# The Impact of Built Environment on Crime Prevention and Safety in Schools: An Environmental-Behaviour Design Guidelines Approach

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**Abstract**  The crime and safety has become one of the most serious social and administrative concrn in schools. School by nature of their occupancy and use require higher standard of safety and secured built environment than another type of buildings. In present context due to increase of accidents and crime in school, as an architect it is the duty to give emphasis on safety and security in terms of planning, building design and detailing and should recognize safety and security as fourth element of architecture. The design of a school and its surrounding campus can play a significant role in preventing crime and facilitating school safety measures. There are many opportunities to enhance school safety and security through physical design features. Architectural features and structural enhancements and spatial definition can deter, detect, and delay potential violent offenders from entering school campuses and buildings. This paper introduces some key concepts that can reduce the risk of harm while also enhancing the ability of school building occupants to avoid or reduce injury and death. This paper also discusses how architectural design could be used to manipulate the environment to influence behaviour for crime prevention. Finally, the paper gives the design guidelines for safe and secure environments in schools against accidents and crime.

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## 1. Introduction

The design of a school and its surrounding campus can play a significant role in preventing crime and facilitating school safety measures. The crime is influenced by a multiplicity of factors such as economic, social, governmental as well as physical elements [1]. In present context due to increase in accidents and crime, as an architect it is the duty to give emphasis on safety and security in terms of planning, building design and detailing and should recognize safety and security as fourth element of architecture. Creating safe schools are the responsibility of the entire community in which a school or school system resides [2]. The design of the environment for effective surveillance, access control and territorial control can be used to enforce safe behaviour to counter crime [3]. A study by Pirbasti indicated that design can create an environment that can encourage normal behaviour and discourage unwanted ones [4].

## 2. Need for Safety and Security in School

Maslow proposed that the hierarchy of the most basic human needs includes five levels where safety needs is at the second level after physiological needs [5]. Dramatic increase in the accidents and crime in school campuses have encouraged the interest in research questions about the relationship between the accidents and crime with the design of built environment in schools [6]. Due to day-by-day increment in the accidents and crime in school, there is a need of making school a safer place. The common accidents in schools are falls, slips, vehicular accidents, electric shocks, heat induced illness and fire accidents. The common crimes are kidnapping, theft, graffiti, fighting, sexual offences, weapon possession, vandalism, robbery, alcohol and drugs. Meanwhile, the contribution of the built environment towards the reduction of crime has received considerable attention in the last four decades. The literature on crime prevention is convincing in the claim that the property crime can be prevented through manipulating the design of individual space, and their relationship to one another and to the surrounding neighbourhood. This process is called crime prevention through environmental design [7]. Designers and other design professionals should take into consideration the surrounding environment in order to reduce or enhance crime rates [8]. The design factor responsible for accidents and crime are congestion, poor building detailing, areas of

neglect in building, handicapped provisions are not taken in accounts, unsafe play equipment, poor landscaping, lack of visual surveillance, undefined enclosure, Insufficient lighting, Hide out spaces and ill maintained area.

# 3. Research Methodology

In this paper, a qualitative method has been used. The research methodology comprises of case studies, survey questionnaire, observation and mapping. The four school buildings in India were selected for the study. The information collected provides the viewpoints of user about the accidents, crime and their opinion about the design, which helped in framing the guidelines. Finally, the findings have been summarized in the form of design guidelines for safe and secure environment in school against accidents and crime.

# 4. Design Guidelines for Safe and Secure School Environment

The crime prevention design is the process of creating 'interdictory spaces' to influence behaviour. These are spaces designed to intercept and ward off or screen and sort out would be users. Five types of interdictory spaces are identified as follows: (i) stealthy space-areas deliberately hidden from general view; (ii) slippery space-those without visible means of approach; (iii) crusty space-those that cannot be accessed because of obstruction; (iv) prickly space-uncomfortable space due to measures inhibiting activities; and (v) jittery space-space under constant observation, both positive and negative [9]. The design guidelines have been studied from the macro level to the micro level. These guidelines have been summarized under the broader heads such as Site Design, Building Design, Interior Spaces, Materials and Maintenance and finally as System and Electronics Equipment.

