



# Safety by **Design**

**Principles and techniques to help make a school safe and ensure it is aesthetically pleasing**

Schools are an integral part of every community in the United States. Many schools are used as shelters, command centers, or meeting places in times of crisis. Schools are also used widely for polling and voting functions.

Consequently, ensuring the safety of students, faculty, and staff in our

schools, as well as the safety of the school buildings themselves, is critically important. Schools should be the safest place our children can be. Security is not a standalone capability; it is a critical design consideration that should be continually reviewed and scrutinized from the design phase through construction or rehabilitation and into building use.

The focus of this article is on the threats posed by potential physical attacks on a school. A school may have considerable vulnerabilities, because of its well-defined periods of use, designated access points, storage of sensitive personal information, minimal security forces, and numerous avenues of penetration and escape for attackers.



**Most schools** are constructed on an open site where the defended perimeter may or may not be on the property line.

### LAYERS OF DEFENSE

■ = First Layer ■ = Second ■ = Third

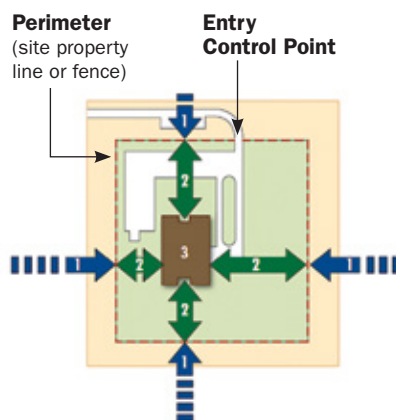


Figure 1

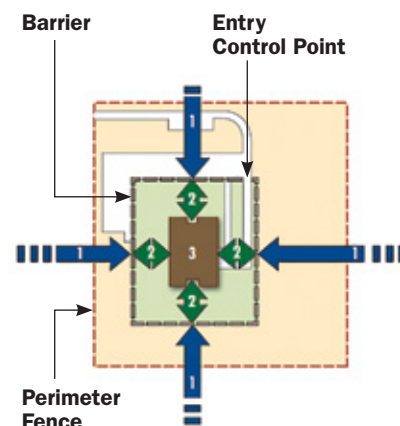


Figure 2

Three main layers of defense emphasized are:

- **First or Outer Layer** that consists of natural or manmade barriers usually at property line or sidewalk/curb line. Typically, the school perimeter is marked by no more than a fence, and is often completely open.
- **Second or Middle Layer** usually extends from the perimeter of the site to the exterior face of a school building.
- **Third or Inner Layer** starts at the building envelope and extends into the interior of the school building.

### Layers of Defense for Single Building Open Sites

Most schools are constructed on an open site where the defended perimeter may or may not be on the property line. Typically, the perimeter barrier designates the standoff distance around the school building beyond which is the area that building owners and occupants do not control.

*Figure 1* shows the whole site as an exclusive protected area; the perimeter barrier is located on the property line, and the onsite parking is within the second layer of defense. Crash-rated barriers are used where the site is vulnerable to invasive vehicles. The rear of the site is impassable to vehicles, so the barrier is limited to a fence to deter intruders.

An alternative solution is to place the barrier inside the property line, thus reducing its length. The onsite parking is outside the access-controlled area, and a minimum standoff distance is provided. *Figure 2* illustrates an example of a site security design for an open site.

### Perimeter Security

A perimeter security system consists of two main elements: the perimeter barrier that prevents unauthorized vehicles and pedestrians from entering the site, and access control points at which vehicles and pedestrians can be screened and, if necessary, inspected before they pass through the barrier.

### Layers of Defense

The basic approach to site security design promoted in this article is the concept of layers of defense. These are multiple consecutive layers of protective measures deployed in concentric circles around a school. They start from the outer perimeter and move inward to the area of the school building with the greatest need for protection.

The layers are mutually independent and designed to reduce the effectiveness of an attack by attrition, i.e., each layer is designed to delay and disable the attack as much as possible. This cumulative protection strategy is also known as protection-in-depth, and has been one of the basic Crime Prevention Through Environmental Design (CPTED) strategies for protecting assets behind multiple barriers.





After 9/11, many cities experienced a proliferation of barriers, street closures, and other security measures around high-risk federal and private buildings. In some cases, these measures have been considered successful from a security, architectural, urban planning, and cultural preservation standpoint. However, in many cases, the installation of security barriers has

been acknowledged as detrimental to the function, quality, and utility of the public realm. Restricting vehicle access can cause significant traffic congestion and can create unnecessary obstacles on streets and sidewalks that minimize the efficiency of pedestrian and vehicle circulation systems and hinder the access of first responders in emergencies.

The following are suggested goals for perimeter security planning:

- **Provide perimeter security** in a manner that does not impede the city's commerce and vitality, excessively restrict or impede the use of sidewalks, limit pedestrian and vehicular mobility, or affect the health of existing trees.
- **Provide security** in the context of streetscape enhancement and public realm beautification, rather than as a separate or redundant system of components whose only purpose is security.

- **Produce a coherent strategy** for deploying specific families of streetscape and security elements in which priority is given to achieving aesthetic continuity along streets, rather than solutions selected solely by the needs of a particular building under the jurisdiction of one public agency.

