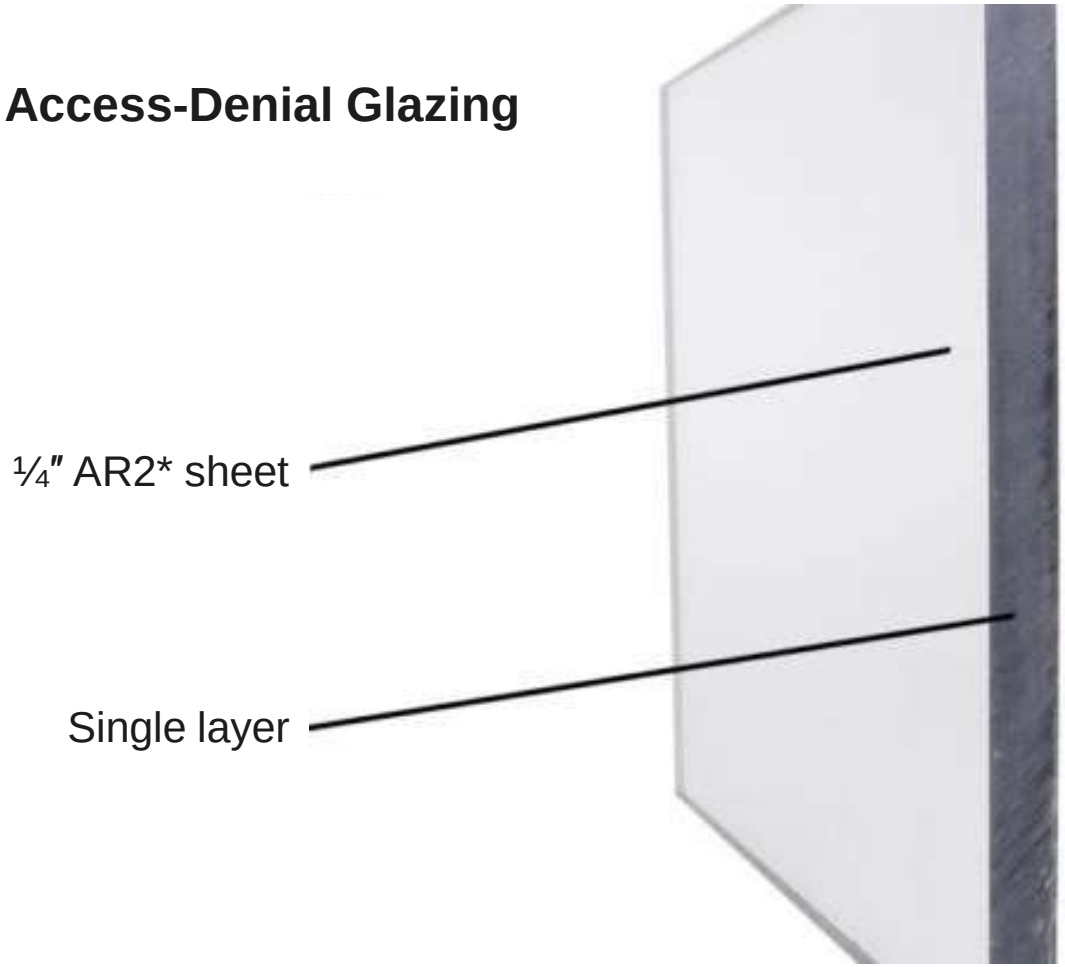
Product Selection Considerations

Access denial with ballistic protection

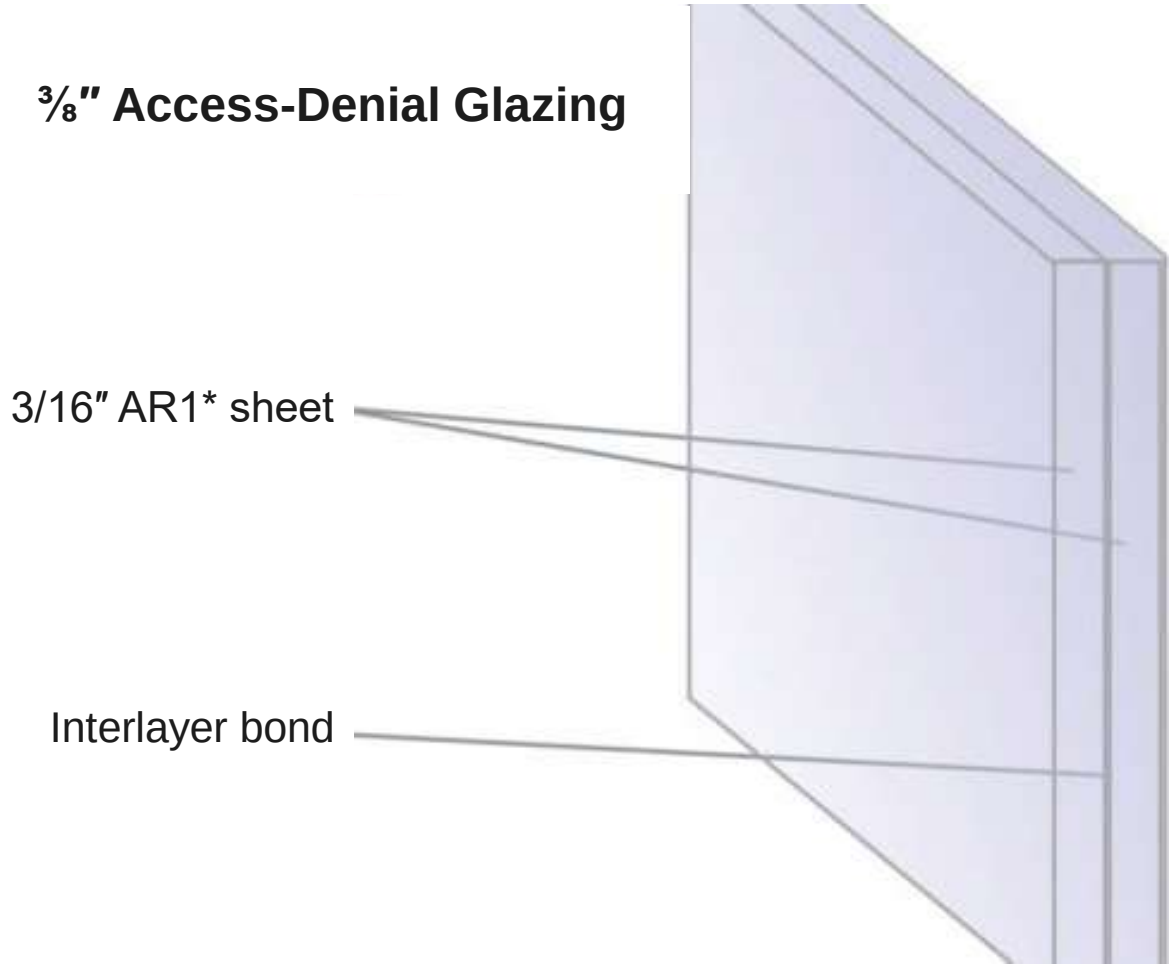
Access denial without ballistic protection