## 4.1. Site Design

### 4.1.1. Site Perimeter

- The property line of school should be clearly defined and the site perimeter is secured by limiting the access with selected entry points.
- The materials used for boundary wall should be such that it maintains safety and security as well as natural surveillance to the surrounding areas.
- Natural surveillance is possible through boundary wall.
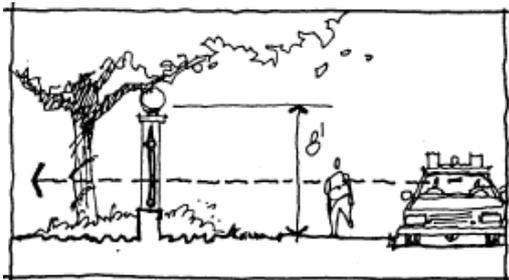- Boundary wall design and material inhibit graffiti, vandalism and robust.



**Figure 1.** Natural surveillance through boundary wall
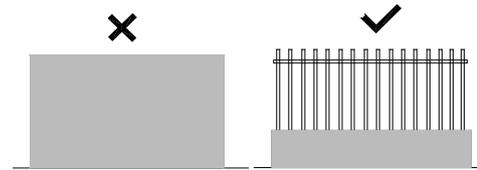


**Figure 2.** Visual transparency in the design of boundary wall

### 4.1.2. Entry and Exits

- Entry point to the site is located in areas of highly visibility where they can be easily monitored by staff and students.
- Main entrances to the premises shall be of adequate width to allow easy access to the fire tender and in no case it shall measure less than 6 meters.
- Security check post should be provided all entry and exits and Lighting should be installed near entrances/exits to provide safety in dark.
- If two entries to a campus are needed, they should be close to each other to allow one individual to monitor both.
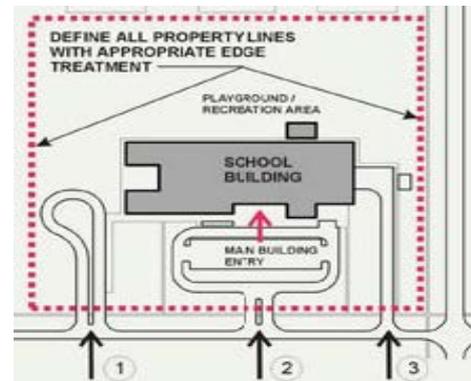


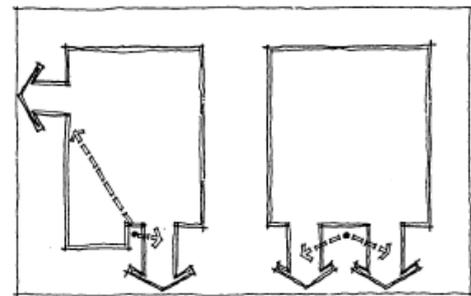**Figure 3.** Entry points for bus, parent drop off and service



**Figure 4.** The position of entries for visual surveillance

### 4.1.3. Vehicular Routes and Parking Areas

- Vehicular routes and parking areas should be in visual proximity to strategic sections of buildings, such as administration and classrooms.
- The vehicular traffic should be locked on one side of the school campus. Vehicular routes should be segregated from pedestrian routes.
- Differentiate and identify parking spaces for students, faculty, staff and visitors.
- Access to parking areas should be restricted to limited number of controlled entrances.
- Long, straight layouts for parking lots, especially for students, should be avoided in order to reduce vehicle speeds and lower risk to pedestrians.

- Accessible parking spaces should be located as close as possible to building entrances.
- Parking spaces for the disabled should never be located at ramped or sloping areas.
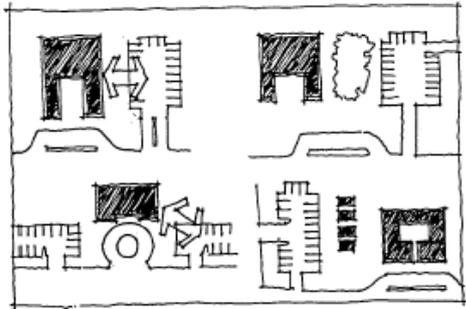- There should be at least two parking space reserved for wheel chair user.
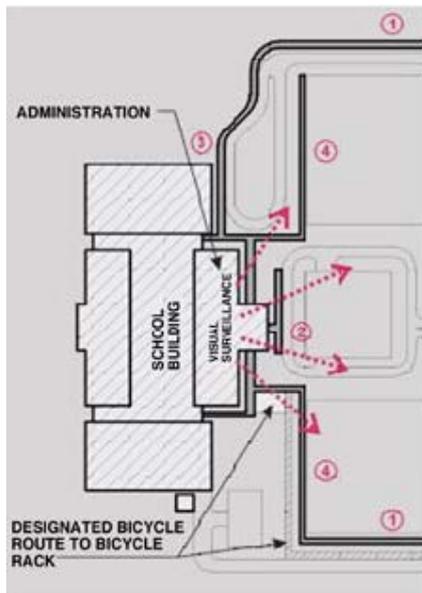


