



ARCHITECT'S RESOURCE GUIDE TO BULLETPROOF GLASS

Total Security Solutions

Everything you need to know about bulletproof glass and bullet resistant barriers. Valuable information to consider when designing a building that could benefit from the installation of a bullet resistant security system.

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In this eBook, you'll find valuable information to consider when working on the design of a building that may benefit from the installation of a bullet resistant security system.

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INTRODUCTION

The **Total Security Solutions** team is committed to helping design and install bulletproof barriers that meet the specifications of your construction project and provide minimal downtime. We are leaders in providing custom bulletproof systems for large or small projects. From national security to the safety of convenience store workers, Total Security Solutions has the knowledge and products to secure any facility. We've combined a lean manufacturing process with just-in-time scalable production to ensure your project will be on time and on budget. Our team values innovation, communication, and unsurpassed customer service.

Our clients view us as a preferred partner because we take a hands-on approach to helping them bring their custom design to life. At Total Security Solutions we work with our clients to create a sense of security for their organization.

We engage with architects, contractors, interior designers, and business executives to create the best possible solution for the safety of their staff while saving them time and money. Total Security Solutions works through the planning phase to provide the most aesthetically pleasing and functional bullet resistant barrier system possible.



Architectural applications for security glass can be found in banks, courthouses, financial institutions, government buildings, hospitals, schools, as well as many other facilities that require added security.

PROTECTING VALUABLE ASSETS

As you begin designing a project, try to envision the needs of the building's future owner. Aside from typical security methods such as locks and double doors, consider whether or not the building project you're bidding on is one that could be prone to robbery or other aggressive situations. If so, the biggest "assets" that organization will have are the people who will occupy the finished building.

Most material things can be replaced or insured after the fact, but due to the fragility of life, people are a much more precious resource. The building's owner should be vigilant about protecting everyone inside his building. If you think it's a building that needs more advanced protection methods like bullet resistant barriers, it's your job as architects to provide a blueprint that includes these safety features.

Most businesses look to protect their employees and will expend the necessary resources to ensure that their workplaces are safe. Bullet resistant barriers are one way to do so and they create a sense of security for both the business owner and the employees.



UNDERSTANDING BULLETPROOF, BULLET RESISTANT, AND SECURITY LEVELS

Bulletproof glass is officially known as bullet resistant glass within the industry because there is no feasible way to create glass that protects from 100% of gunfire. This type of glass is created to resist bullet penetration, and is constructed from a variety of materials depending on the level of protection desired.

THE BASIC CONSTRUCTION ELEMENTS

Six inches of lead sheathing or a foot of solid concrete can be described as "bulletproof", but the realities of commerce dictate visibility and easy communication. There are many materials – acrylic, polycarbonate, laminated fiberglass – at our disposal that provide excellent stopping power against most common handguns, shotguns, and rifles and they can be employed in ways that are almost invisible to the undiscerning eye.

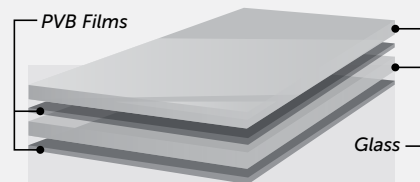
Bulletproof glass is usually constructed using a strong but transparent material such as polycarbonate thermoplastic or by using layers of laminated glass. The result is a material with an appearance and light-transmitting behavior of standard glass enhanced with various degrees of protection from small arms fire.

The polycarbonate layer is often sandwiched between layers of regular glass. The use of this plastic in the laminate provides impact resistance, such as physical assault with a hammer or other blunt force. The plastic provides little in the way of bullet resistance. The glass, which is much harder than plastic, flattens the bullet and thereby prevents penetration. This type of bulletproof glass can range from 70mm to 75 mm (2.8–3.0") in thickness.

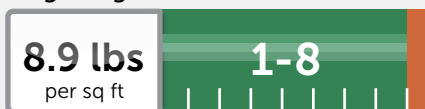
Glass-Clad Polycarbonate

Its thick layers make the highest-rated levels of bullet resistance obtainable.

A great choice for exterior use.



Avg Weight **Resistance Level**



Bulletproof glass constructed of laminated glass layers is built from glass sheets bonded together with polyvinyl butyral, polyurethane or ethylene-vinyl acetate. This type of bulletproof glass has been in use since World War II. It is typically about 100–120 mm (3.9–4.7") thick and can be extremely heavy.