Sample Access-Denial Glazing Products

¼″ Access-Denial Glazing



Sample Access-Denial Glazing Products



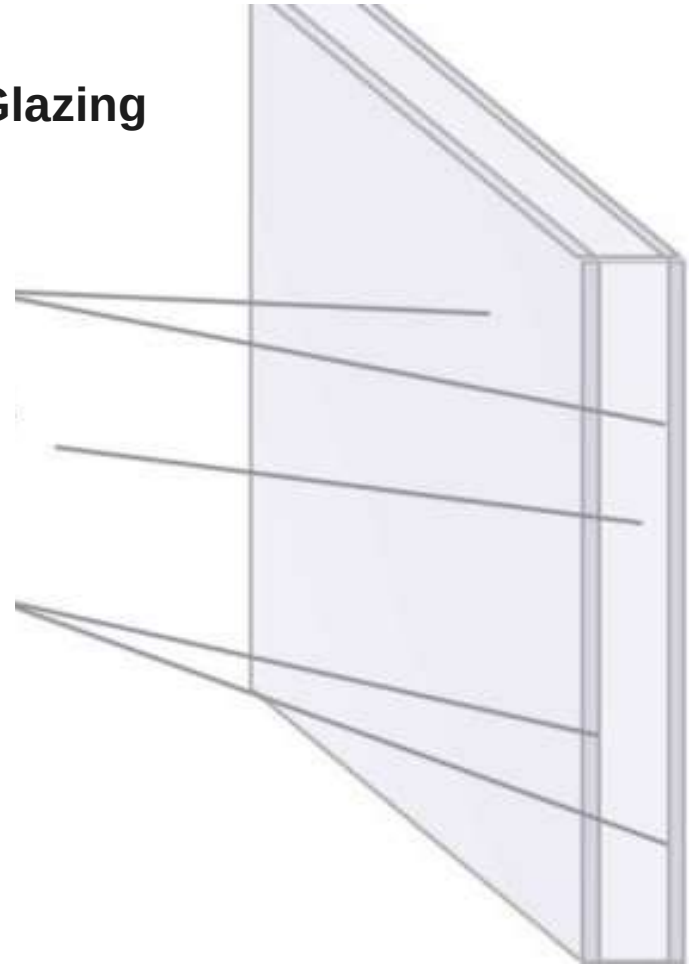
Sample Access-Denial Glazing Products

½″ Access-Denial Glazing

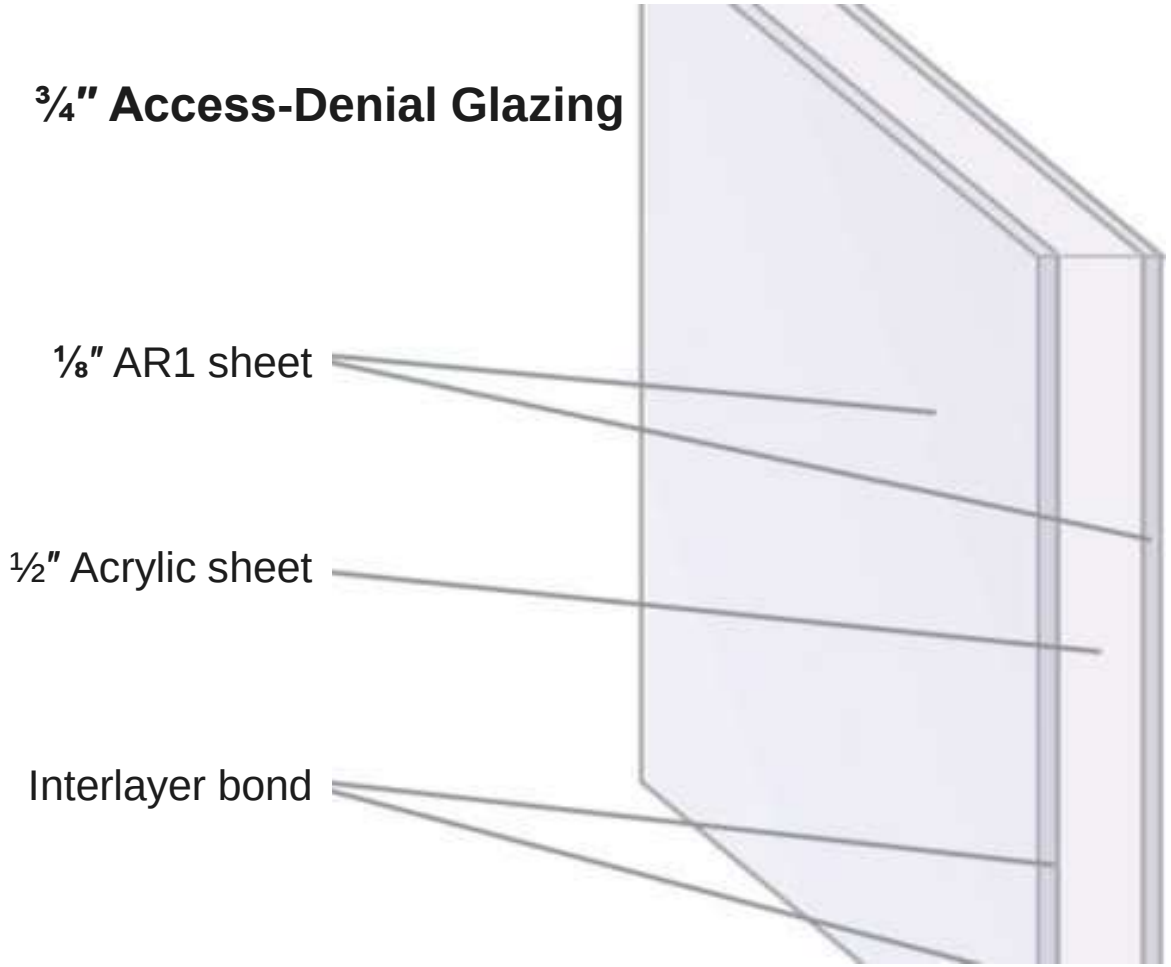
