
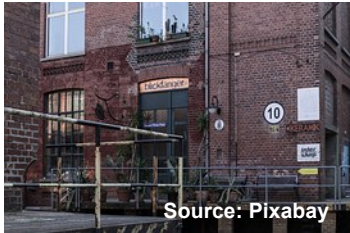



**WORKBOOK 13.3: PASSIVE STRUCTURAL BARRIER MODIFICATIONS** 

**Purpose:** To present information about passive structural barriers to help you improve the delay function of a facility’s physical protection system


When evaluating a facility’s passive structural barriers, you should consider the primary function of barriers: to increase the time it takes an intruder to carry out an attack plan. The following considerations and recommendations will help you to improve the delay function of a facility’s physical protection system.

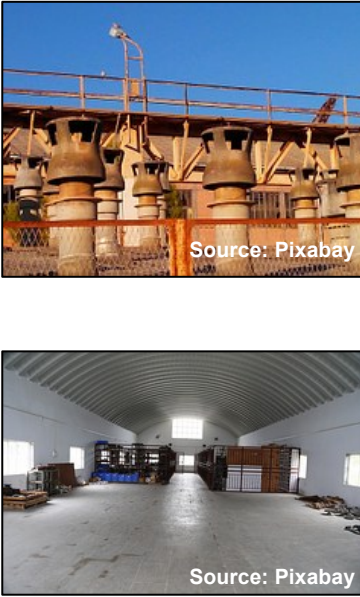
Type	Photos	Considerations and Recommendations
Walls	 <p>Source: Pixabay</p>	<ul style="list-style-type: none"> <li>▪ Concrete walls are commonly used in structures to store and protect sensitive materials.</li> <li>▪ Walls are usually more resistant to penetration than other structural barriers (doors, windows, and vents).</li> <li>▪ Because of their rugged appearance and known structural composition, concrete walls are almost universally believed to be undefeatable barriers.</li> <li>▪ However, in less than five minutes, an intruder with explosives and cutting tools can make a crawl hole through a 46-centimeter thick steel reinforced concrete wall.</li> <li>▪ Even though explosives can penetrate concrete, the reinforcing steel usually remains intact to the extent that it must be moved out of the way to accomplish entry.</li> <li>▪ Two or more reinforced concrete walls in a series provide longer penetration delay times than one wall with a thickness equal to their combined thicknesses.</li> <li>▪ This is because penetration of multiple walls requires multiple individual efforts and the transport of tools through preceding walls.</li> <li>▪ Also, if explosives are used, contained internal pressure from the explosive charge could cause roof and surrounding structure collapse, which further</li> </ul>

Type	Photos	Considerations and Recommendations
		<p>causes a rubble and debris barrier.</p> <ul style="list-style-type: none"> <li>▪ Upgrading wall structure to reinforce thickness will force an intruder to increase breaching tool requirements and alter their penetration method.</li> <li>▪ <b>For discussion: How can using two or more concrete walls in a series increase delay time?</b></li> </ul>
Doors		<ul style="list-style-type: none"> <li>▪ In all structures, the weakest component determines the value of the barrier.</li> <li>▪ This is particularly relevant to doors, as they are often one of the weakest links in a structure due to design limitations.</li> <li>▪ For example, many buildings with concrete walls provide pedestrian access through hollow steel doors.</li> <li>▪ The barrier value of the wall is fairly high but is weakened by the use of ordinary doors, frames, or hinges that can be quickly penetrated.</li> <li>▪ Doors, frames, and related hardware should be strengthened to afford the same delay as that provided by the connecting floors, walls, and ceilings.</li> <li>▪ Attack and bullet-resistant doors offer increase in penetration resistance over standard industrial doors.</li> <li>▪ The first step in upgrading existing facilities is to eliminate all unnecessary doors.</li> <li>▪ Adding steel plates to existing doors will increase penetration resistance of a door by hand or light power tools.</li> <li>▪ Heavy-duty hinges should be used to support added weight and frames should incorporate concrete to strengthen the supporting structure.</li> <li>▪ Most exterior doors are equipped with panic (emergency exit) hardware that allows rapid emergency exit, which is usually a building code requirement.</li> </ul>