**Figure 5.** Design of a Parking Lot



**Figure 6.** Zoned parking 1) Zoned parking 2) Visitor parking 3) Faculty/staff parking 4) Parent's drop-Off 5) Bus drop-Off
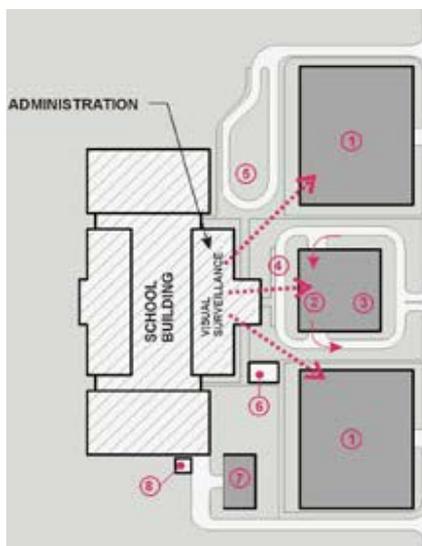


**Figure 7.** Segregation of circulation 1) Pedestrian Entry 2) Path from Parent Drop-Off 3) Path from Bus Drop-Off 4) Path from Zoned Parking

### 4.1.4. External Pedestrian Routes and Canopy

- Routes should be well defined with smooth walking surface and adequately lighted.
- Path from the drop-off areas and routes to entry point need to be wide enough to accommodate peak period of use, thus preventing congestion pushing, fighting and accidents.
- Minimize hiding place along the pedestrian routes.
- Place exterior pedestrian routes so as to maximize surveillance from inside adjacent space.
- Uneven floor and level differences should be avoided.
- Walkways gradient should not be more than 1: 20.
- To allow for the wheelchair user pavement width should be kept minimum 1.2m.
- Tactile flooring shall be made between side walk and main road and paving material should be non-skid, well-marked and anti-glare.
- Provide physical buffer between side walk and vehicular routes.
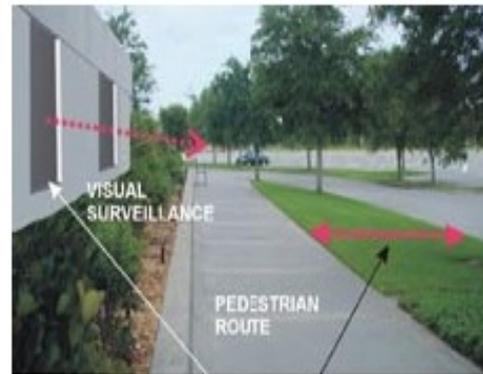- Canopies should be used to provide shaded and dry areas for students.