⅛″ AR1 sheet

¼″ Polycarbonate sheet

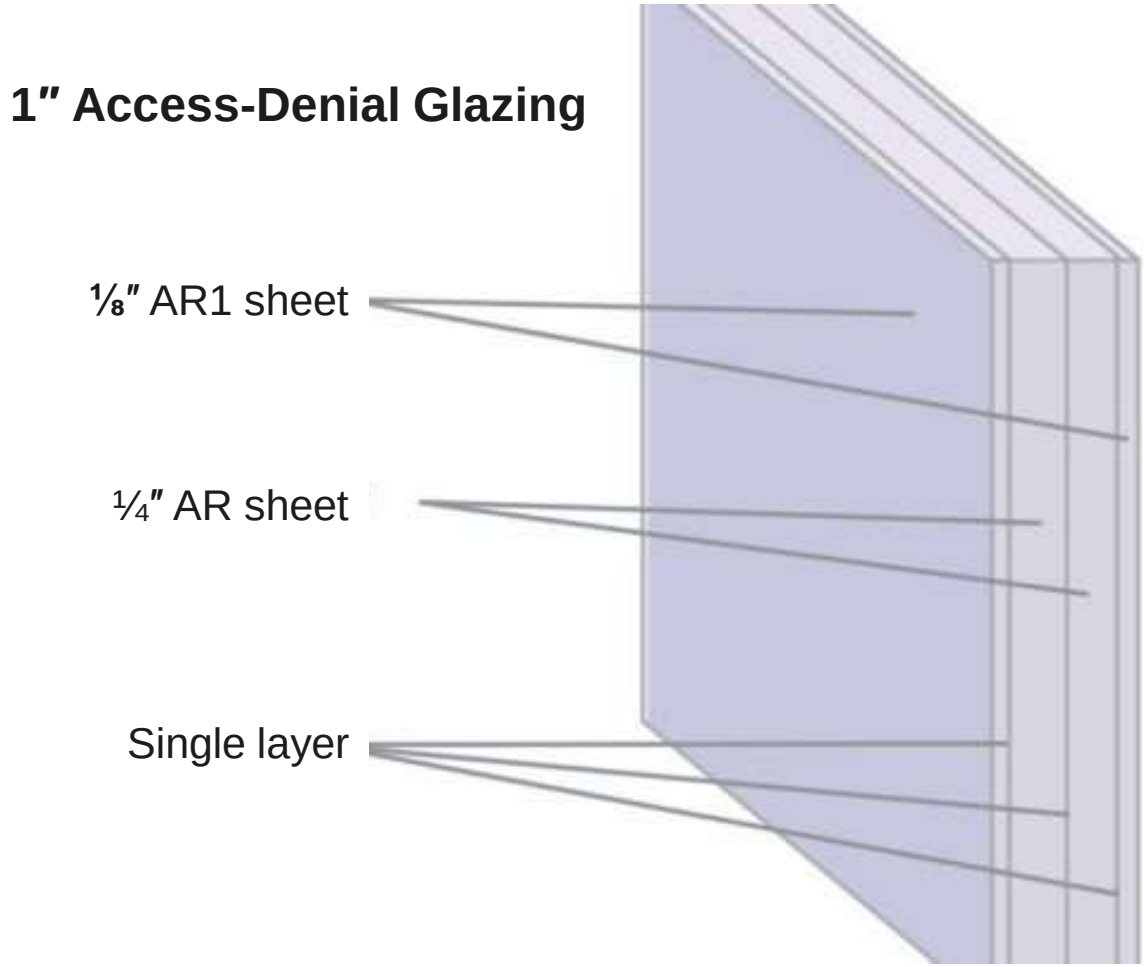
Interlayer bond



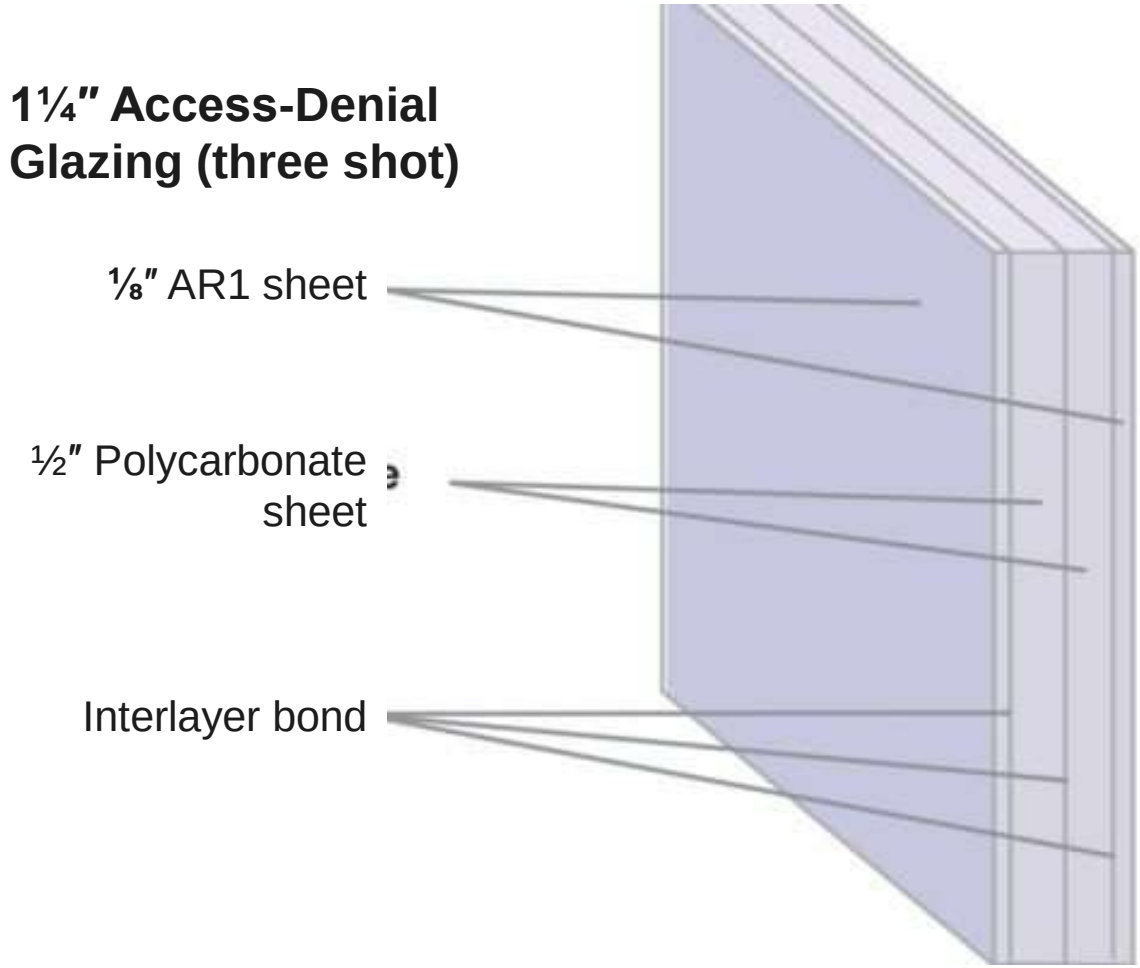
Sample Access-Denial Glazing Products



Sample Access-Denial Glazing Products

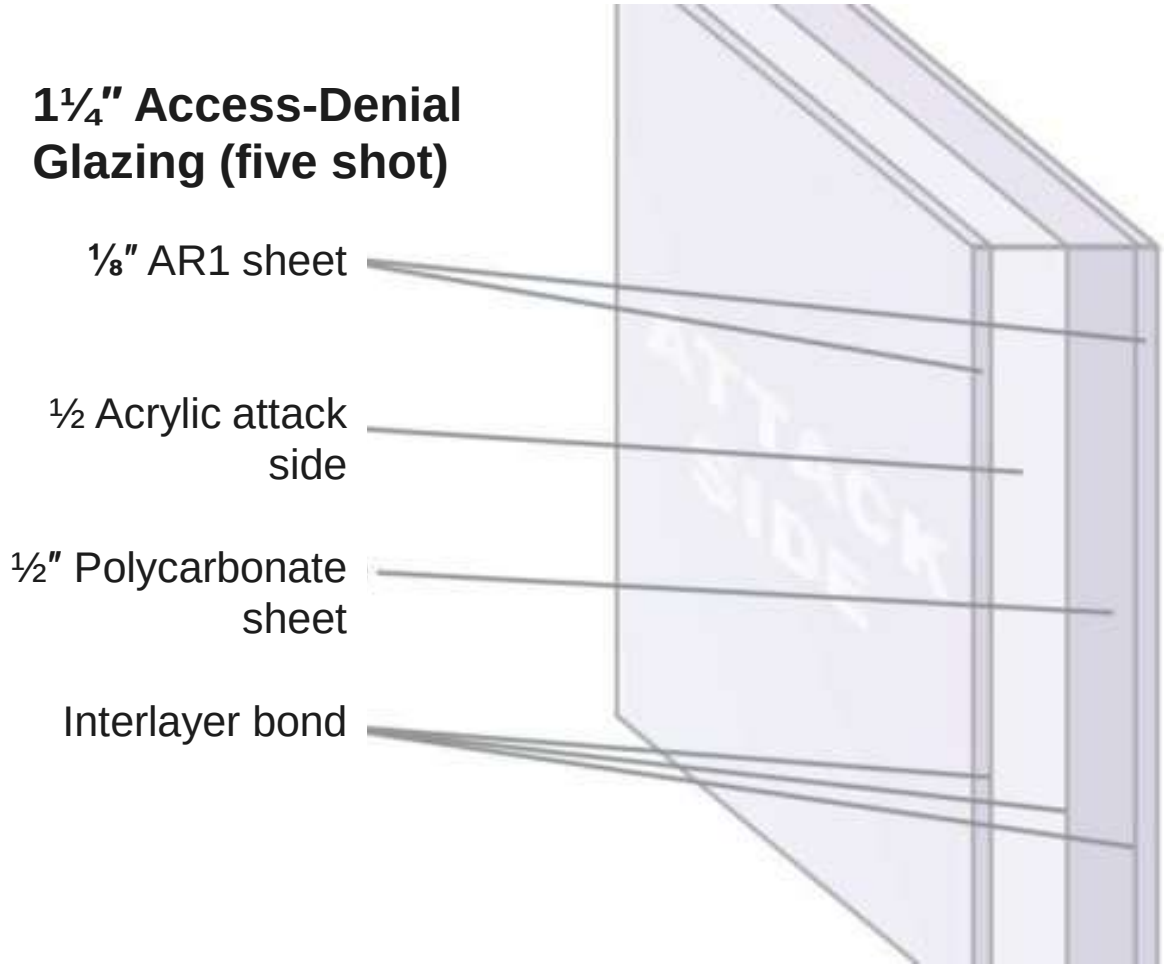