A barrier system designed and installed by an experienced company will provide high security and protection against most projectiles, without making your interior space resemble a maximum security prison.

STANDARD UL PROTECTION LEVEL RATINGS

Security levels for bullet resistant systems have been established by UL (Underwriters Laboratory), the primary testing organization for materials used in bullet resistant barrier systems. Each level has been tested and found effective at stopping certain types of projectiles, ones most typically employed during an armed robbery. While ratings extend to Level 8, the needs of most banks, credit unions, and convenience stores are covered in Levels 1-3.

All Total Security Solutions systems pass rigorous testing, often conducted by multiple standards agencies. All materials are made to our stringent specifications, the most demanding in the industry. Can a sheet of transparent, 1" acrylic capped on each side by a 1/8" cap sheet of lexan stop a .357 Magnum jacketed lead soft point round or a .44 Magnum semi-wadcutter round? The answer is yes.

The 8 Levels of Resistance

Each level of glass has been tested and found effective at stopping certain types of projectiles, ones most typically employed during an armed robbery.

Ammunition	# of Shots	Level
9mm Pistol	3	L1:
.357 Magnum	3	L2:
.44 Magnum	3	L3:
30-60 Hunting Rifle	1	L4:
AK-47 Assault Rifle	1	L5:
Uzi Submachine Gun	5	L6:
M16 Assault Rifle	5	L7:
AK - 47 Assault Rifle	5	L8:

Pro Tip: Work with a company who can show you they are using materials that have been officially tested and certified.

SELECTING A BULLET RESISTANT BARRIER SYSTEM

The three types of bullet resistant barrier systems are: **fixed**, **freestanding**, and **sliders**. You'll need to know what the best option is for you based on the project you're working on. Other considerations like weight requirements and budget also become factors. Keep in mind that each of these systems works best for specific usages.

FIXED BARRIER SYSTEM

If your project calls for a single transaction or ticket window (convenience store, bus station, will call window, etc), you will want to select a Fixed barrier system. Without proper security, buildings that could benefit from a fixed barrier system will be vulnerable to criminals. That is why these systems are ideal for places where there will be an active exchange of money because they keep the employee safe behind a pane of bulletproof glass. With this system, you should also consider installing bullet resistant frames, and if the system is isolated from the rest of the building, a security door that is bullet resistant and locked.

Having these elements in your fixed barrier system (glass, frame, and door) will act as a deterrent for anyone contemplating committing a crime at your location. Fixed barrier systems are ideal when installing doors and windows in drywall openings, or in applications where aesthetics will not be affected by the presence of metal frames.



Pro Tip: With fixed and freestanding barriers, also consider in your design how the person behind the glass is going to communicate with the outside world. (See pg 9)

FREESTANDING BARRIER SYSTEM

Freestanding barrier systems can be used instead of fixed barrier systems if your project calls for a row of transaction windows like you'd see in a bank, a professional sports stadium, a movie theater, or a horse track. When you have multiple consecutive stations that need protection, the freestanding option is more aesthetically pleasing because you won't need to install bullet resistant frames around every individual transaction window.

You do not need to plan on using bulletproof glass all the way to the building's ceiling. Instead, you can switch to regular glass when you get closer to the ceiling and still offer a seamless look. This will keep the cost of the job down considerably. Statistically, if your location is involved in a crime, the criminal will not be shooting at high portions of the glass. Clear bullet resistant acrylic doors and windows can also be combined with bullet resistant counters and other millwork to blend in with existing decor, which gives the interior of the building a more clean and clear look.



SLIDER SYSTEM

The Slider system should be considered if workers within the building will need varying levels of protection throughout the day. With the slider, an employee will be able to move the bulletproof glass as necessary. An example of businesses that would need this type of setup include fast food establishments, 24-hour gas stations, and convenience stores. During the day, the threat level is relatively low in these businesses, so employees can keep the system open, but when the traffic dies down in the late hours of the evening into early morning, they can latch the system closed for extra protection. Due to high traffic volume in these establishments, and the need for money exchange, the sliders can be outfitted with optional package passers. Slider systems are available as vertical and horizontal systems.



