Back in the good old days, window film’s only function was to block solar heat coming through windows and glass doors. It lowered temperatures and the cost of air conditioning. Today, when applied to existing glass, the most advanced heat-blocking window film is also a security film that can save lives, reduce injuries and protect property from damage in natural disasters, accidental explosions and terrorist attacks. The ability to save energy and protect building occupants from injury is important for glass doors, not only in office buildings, but particularly in high-traffic retail environments where frequent door use contributes to both energy conservation and security challenges.

Enhancing Building Security

In reviewing building security, managers give serious consideration to access control, video surveillance, employee background checks and a myriad of other devices and procedures that comprise a company’s or retail establishment’s security program. Unfortunately, the danger to building occupants posed by the ubiquitous presence of glass doors, windows and fixed glass is often overlooked even though broken glass is a frequent source of injury when disaster strikes.

Most glass doors have been designed to deal with insulation against heat loss, reduction of air infiltration and even the lessening of noise transmission. Unfortunately, such otherwise sophisticated door systems are not capable of effectively resisting the often powerful and devastating force of wind-blown debris, earthquakes, explosions and terrorist attacks, not to mention the life-threatening consequences of building occupants and retail customers accidentally walking into a glass door.
In fact, most injury from glass is caused by accidental impact. When broken, glass falls causing injuries to the upper leg and knee. The next most likely area of injury is to the head, neck and shoulder. If not fatal, these injuries can lead to loss of limb or limb function.

Subject to the stress of storms and explosions door glass through usually tempered-glass often breaks into pellet-like pieces that can be flung out of the door frame putting building occupants and passers-by in harm’s way. If the explosion is sufficient, the glass may become atomized. As the explosive shock wave causes victims to gasp, they breath in atomized glass particles that can result in death.

Many of the 5,000 injuries in the 1998 bombings at the embassies in Kenya and Tanzania were a function of broken glass. Broken glass in the 1996 terrorist bombing of Khobar Towers at the US Air Force base in Saudi Arabia resulted in over 330 injuries, 80 to 90% the result of broken glass. Glass broken in buildings adjacent to the World Trade Center may not have caused the damage that resulted had that glass been equipped with security window film.

Of course, shattered glass also results from natural disasters such as the Northridge and Kobe, Japan earthquakes and Hurricanes Katrina and Rita. Before 1990 there were no insured loses exceeding $1 billion from natural catastrophes. Since then, of the 25 largest insured catastrophes in the US, over 21 have occurred in the last decade. Volatile weather as a function of global warming may cause more widespread property damage and glass related injuries and fatalities.

Security window film can strengthen existing glass doors. It is either optically clear, tinted or reflective layers of polyester film applied to the interior surface of existing glass. Usually, installed security film is applied to the visible portion of the room side of the glass all the way to the edge of the frame but does not extend to the glass edge within the frame.

Because security film can expand, it can absorb a significant explosive shock wave. As this explosive force moves toward the glass and pushes it inwards, the glass eventually breaks. The security film that is applied to the room side surface of the glass continues to absorb the shock wave. It expands until it can no longer withstand the force at which time it bursts.

The shock wave, when great enough to break the glass, is not enough to shear the film. This results in the glass being broken but held intact by the film. In these cases, not only are there few or no injuries from broken glass, but there is little or no damage to the building. In other cases, the shock wave breaks the glass and shears the film. The glass collapses attached to the security film with minimal damage and injuries. Security film may also prevent glass from falling out of the door and into the street. Ultimately, the extent to which security film can reduce the lethality of broken glass by reducing the likelihood it
will become deadly flying projectiles or atomized particles able to be inhaled is the true test of its value.

Unfortunately, there is much confusion about the role of security film. Some critics contend that because hurricane force winds can thrust an object through a glass door to which security film has been applied the security film has failed. In reality, no glass of any type, regardless of security film having been applied, will provide protection against flying objects equal to that of a solid wall. The correct comparison is not to compare the strength of window film to a solid wall, but to evaluate ordinary glass’s ability to resist impact compared to that of a glass door to which a security film has been applied.

Film can be applied to single pane and insulating glass. Proper application of film to insulating glass does not impact the integrity of an insulating glass sealant or generate thermal stress to glass from uneven heat absorption.

**Security Window Film vs. Laminated Glass**

Existing glass can be replaced with laminated glass, two or more pieces of glass bonded by a polyvinyl butyral plastic interlayer. Both laminated glass and security window film may mitigate the impact of explosions, wind blown debris and earthquakes. The performance of both depends on the relationship of each to the building’s existing door frames.

For laminated glass, the door frame must support the weight and thickness of the glass for the entire door system to effectively resist stress. Installing laminated glass in existing door frames that are not designed to support the weight of laminated glass may not prevent the glass separating from the frames when the glass is stressed.

The ability of security window film to resist force may increase if the film is not only applied to the glass but attached to the door frame. Many film manufacturers market mechanisms that secure film to frames. Independent tests verify that many security window films provide equivalent ability to withstand stress compared to laminated glass.

**Energy Savings**

The optimum security window film not only provides increased protection from stress, it may reduce a building’s energy consumption by blocking solar heat. According to the California Energy Commission, as much as 40% of a building’s cooling requirements are a function of heat entering through existing glass. Stopping heat at the glass door and window is the most effective means of lowering temperatures and reducing heating, ventilating and air conditioning (HVAC) operating costs. In new construction, reducing heat coming through doors and windows can mean the need for smaller and less expensive HVAC systems.

Film applied to glass doors and windows is the least expensive and preferred solution to mitigate the impact of too much solar heat entering glass. The good news is conventional tinted and reflective applied films successfully block some solar heat thereby reducing the use of HVAC systems.

The bad news is that these same films reduce a significant percentage of visible light through the glass. Many of these films are highly reflective in daylight, giving them a mirror-like appearance when viewed externally. In artificial light and at night, internally, reflective films appear mirrored. In the case of retail establishments, visible light is reduced inside the store and shoppers outside cannot clearly see inside.

Most conventional window films transmit less than 34% of visible light, a good 36% less than the 70% necessary to be detected by the naked eye. The result is that building interiors are correspondingly darkened, often requiring the use of increased illumination. This may lead to higher electricity consumption and increased utility costs defeat the major benefit of the film—cost savings.

Clear spectrally-selective applied window film offers the best ratio of visible light transmission to heat rejection. Spectrally-selective refers to the ability of the film to select or let in desirable daylight while blocking out undesirable heat. **dh**