Sample Access-Denial Glazing Products



Sample Access-Denial Glazing Products

1¼″ Access-Denial Glazing (five shot)



Framing

Extruded aluminum:

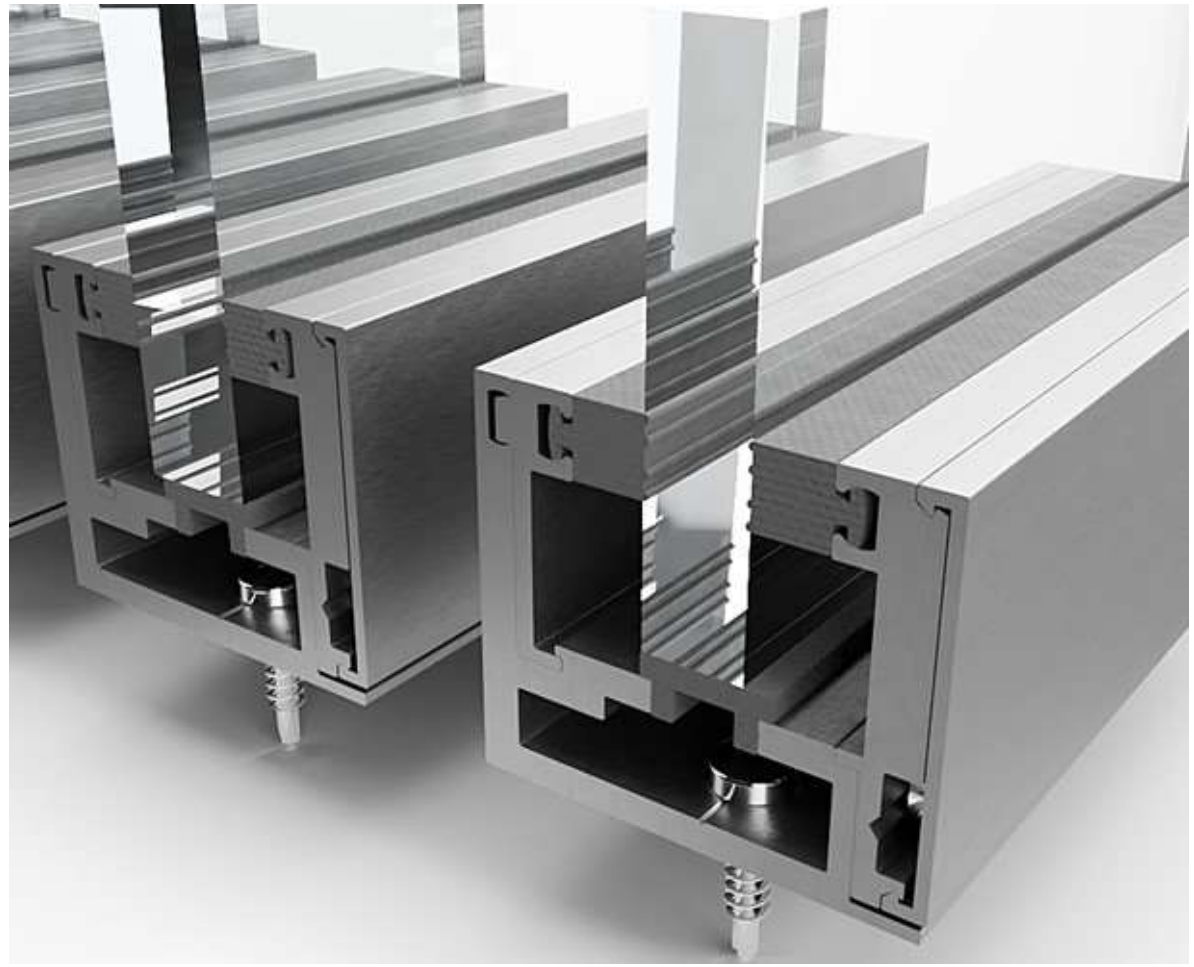
bronze or clear anodized finish to match