OTHER SYSTEM CONSIDERATIONS

While the overall goal of installing a bullet resistant barrier is safety, you should consider the aesthetics as well. When offering superior safety, the system should fit seamlessly into the design and improve the overall look of your building. All three system types can be equipped with optional package pass-through and cash drawers. Finally, if installing a transaction window instead, keep in mind that users will need to communicate with customers as well as colleagues.

Consider what type of communication means you want to add when deciding on the look of the system. This is especially important in noisy or high traffic areas. *Do you really want people yelling through the glass or putting their ear down to the cash tray to communicate?*

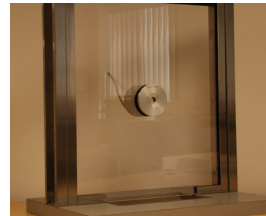
ACRYLIC VOICE PORTAL

This portal is an ideal choice for interior acrylic transaction windows. This allows everyone to communicate effectively and offers minimal exposure to the person behind the window.



ELECTRONIC TALK-THRU

This system should be considered in areas where background noise could be an issue. If selecting this device, you'll also need to run power to the area being protected.



ARCHED VOICE PORT

The arched voice port is a more aesthetically pleasing selection of transaction windows. It offers optimal sound transmission in comparison to standard bulletproof windows.



NATURAL VOICE TRANSMISSION

The (NVR) communication solution can be found on custom prefabricated transaction windows. Sound travels through the vertical side rails and allows for no visual obstruction.



STAINLESS STEEL VOICE PORTAL

Stainless steel voice portals should be considered for exterior applications as they offer optimal sound transmission and are designed to withstand the elements..



SELECTING THE TYPE OF GLASS

Bulletproof glass is manufactured out of three different materials: **acrylic**, **polycarbonate**, and **glass-clad polycarbonate**. Once you've decided what type of system best fits with your construction project, it's time to choose the glass.

ACRYLIC

Acrylic is the most popular bulletproof glass option for most projects. Acrylic can be drilled, routed, cut, and slotted to integrate seamlessly with the mounting hardware and surrounding architecture in a quality bullet resistant system, or to build custom bullet resistant structures. Acrylic passes light almost perfectly, and since its rough cut edges can be flame-polished clear, it lends itself to the attractive, unobtrusive installations favored in most public buildings. If your building calls for Bullet Resistance Levels 1-3, acrylic is typically the best option.

Common Uses: Interior Fixed and Freestanding Systems, and Slider Systems

POLYCARBONATE

Polycarbonate is great for exterior windows because of its resistance to forced entry. A sheet of polycarbonate will take an hour of beating with a sledgehammer, where a comparable piece of acrylic might succumb in just minutes. This polycarbonate security glass from Total Security Solutions comes standard with abrasion resistant coating, which increases durability against solvents, weather, and ultra violet light.

Common Uses: Exterior Fixed and Freestanding Systems

GLASS-CLAD POLYCARBONATE

Like traditional laminated glass, glass-clad polycarbonate is challenging to fabricate into acrylic-style seamless systems. And, like polycarbonate, it suffers from poor light transmission. Glass-clad polycarbonate can be layered thicker and thicker to the highest-rated levels of bullet resistance, yet still stop a burst from an M16 or AK-47. This makes it a great choice for exterior applications. Glass-clad polycarbonate holds up in high-traffic areas, weathers excellently, and carries ratings for forced entry, explosive blasts, and hurricane winds.

Common Uses: Exterior Fixed and Freestanding Systems, and projects needing a Resistance Level of 4 or more

SELECTING DOORS, FRAMES, AND FIBERGLASS FOR YOUR SYSTEM

Doors, windows, and other points of entry are the inherent weak spots in any security system. That's where Total Security Solutions is at its best, specializing in secure, bullet resistant, rated frames.

DOORS

If you have a drywall opening designed for your project, then you would typically choose between a wood door or a steel door designed for bullet resistance. This can help protect against a security breach inside of a cash office for example. Aluminum doors are also commonly used in entryway systems and high-use areas. Any of these doors can be prepped with matching hardware and with bullet resistant view windows. Finally, while not as common as the wood, steel, or aluminum options, acrylic doors can be used on the end of a freestanding system to preserve the aesthetics of the interior space.