**Figure 8.** Pedestrian routes with buffer zone

### 4.1.5. Recreational Areas

- Locate recreational areas in visible location whenever possible.
- Provide separate facilities related to recreational areas such as rest room, water fountain and vending areas where applicable.
- Provide multiple enclosures around recreational areas to achieve greater access control.
- Utilize sea through fencing in recreational areas to enhance supervision.
- Avoid blocking line of sight into recreational areas with fencing, signage and landscaping.
- Locate hard courts areas away from the building.
- Protect the window opening located near hard courts with mesh covers that permit light and ventilation as well as emergency ingress and egress.
- To enhance player and spectator safety, safety borders should be provided around basketball courts-a minimum of six feet wide along the sides and eight feet wide on the ends. Walls or protrusions at the ends of courts may require padding, where safety borders are too narrow.
- Playground equipment with sharp edges, rough surfaces, or hazardous projections that may entangle clothing or cause injury should be avoided.
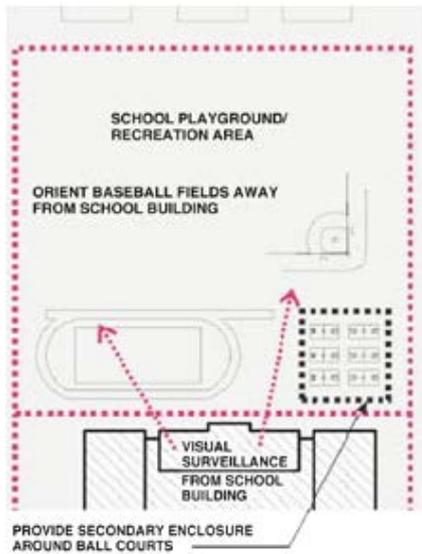
**Figure 9.** Provision of secondary enclosure

### 4.1.6. Signage Systems

- Design signage with large and bold graphics and simple direction.
- Design signage to eliminate spaces that permits concealment.
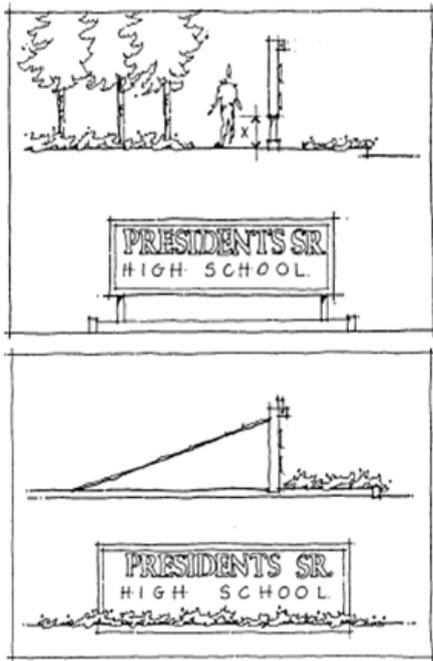- Avoid blocking lines of sight with signage.



**Figure 10.** Signage with large and bold graphics without concealments

### 4.1.7. Landscaping

Landscape design helps to improve the appearance of a space. It adds texture and color and softens harsh building materials and outlines. If used wisely it can also make a positive contribution to accidents and crime prevention.

- Lighter foliage variety should be used to provide visual permeability, while still offering amenity screening.
- Tree species that will resist winds should be selected. Species that could split off in a storm, causing additional hazards, should be avoided.

- Trees should be trimmed up to 2.4 m and shrubs should not be more than 600-750 in height, otherwise they impede normal vision.
- Landscaping should never prevent visual access into school property.
- Trees should be located away from the school building where they can become aids to climbing over boundaries or onto buildings.
- Trees should not obscure lighting.
- Street furniture like bollards, benches, dustbins should be located away from the building edges and boundaries to avoid intrusion.
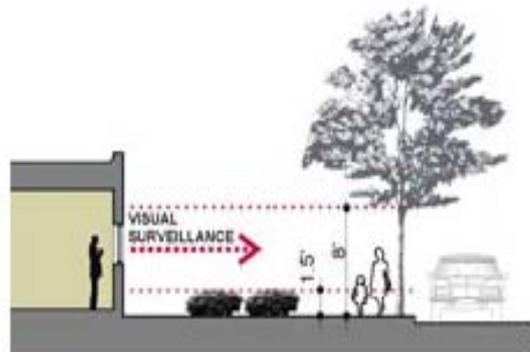- Depth of the water bodies should not be more than 1.0 meter.
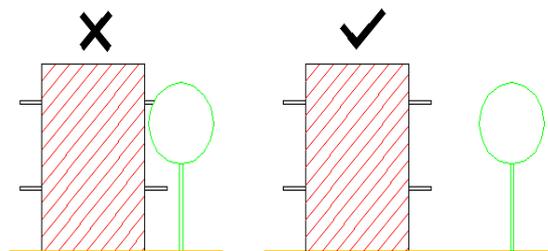


**Figure 11.** The required height of a tree canopy



**Figure 12.** The positioning of the trees with respect to building block

### 4.1.8. The Site Utilities

- All the site utilities should be enclosed and locked properly. The see-through fencing should be provided around site utilities areas for supervision.
- It should not provide any space for hiding.
- Access to site utilities such as electric substation, transformer, A.C. units, switch room and pump room should be restricted.