### ■ Building Configuration

School building organization, or plan configuration, directly affects the building's physical security and the ability of school authorities to monitor and enforce access control. Many suburban schools use the campus style of organization, with multiple single-story buildings spread around the school grounds. This type of organization is difficult to secure unless the perimeter is controlled and only a single access point to the school is maintained and monitored at all times. Nevertheless, the dispersed school build-

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ings remain exposed to attacks from any direction.

A more compact organization of multiple school buildings, usually grouped around a central courtyard provides for easier surveillance and access control. By limiting the access to the inner courtyard and creating a secure enclosure, the school buildings' exposure to attack from the outside is significantly reduced. An even more compact organization involves a single building with a multi-story configuration or a single- or multi-story configuration with wings, such as U-, H-, or simple L-shaped plans. Though open, the courtyards formed by this type of school building are easier to monitor and control than the completely open grounds of a campus configuration.

With respect to the attacks with explosive charge, the shape of the school building can contribute to the overall damage to the structure. For example, U-, H-, or L-shaped build-

## Other Factors to Consider...

### TOPOGRAPHY

**The topography of the site is a very important security issue**, because — depending on the placement of the school building on the site — it determines the opportunities for internal surveillance of site perimeters and screening of internal areas from external observation points. Elevated sites may enhance surveillance of the surrounding area from inside the facility, but may also allow observation of onsite areas by adversaries. Buildings placed immediately adjacent to higher surrounding terrain may be overly exposed to intrusive surveillance.

### BUILDING ORIENTATION

**The physical positioning of a school building** on site, can be a major factor for security. A structure's orientation relative to its surroundings defines its relationship to that area. In both aesthetic and functional terms, a building can “open up” to the area or turn its back; it can be inviting to those outside, or it can “hunker down” defensively.

### VEGETATION

**Vegetation onsite can open or block views** for security purposes, as well as provide shade and enhance the appearance of the site. However, vegetation at the base of school buildings and structures may exacerbate certain vulnerabilities by obscuring views, providing hiding places for people and explosive devices, and facilitating surreptitious approach by potential attackers. □



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## Safety Factors for School Entrance

- **The visitor parking lot** should have an unobstructed view from the reception desk
- **The sidewalk** to the main entrance should have an unobstructed view from the reception desk
- **The locked exterior door** should have an unobstructed view from the reception desk
- **The locked vestibule door** should have an unobstructed view from the reception desk
- **There should be a locked door** that leads from the main office to access the rest of the building
- **Locked doors** should be controlled remotely

Source: Eppstein Uhen Architects

ings tend to trap shock waves, which may exacerbate the effect of explosive blasts. For this reason, school buildings with corners where two exterior walls come together in a 90-degree angle are much more vulnerable to blast damage. In general, exterior walls that extend outward rather than inward are preferred when designing a school building.

Additionally, school buildings with the ground floor at grade are

vulnerable to vehicles being driven into them. Similarly, building openings and glazed walls oriented toward publicly accessible areas increase the vulnerability of school occupants to attacks using explosives and various projectiles.

### ■ Parking

School parking is typically accommodated by open surface parking lots. On-street parking lanes may

occur on any site but are particularly characteristic of urban areas.

All parking in an open site should be located outside any protective barriers designed to protect the school from vehicles. Warning signs that are easy to understand should be installed along the physical barriers and at each entry. An important design goal is the development of an efficient layout of the parking spaces and provision of an internal circulation that has clear paths for pedestrians and vehicles. Parking restrictions can help to keep potential threats away from a school building. Operational measures may also be necessary to inspect or screen vehicles entering parking areas.

The following considerations may help implement sound parking measures for schools:

- If possible, locate unexpected visitor or general public parking near, but not on, the site itself, or outside the protective, standoff zone.
- Locate vehicle parking away from high-risk school buildings to minimize collateral blast effects from potential vehicle bombs.

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## Considerations for Visitors going beyond locked doors

- **Scan driver's license** to check police database
- **Require visitors** to hand over driver's license
- **Require visitors** to wait outside for students
- **Require visitors** to wait in a reception area without access to the rest of the building

Source: Eppstein Uhen Architects

- If possible, design the parking lot with one-way circulation to facilitate monitoring for potential aggressors.
- Locate parking within the view of occupied school buildings. Use carefully chosen plantings around parking structures and parking lots to permit observa-

tion of pedestrians while at the same time reducing the visual impact of automobiles. Topography, existing conditions, or aesthetic objectives may make this difficult or undesirable to achieve, and CCTV surveillance cameras may be substituted.

- Provide parking lots with CCTV cameras connected to the security system and adequate lighting capable of displaying and videotaping lot activity.

### Conclusion

Most schools in the United States were built 30 to 60 or more years ago. Security issues were almost nonexistent at the time, and technology was dramatically different. As a result, school building designs are not always compatible with today's more security-conscious environment.

The fundamental objective of site planning is to place school buildings, parking areas, and other necessary



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structures in such a way as to provide a setting that is functionally effective as well as aesthetically pleasing. Increasing concerns for security add another dimension to the range of issues that must be considered.

The nature of any threat is always changing. Although indications of potential future threats may be scarce during the design stage, consideration should be given to accommodating enhanced protection measures in response to future threats that may emerge. School protection objectives must be balanced with other design objectives, such as the efficient use of land and resources, and must also take into account existing physical, programmatic, and fiscal constraints. ■

*This article is excerpted from the U.S. Department of Homeland Security's report "Primer to Design Safe School Projects in Case of Terrorist Attacks and School Shootings." You can view the entire report at <https://goo.gl/eWieXs>.*



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