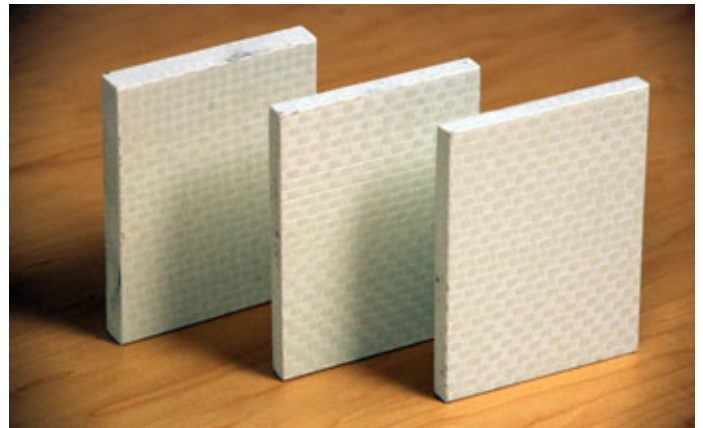
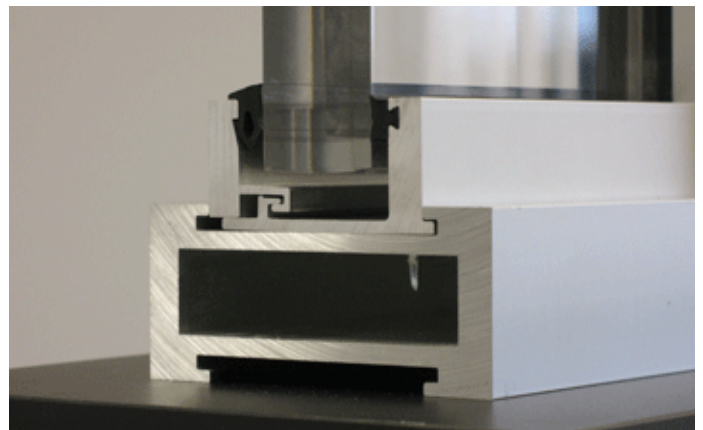
Pro Tip: When you get a quote from a bulletproof vendor, be sure that the quote includes hardware (hinges, door knobs, etc).

FRAMES

If your project only requires Level 1 or Level 2 glass, you have the option to go with a frame that isn't bullet resistant. You'll want to make this decision after the potential threat level is assessed. Cost is also a factor. If you're trying to be more cost-conscious with your project, a non-ballistic frame may be suitable for your needs. If, on the other hand, your project calls for Level 3 glass or higher, you'll want to have bullet resistant frames as part of the complete system.

FIBERGLASS

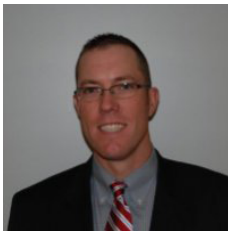
Fiberglass can be shipped ahead and built into the walls and millwork of your project. Another option is to have it put into the counter and laminated when Total Security Solutions comes to install everything. We are able to color match any laminate or existing millwork. One final option for the fiberglass is to paint it and put it behind an existing counter or desk area. If you do this, keep in mind that you will have less protection and coverage because of file drawers and cabinets.



Pro Tip: CAUTION: Gluing fiberglass inside a frame does not make it bulletproof! If hit with a bullet, a person's safety will be compromised. Our Level 3 frame is all aluminum, but is certified and test as bullet resistant.

INSTALLATION

Our specification and manufacturing process is set up to accommodate your needs, and we can likely do it faster and more efficiently than anyone in the industry. We'll provide spec sheets for you to complete and cut, route, and drill to your measurements, or we can provide products in bulk for you to work with. If you go this route, it's important to have the glass shipped ahead of time so the millworker can integrate the barrier system into their part of your project.



Vice President | Jim Richards

Jim Richards, Vice President of Total Security Solutions, also offers up these top considerations architects need to think about when installing a new bullet resistant barrier system:

- Make sure you use care when handling and installing any bullet resistant product. If mishandled, cracking or breaking can occur.
- When supplying a fixed opening for a door or window, make sure there's proper anchoring in the walls to support the weight of the barrier.
- Counters will need to be supported with additional framing in order to hold the bullet resistant glass.
- Do not lean bullet resistant wood doors against a wall for long periods of time. The weight of the door and the gravitational pull will cause it to bow.
- Only approved cleaning materials and solvents can be used to clean the transparency. Not using the proper materials will damage your glass.
- Never clean glazing material with lacquer thinner. Don't even get the thinner close to the glazing material.
- Special drill bits must be used to drill the acrylic and polycarbonate materials.