## 4.2. Building Design

### 4.2.1. The Built Form

If properly designed, the overall organization of a school can enhance the safety authorities' ability to maintain a secure environment and can also discourage vandalism, trespassing, and breaking and entering. The narrow wing of traditional school organization lends themselves to common configurations. 'U' and 'H' shaped buildings result in courtyards protected on three sides. This makes monitoring activity in the courtyard easier and helps provide shade and shelter. These types of organization are also easy to lock and secure.
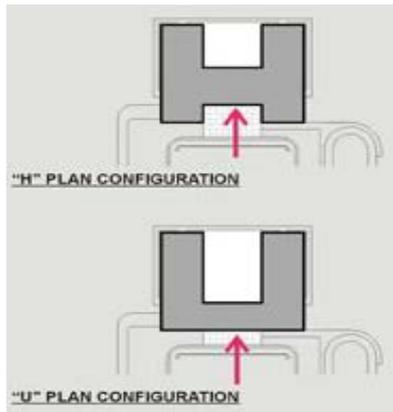
**Figure 13.** U and H shaped buildings helps in monitoring activity

## 4.2.2. Exterior Covered Walkways

Covered walkways provide protection from the rain and sun for primary exterior circulation paths. However, if designed improperly, these structures can provide opportunities for criminal activity, unauthorized access and also causes accidents.

- Design covered walkways to eliminate opportunities for gaining access to roofs, windows, or other upper level areas.
- Apply slippery finishes or coatings to columns.
- Design landscaping and tree placement around covered walkways to eliminate access to roofs, windows, or other upper level areas.
- Avoid blocking lines of sight along exterior covered walkways.
- Exterior covered walkways should also be designed with "T" connections at entries to provide a continuously protected walkway without using niches, which can create hiding places.
- "T" connection at the entries ensure clear surveillance thus avoid any hitting and hide outs.
- Design lighting to reinforce natural surveillance along walkways. Low walls, trees, and planters should be located away from canopies to prevent access on to rooftops and into buildings through upper level windows. Incorporate windows that overlook covered walkways whenever possible.
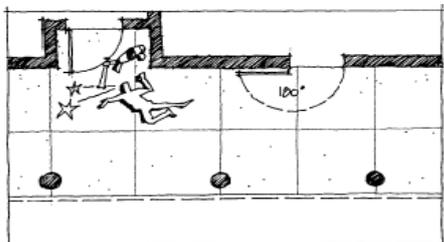


**Figure 14.** Windows to overlook the covered walkways



**Figure 15.** The niches at entry are prone to accidents

## 4.2.3. Points of Entry and Exits to the Buildings

Minimize the number of unmonitored entrances into the building. Design a well defined main entry with signage and rules to direct all visitors to the administration area during school hours.

- Locate main point of entry at the front of the school near the administration area and visitor parking/drop-off area.
- Every entrance/exit within the building shall be such that a wheelchair user can use it with ease.
- All exits shall be free of obstructions.
- Exits shall be clearly visible and the routes to reach the exit shall be clearly marked and sign posted to guide the population of floor concerned.
- Each floor shall have minimum two exits.
- Every room with a capacity of over 45 people shall have at least two doorways.
- Entrances width shall be minimum 90 cm or more.
- The entry overhang should be large enough to shelter a large number of people from the sun and rain. This can prevent heatstroke during the summer as well as wet and slippery ground surfaces during storms.
- Provide covered seating areas at main entry and bus loading area.
- Provide windows and glazed doors at main entry to enhance natural surveillance.
- According to survey data and site visits, secondary entries are a common problem area for school security. Even if properly designed as "exit only" access points, students frequently prop these doors open.
- Secondary entrances should be designed to avoid alcoves and niches.
- Secondary entries should be equipped with alarms to indicate when these doors are open. Secondary entries require careful design to prevent them from becoming dark alcoves where someone can hide.
- Lifts and escalators cannot be considered as exits.
- Exits shall be so located so that the travel distance on the floor shall not exceed 22.50 m. for educational, institutional and hazardous occupancies.
- Points of entry should have adequate illumination with vandal resistant fixtures.
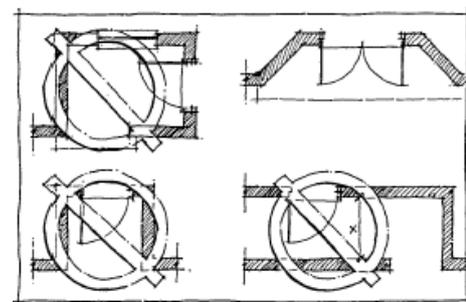