Mil finish (raw aluminum) powder coated in custom colors

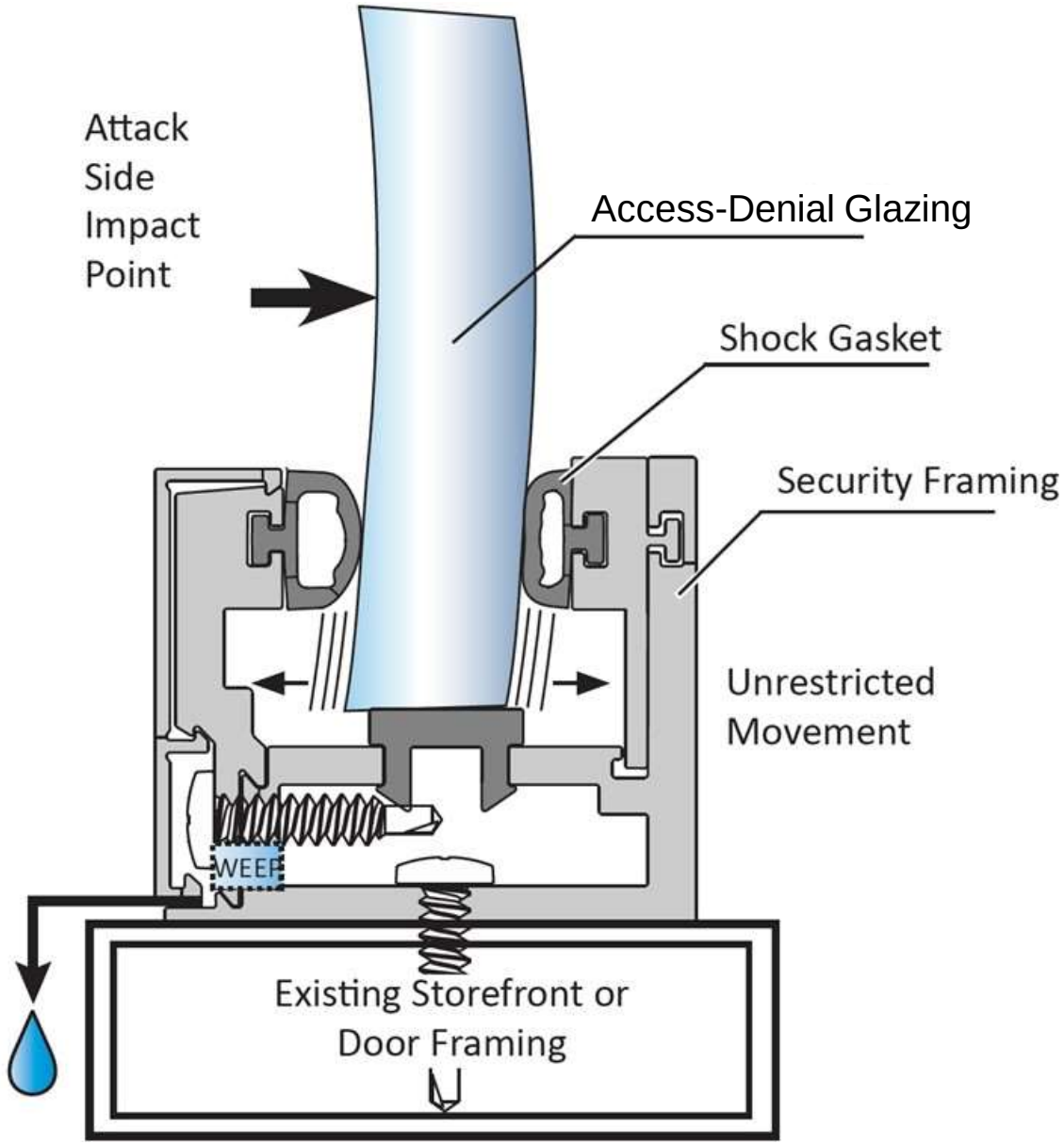
Frames fit:

vinyl, wood, fiberglass (doors),

aluminum, steel



System Anatomy



Installation Overview: Full Frame Example

STEP 1: CLEANING

- Clean glass using T-blade tool and lint-free microfiber cloths

STEP 2: PREPARATION

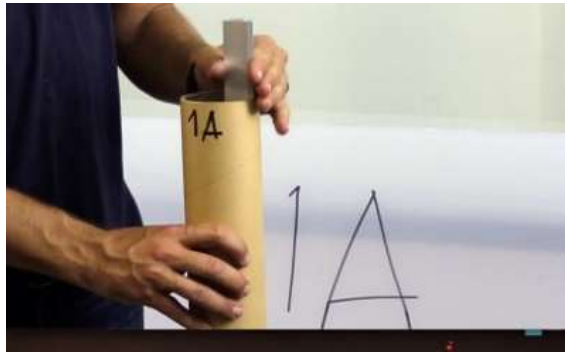
- Match framing and access-denial glazing panel to corresponding windows

STEP 3: BASE INSTALLATION

- Mark, trim, dry fit base frame pieces
- Space appropriately and screw into place

STEP 4: DRY FIT PANEL

- Using spacers, dry fit access-denial glazing panel
- Trim if necessary



Installation Overview: Full Frame Example

STEP 5: FINAL CLEANING

- Vacuum debris
- Clean using one damp cloth and one dry cloth, removing all moisture

STEP 6: PANEL INSTALLATION

- Remove protective masking liner from one side
- Place panel into framing

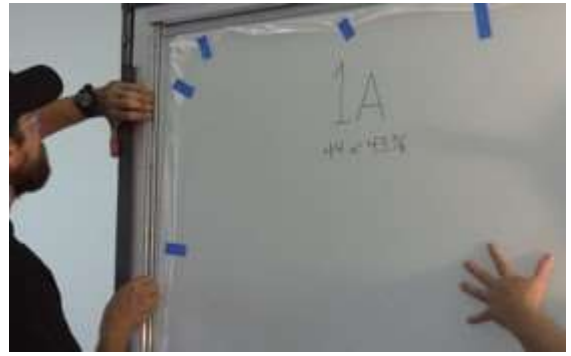
STEP 7: WEDGE INSTALLATION

- Insert wedges flush with panel
- Attach panel to framing using self-tapping screws

STEP 8: CAP INSTALLATION

- Mark, trim, dry fit cap pieces
- Press into place, tap to seal



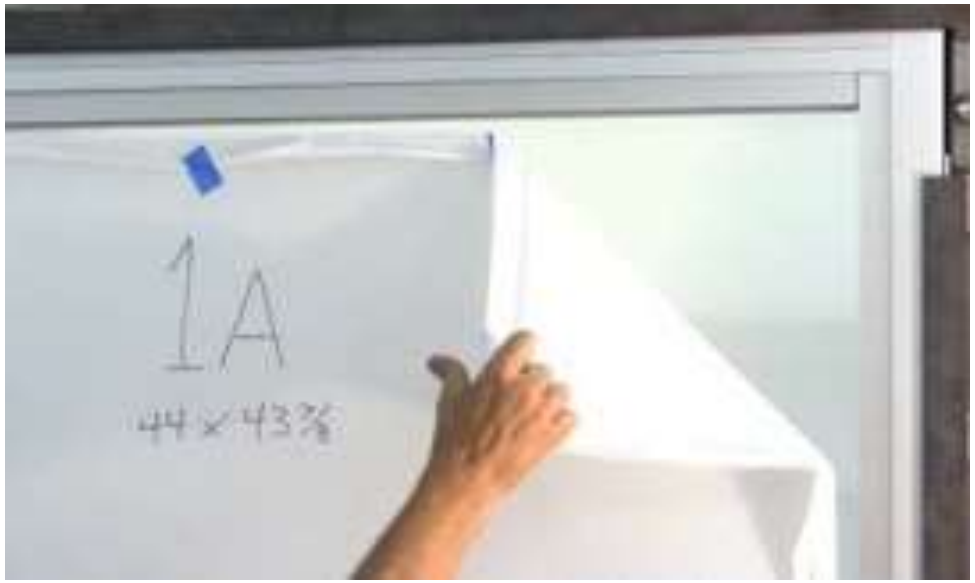





Installation Overview: Full Frame Example

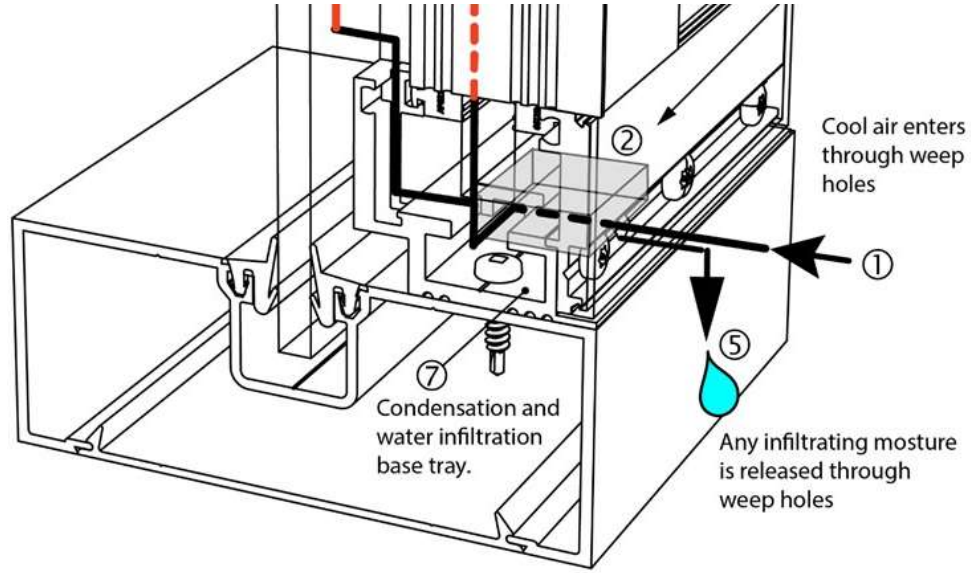
STEP 9: REMOVING MASKING

- Remove exterior protective masking liner



STEP 10: WATER SEALING (OUTDOORS)