MAINTENANCE

Bulletproof glass is a major investment, and will look great for years with proper maintenance. That maintenance includes never using products like Windex on your windows. When the bulletproof polycarbonate or acrylic is cut, drilled, or flame-polished, microscopic fractures form in the plastic. These are not visible to the naked eye, and are structurally inconsequential, but as we mentioned below, using these types of products will cause crazing to occur.

CLEANING BULLET RESISTANT PRODUCTS

To clean aluminum stock materials, gently wipe them down with a cloth dipped in lacquer thinner. Acrylics and polycarbonates can be cleaned by using the provided 210 Glass Cleaner and a soft cotton cloth or microfiber towel. Additional 210 Glass Cleaner may be purchased through Total Security Solutions or you can also use a diluted solution of 5% Dawn dish soap to one gallon of water. Glass-clad Polycarbonates can be cleaned using standard glass cleaning products with a non-ammonia base.

PREVENTING FINE CRACKS

Crazing, or hairline cracks along the surface of acrylic, is the result of using improper cleaning chemicals on the acrylic. These chemicals release inherent stress in the material formed in the casting process. Crazing cracks cannot be repaired or reduced in appearance. To avoid this, it is imperative that you use the appropriate cleaning materials.

REMOVING SCRATCHES FROM THE SURFACE

Surface scratches are inevitable with acrylic. It is up to you as the end user, however, to determine if the repair on the acrylic will be of more harm than the scratch itself. If there is any white coloring in the middle of the scratch, it is not repairable. It is possible to get it back to a clear opacity, but the scratch itself will still be visible.

ORDERING FROM TOTAL SECURITY SOLUTIONS

When you've made the decision to work with Total Security Solutions and are ready to order, simply contact your salesperson or project manager to start the ordering process. Aside from our standard product offerings, we have several quick ship options that can ship out within three business days on average.

TOTAL SECURITY SOLUTIONS DELIVERY

Estimated delivery dates are best derived from information provided by the freight company. When materials ship from the fabricating facility, Total Security Solutions will send an email containing a tracking number, as well as the Bill of Lading number from the freight company, to the contact identified on the order. Tracking information will be available after 5:00 pm EST on the ship date. For additional information on the status of an order, please contact your salesperson or project manager at Total Security Solutions.

ISSUES WITH DELIVERED PRODUCT

To help Total Security Solutions assist you in resolving a defective product issue, please take a photo of the area containing the defect. For size reference, please include a coin next to the defect when taking the photo. Contact your Total Security Solutions salesperson or project manager and email your photo for information on appropriate next steps.

In the unfortunate circumstance that you experience damage during shipping, please take a photo of the damaged products, as well as a photo of the crate in the condition it was delivered to your facility. Contact your Total Security Solutions salesperson or project manager and email your photo for information on next steps.

In order for Total Security Solutions to assist you in resolving a claim for products damaged outside of shipping, we request that you take a photo of the area that is damaged. Contact your Total Security Solutions salesperson or project manager and email your photo for information on next steps.

TOTAL SECURITY SOLUTIONS

Total Security Solutions produces the most comprehensive line of bulletproof barriers and products available. Three decades of experience have made Total Security Solutions an industry leader in bulletproof barrier systems, and the Total Security Solutions team brings that expertise to bear on your security challenges.

Thank you for reading our eBook about bullet resistant glass barriers. We would like to be your partner as you plan and spec out your building project. If you would like more information, please visit us at www.tssbulletproof.com or call us at **800.513.1468**.

OTHER RESOURCES FOR ARCHITECTS

DOWNLOAD THE ULTIMATE GUIDE TO BULLETPROOF GLASS AND BULLET RESISTANT BARRIERS



Have your questions answered in *the Ultimate Guide to Bulletproof Glass and Bullet Resistant Barriers*.

This infographic guide provides detailed information for both professionals and first time buyers.

GET OUR SCHOOL SECURITY CHECKLIST: 5 STEPS FOR SECURING SCHOOL DOORS & ENTRYWAYS



Our *5-Point School Security Checklist* is designed to guide you through key steps to retrofitting school entryways with a bullet resistant security barrier to protect students, faculty, and staff.

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