**Figure 16.** Design entries to avoid alcoves and niche

## 4.2.4. Courtyards

The overall organization of the school can create a beneficial enclosure of exterior space. The traditional form of the courtyard school allows for uncomplicated supervision and control. An outdoor circulation arcade

around the courtyard allows one person to oversee activities during class changes.

- Secure and limit entries to courtyards.
- Place main entry to courtyards adjacent to administration or staff/faculty office spaces.
- Design courtyards to eliminate unauthorized after hours access.
- Provide windows with views into courtyards.
- Maintain unobstructed lines of sight across courtyards.
- Seating, planters, and landscaping should be located away from courtyard enclosures to eliminate opportunities for gaining unauthorized access into the courtyard.
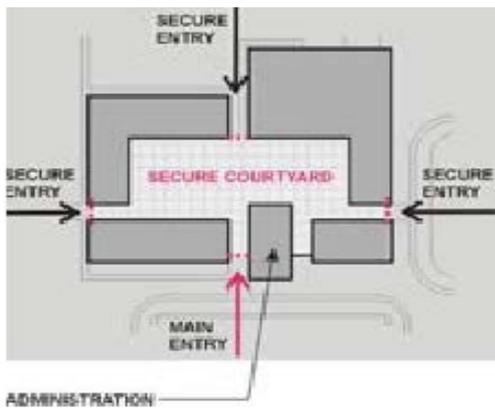- Minimize ambiguous, unowned spaces in courtyards.



**Figure 17.** The proper location of administrative block

### 4.2.5. External Walls

Wall form, texture, and use influence safety concerns. Avoid utilizing walls that undulate or project into small wings, which can create niches and hiding places. When such niches occur, security can be enhanced by incorporating windows that have unobstructed lines of sight into these areas. In addition, these recesses or niches should also be well-lit to enhance safety.

- Design screening walls and architectural features on exterior walls that do not allow footholds or handholds.
- Walls in graffiti prone areas should be made of a durable vandal resistant material or be replaced with see-through fencing, when appropriate, to reduce maintenance and vandalism.
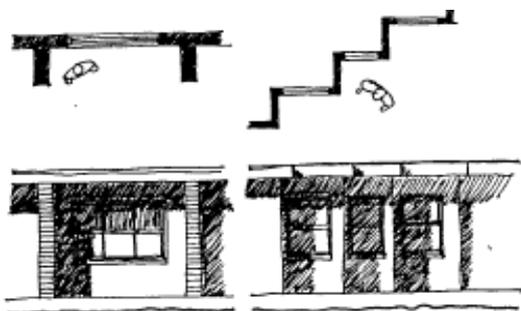


**Figure 18.** Design of an external wall

### 4.2.6. Doors

- Door niches on hallways should be chamfered and wide enough to provide clear lines of sight down hallways.

- Doors which open into corridors must be recessed or protected by wing walls so that no part of the door swings projects into the circulation path by more than seven inches.
- Multiple single doors reduce congestion and are recommended, rather than double doors.
- Incorporate tamper resistant doors and locks.
- Exterior doors should be a minimum of 45 mm thick, preferably of solid core wood.
- Door frame materials should be strong and of steel and door frame should be fixed in concrete block.
- Design classroom doors with locksets that allow the door to be locked from both side and always opened from inside.
- Design doors with view panels or sidelights to increase visibility of adjacent circulation spaces.
- Provide kick plates at classroom, assembly, and circulation doors.
- Doors along main corridors must either be located in a recess or must swing a full 180 degrees; these recesses can be dark and can provide opportunities for hiding. One solution is to chamfer the corners of the recess.
- Door handles shall not be less than 90 cm and more than 100 cm.
- No doorway shall be less than 100cm in width and shall be not less than 200cm in height.
- Doorways for bathrooms, water closet, stores etc. shall be not less than 75cm wide.
- All the main exits doors should open out wards.
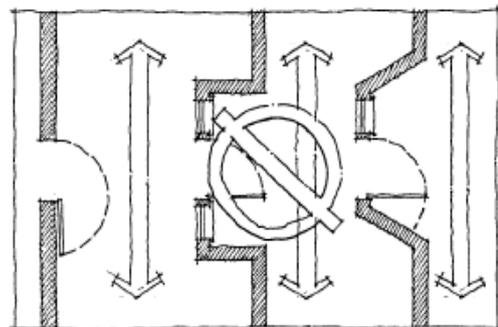