- Add thin bead of clear silicone where the cap meets panel
- Add a second bead of silicone where cap meets original window frame and into all exposed joints where water could infiltrate



Advantages

Strength

Fills the gap

Lightweight

Easy to install

Affordable

Wide range of applications

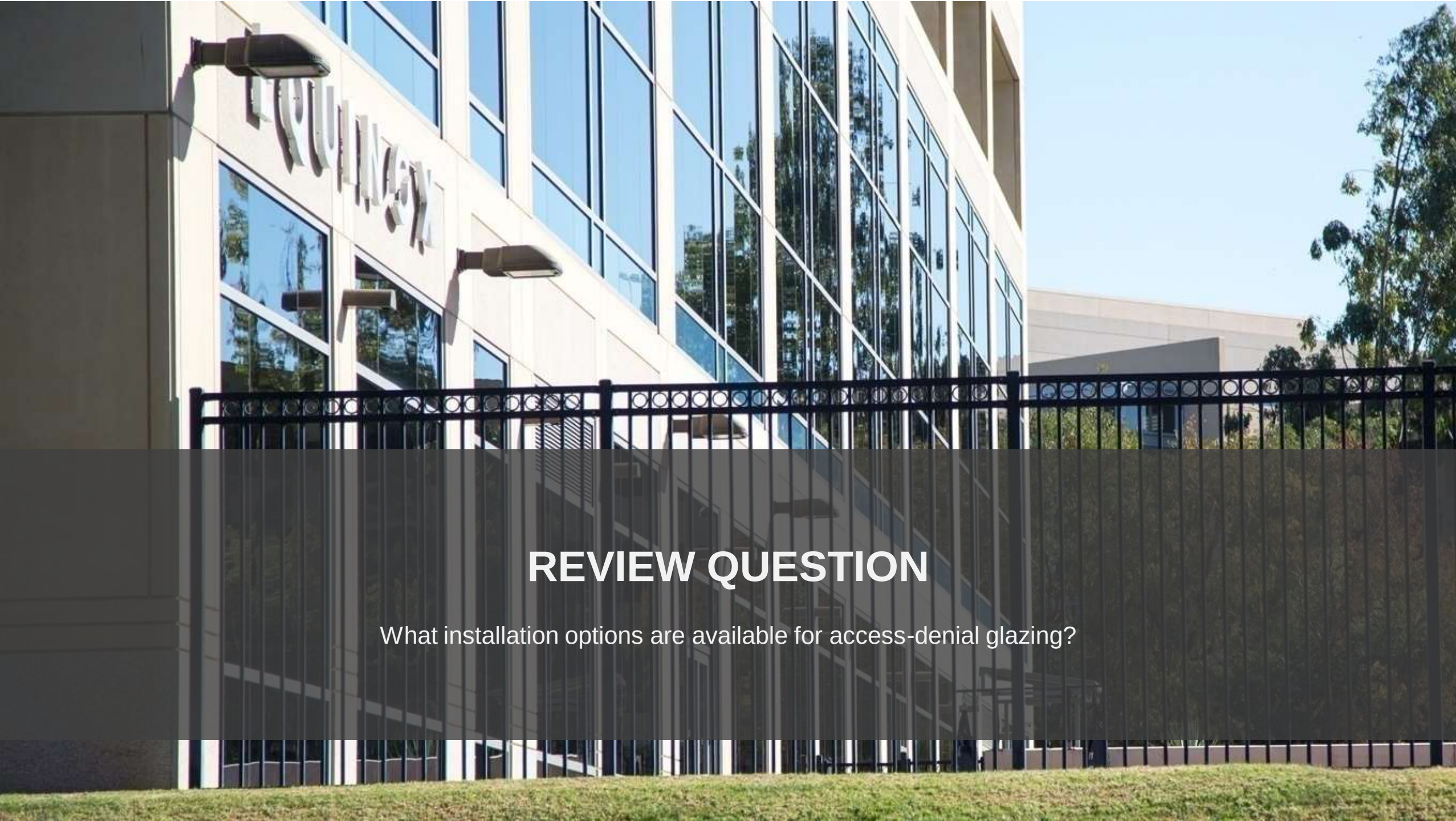
Forced-Entry Testing Demonstration

This video demonstrates forced-entry testing done on a ¼″ access-denial glazing and framing system in a surface-mount installation.

The system is installed over single-pane tempered glass with an 8-mil spall window film.

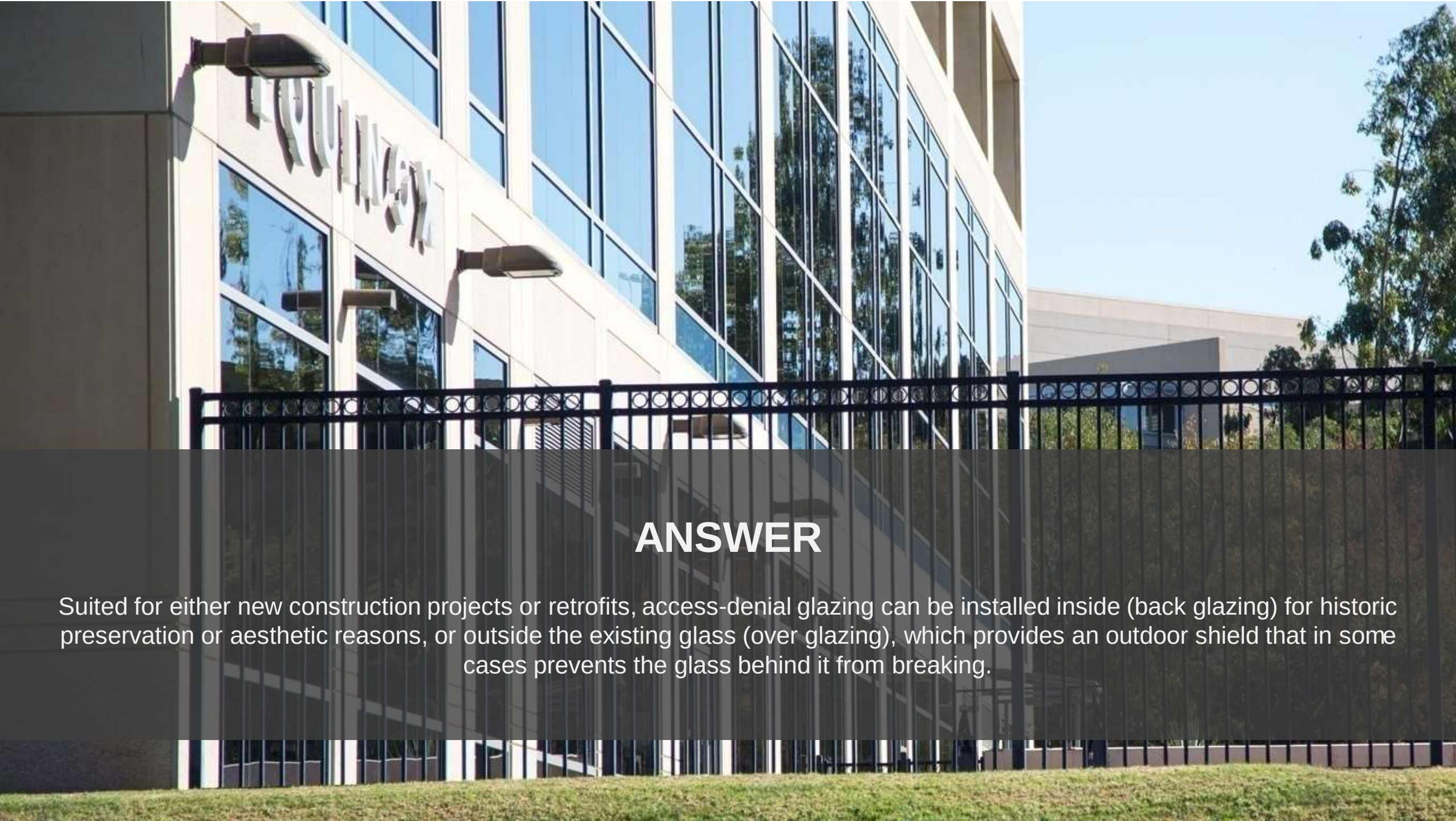
Click on the image to view the video on YouTube (includes audio).