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		<ul style="list-style-type: none"> <li>▪ As mentioned earlier, this safety feature increases the vulnerability to defeat.</li> <li>▪ Panic (or crash) bars can be defeated in one minute using small hand tools,<sup>1</sup> which produce less noise than does thermal cutting.</li> <li>▪ To strengthen a door equipped with a panic bar, add a steel plate with a drill-resistant steel section fastened to it, which prevents chiseling and wire hooking of the panic bar.</li> <li>▪ Electronic control devices are also available for use with emergency exit hardware.</li> <li>▪ These devices require the push bar to be depressed for a pre-set amount of time before an electronic deadbolt is released.</li> <li>▪ This provides a security force member time to assess the situation through closed-circuit television or to respond to a door alarm.</li> <li>▪ <b>For discussion: How can you reinforce doors to increase penetration resistance?</b></li> </ul>
Windows and utility ports		<ul style="list-style-type: none"> <li>▪ Most windows without reinforcement can be penetrated in less than 30 seconds; therefore, windows require reinforcement to provide significant penetration resistance.</li> <li>▪ In addition to windows, many facilities often have unattended structural openings, also known as utility ports, such as ventilating ducts, utility tunnels and service openings, which can be used as entry and exit paths for an intruder.</li> <li>▪ Often, these openings include screens installed for safety, decoration, and also to function as barriers for insects, rodents, and small animals.</li> <li>▪ Penetration resistance of a utility port can be increased by installing protective coverings, such as grills and grates constructed of steel mesh,</li> </ul>

<sup>1</sup> Garcia, 212.

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		<p>expanded metal, and bar stock.</p> <ul style="list-style-type: none"> <li>▪ If bars are used, they can be placed close together to prevent crawling through the port.</li> <li>▪ While some of these utility ports cannot be covered during normal business hours due to safety or other reasons, use of additional metal or steel reinforcement coverings can occur at or immediately after detection to provide protection.</li> <li>▪ Methods to increase window penetration resistance include:             <ul style="list-style-type: none"> <li>• Installing steel grates over the window opening.</li> <li>• Using reinforced frames that contain concealed materials that resist cutting tools.</li> <li>• Repositioning the window’s locking mechanism to a location that is not readily accessible from the outside.</li> <li>• Using reinforced locking mechanisms.</li> <li>• Installing windows that do not open.</li> </ul> </li> <li>▪ In addition, the window glass itself can be reinforced with added thickness, wire mesh, or polycarbonate glazing; however, with hand tools or axes, most reinforced glass construction can be penetrated with minimal difficulty and time.</li> <li>▪ This reality increases the importance of using sensors with high sensitivity, working in conjunction with a fully operating alarm communication and display system.</li> <li>▪ <b>For discussion: How can you increase window penetration resistance?</b></li> </ul>

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Roofs and floors	 <p>Source: Pixabay</p> <p>Source: Pixabay</p>	<ul style="list-style-type: none"> <li>▪ Penetration threats against roofs and floors include hand tools, power tools and thermal tools, and explosives used alone or in a combination.</li> <li>▪ Construction methods and materials used for roofs and floors are similar, although the basic materials may vary slightly in total thickness, type, and quantity of steel reinforcement, and concrete strength.</li> <li>▪ Penetration tests indicate that barriers placed below the roof (roofline) are sometimes more effective than those in the roof itself.</li> <li>▪ The optimum distance below the roofline appears to be 25 to 30 centimeters.<sup>2</sup></li> <li>▪ Roofline reinforcement enhancements include:             <ul style="list-style-type: none"> <li>• Material using embedded screen.</li> <li>• Several centimeters of added insulation.</li> <li>• Reinforced concrete and expanded steel mesh.</li> <li>• Larger rebar formed into multiple layers or rows.</li> <li>• Heavy gauge fasteners to secure joints on metal systems.</li> </ul> </li> <li>▪ Typically, floors offer more penetration resistance than do roofs, because they are protected by the main structure and are designed to accommodate heavier loads than roofs.</li> <li>▪ <b>For discussion: Why do floors offer more penetration resistance than roofs?</b></li> </ul>

<sup>2</sup> Garcia, 216.

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