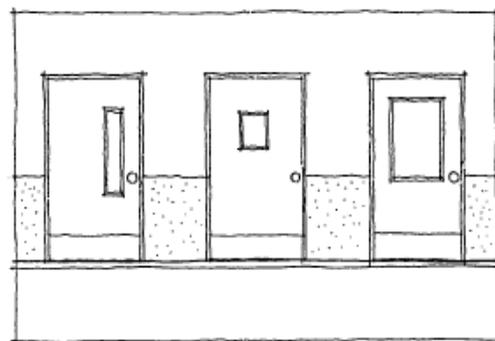**Figure 19.** The opening of door in the corridors



**Figure 20.** The view panels and door sidelites

### 4.2.7. Windows and Grills

- Frame should be of steel.
- Window glass should be fixed from inside rather than outside.

- Grills should have spacing not more than 150mm and it should be of robust and vandal free material and of 8mm thick iron section
- The grill should also be inserted in frame or welded, instead of screwing.
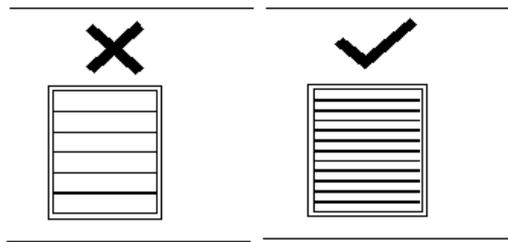


**Figure 21.** The spacing of window grill

### 4.2.8. Roof Design

A key concept for safe school design is to minimize opportunities to gain access to school roofs and into the school from roofs through potential entry points.

- Avoid the use of permanent mounted roof access ladders, short walls adjacent to low canopy roofs, screen walls and columns using decorative block, or other building materials that make climbing up to roofs easy.
- Avoid using building materials or designing architectural elements that provide access to roofs.
- Apply slippery finishes or coatings to exterior pipes and columns.
- Install locks on roof hatches.
- Protect roof equipment from access and vandalism.
- Minimize access through roof skylights.
- Design roof parapets to allow for surveillance from the ground whenever possible.
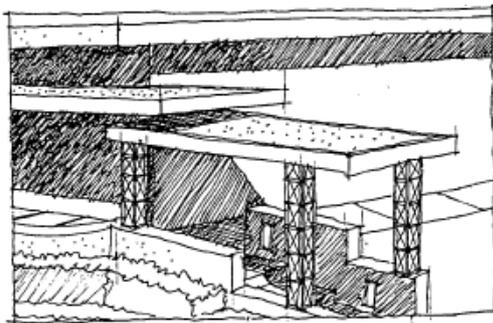- Height of the parapet is not less than 900 mm and spacing of railing not more than 300mm.



**Figure 22.** The roof design for uneasy access

### 4.2.9. Lighting

Lighting should be designed to enhance external security for both people and property, through the provision of adequate continuous illumination during the hours of darkness. Lighting should be such that it maximizes natural surveillance and creates a feeling of security.

- All public areas like parking, streets, parks, internal courts, lifts and stairwell should be well lit to allow surveillance and usage during night hours.
- Special provisions should be made to light entrances, parking space and junctions.
- Light fittings should be robust and vandalism free.