Other Considerations



REVIEW QUESTION

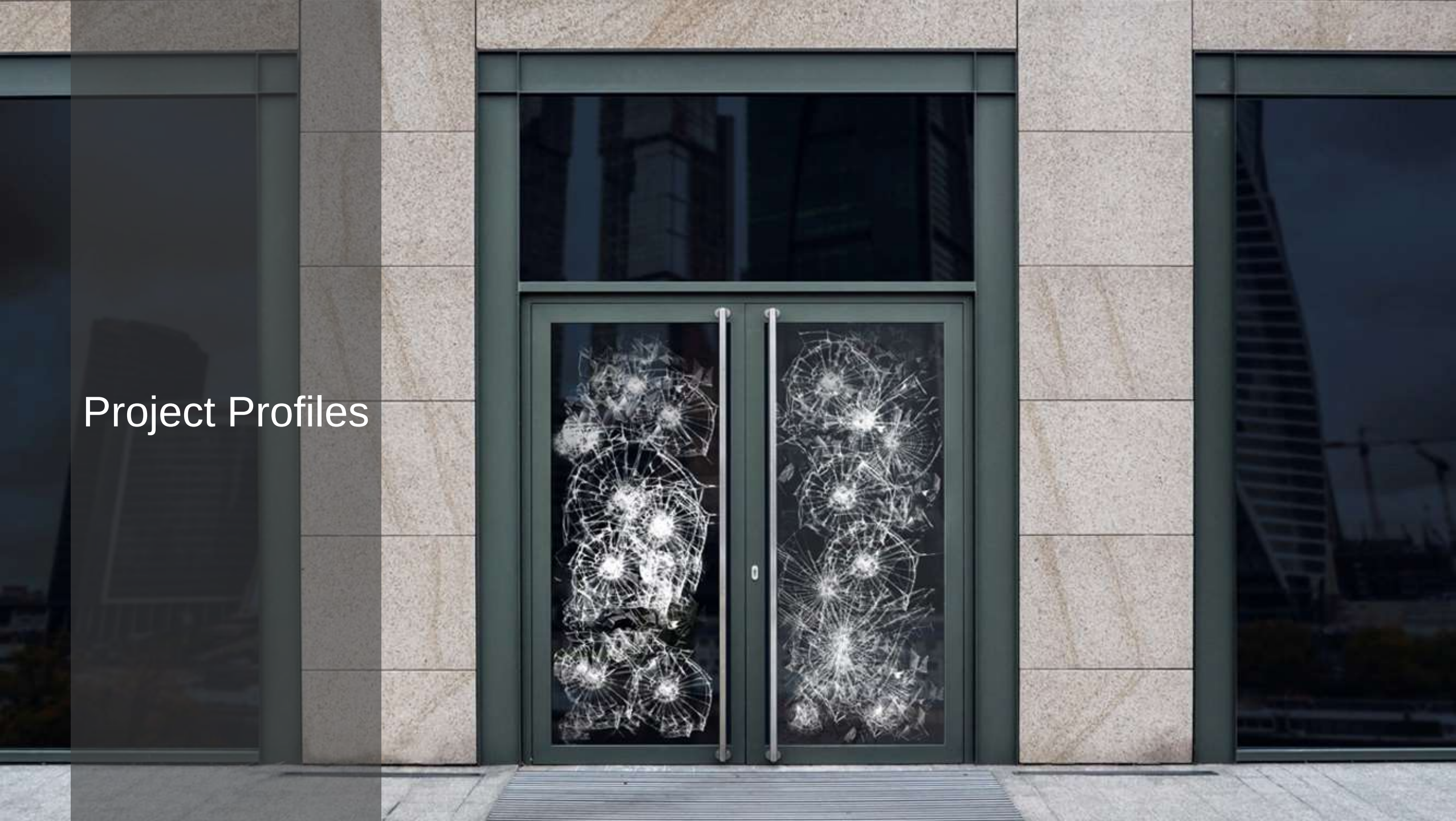
What installation options are available for access-denial glazing?



ANSWER

Suited for either new construction projects or retrofits, access-denial glazing can be installed inside (back glazing) for historic preservation or aesthetic reasons, or outside the existing glass (over glazing), which provides an outdoor shield that in some cases prevents the glass behind it from breaking.

Project Profiles



Learning from the Past: Our Lady of the Angels School

Learning from the Past: Sandy Hook Elementary School

Taking Action

Building owners face serious liability issues. It is their responsibility to:

- assess threat levels and identify security risks
- hire an outsourced active shooter consultant, schedule regular training classes and drills, assign duties, and provide protocols for records
- protect the glazing at vulnerable entrances and other areas to prevent easy access to the inside of the facility.

Retail Store

Retail Outlet

Mortuary

Gas Stations / Convenience Stores

Jewish Center

Elementary School

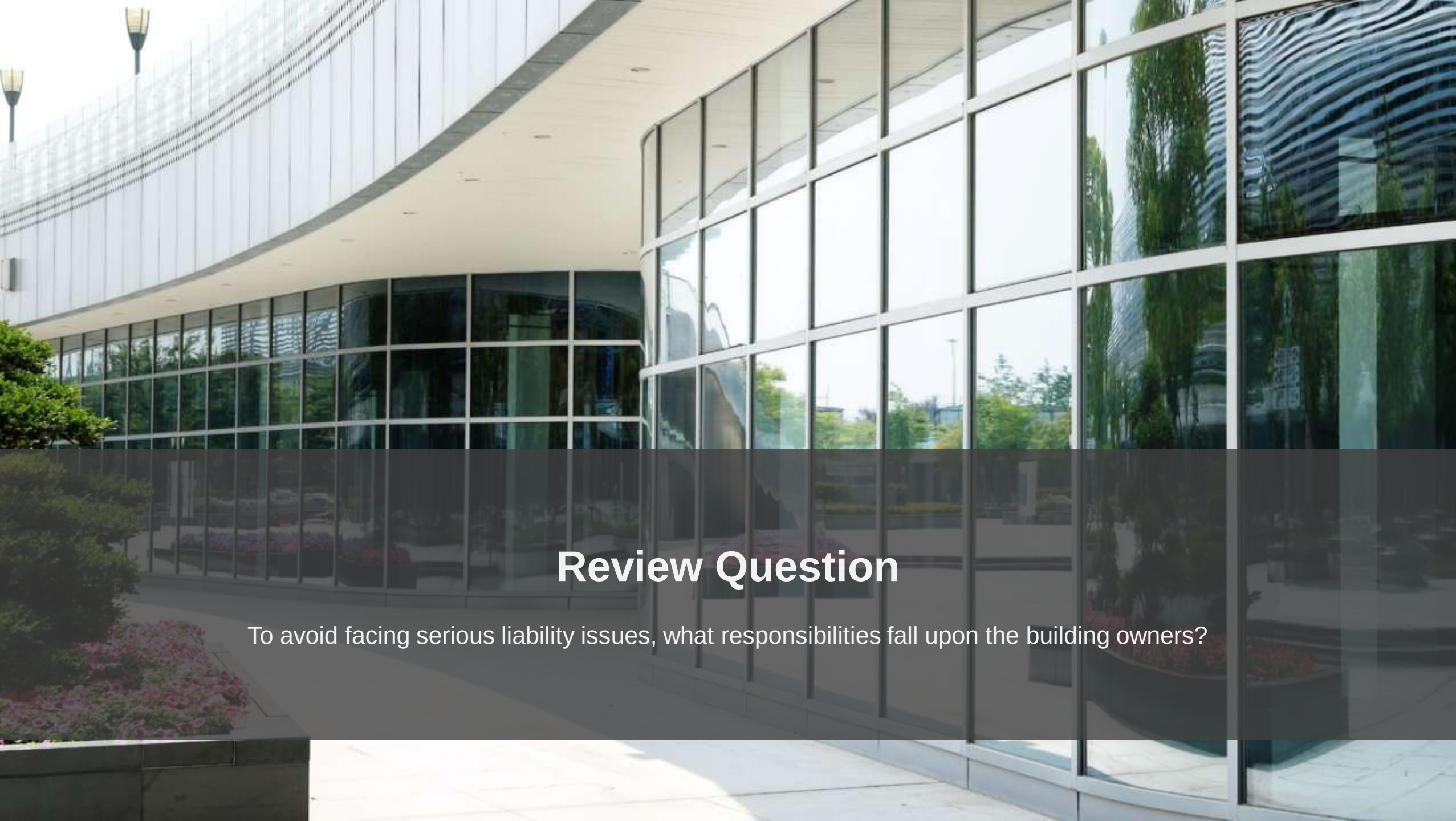
Private Business

International Sports Conglomerate

Marijuana Dispensary

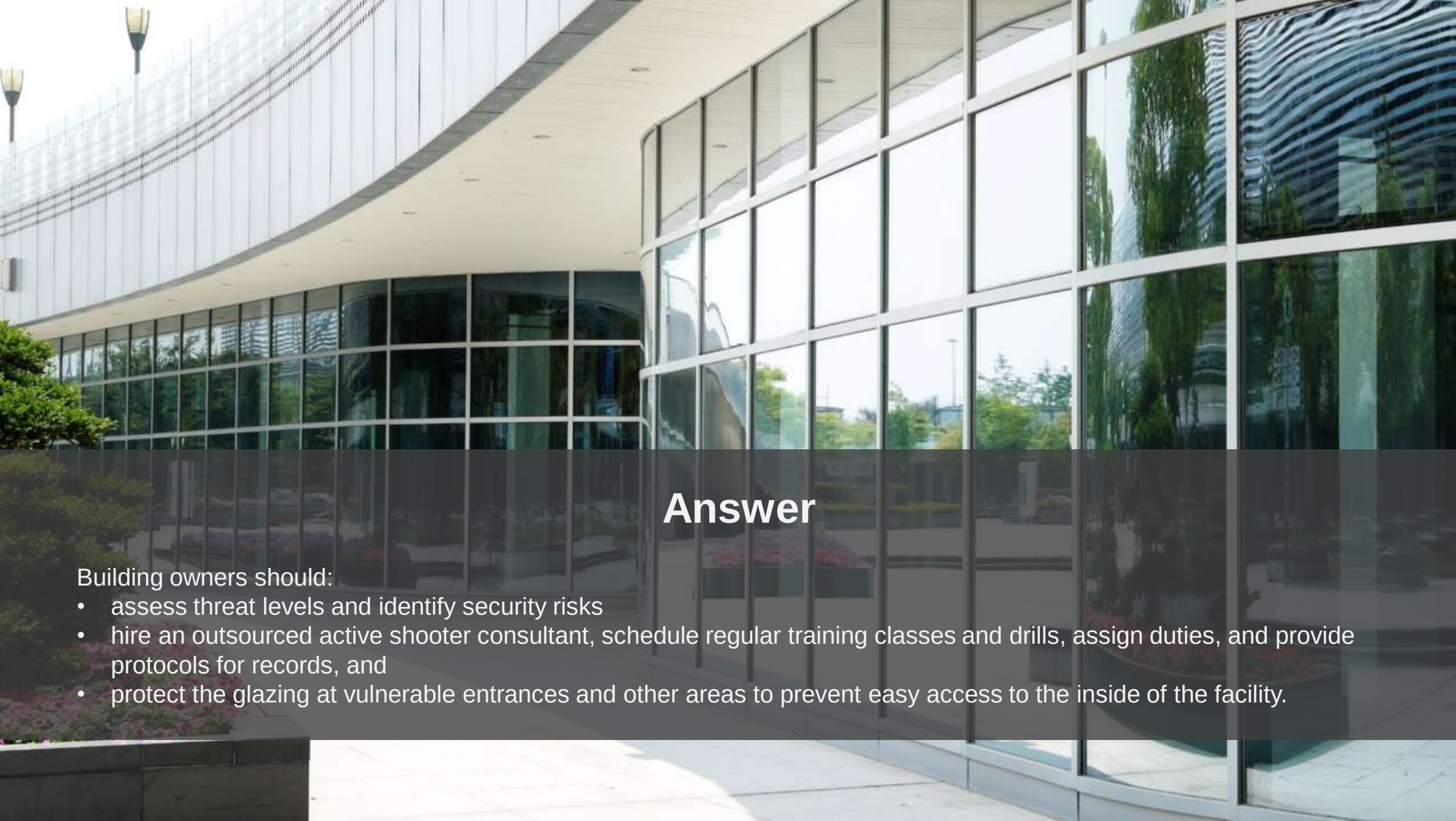
Jewish Synagogue

Beauty Supply Chain



Review Question

To avoid facing serious liability issues, what responsibilities fall upon the building owners?



Answer

Building owners should:

- assess threat levels and identify security risks
- hire an outsourced active shooter consultant, schedule regular training classes and drills, assign duties, and provide protocols for records, and
- protect the glazing at vulnerable entrances and other areas to prevent easy access to the inside of the facility.

Resources

Resources

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Resources

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Thank You for Your Time

Questions?

This concludes the American Institute of Architects Continuing Education System Course

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