- Street light poles should be away from school building edges to avoid climbing.
- Designing of lighting poles should not provide foot holds and hand holds for climbing.
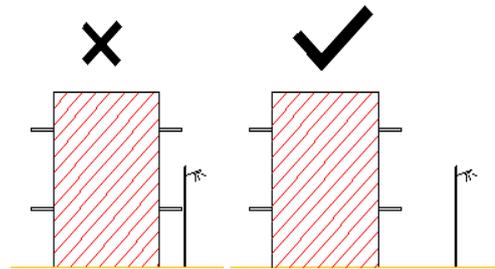- Lighting should not create glare and such that a person can recognize face from 10m.



**Figure 23.** The location of electric poles

## 4.3. Interior Spaces

### 4.3.1. Lobbies and Reception Areas

- To control access and limit intrusion, visitors should be guided to a single control point and required to pass directly through administration reception areas when entering or leaving.
- Lobbies should also be designed to be easily secured after hours and during emergencies.
- Lobbies and reception areas should be located close to administrative areas or desk adjacent to main entry.
- There extensive glazing and windows in lobby area for visual surveillance.
- Provide seating at reception/information areas.
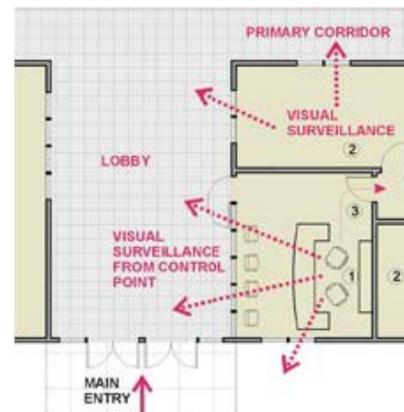


**Figure 24.** The reception and lobby should be properly located for visual surveillance.

### 4.3.2. Administration Area

- Administration areas should be adjacent to main entry areas and designed to allow a visual connection through windows between administrators and students or visitors.
- Incorporating extensive interior glazing in administration areas to provide unobstructed views and natural surveillance.
- Design and locate the administration area to reinforce its role as the guardian of school facility.
- Provide seating at visitor information areas.

**Figure 25.** The administrative area should be adjacent to main entry

### 4.3.3. Corridors

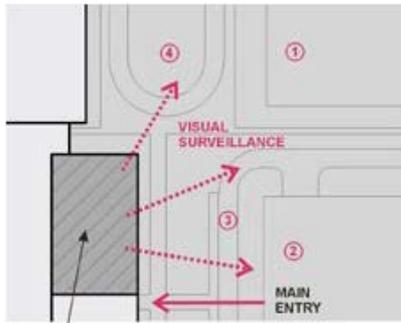Corridors should be carefully designed to accommodate large numbers of students during peak-use hours. Although a minimum corridor width is dictated by code, research has shown that this minimum width may not be sufficient. It is recommended that corridors be designed beyond the minimum width, especially where lockers are located. Corridors should be well-lit and clearly defined without projections that might impede the flow of movement.

- Designs that lead to sudden 90 degree turns should be avoided in corridors.
- Secure exterior doors located along corridors to prevent unauthorized access into the building.
- Incorporate interior glazing where possible to avoid long corridors with dead walls that block off natural surveillance. Minimize hiding places and blind corners in corridors.
- Recess lockers to eliminate hiding places.
- Corridors shall have a min. width of 1.2m. The width should be increased at critical junctions.
- Railing at 80 cm height should be provided in corridors.
- A space not less than 1.5 sqm shall be provided at every dead end.
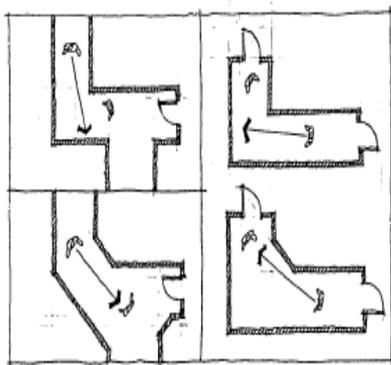- It should have the same level and slip resistant surface.



**Figure 26.** The design options for a corridor junction

### 4.3.4. Ramps

- Handrails should be provided preferably to each side of the ramp.
- A level platform of minimum length 1.5 m should be provided at the top of the ramp.
- Width of the ramp should be at least 1.2m to enable a wheelchair to turn preferably at least 1.5m to allow two wheelchairs to pass.

- Handrail should extend a minimum 45cm beyond top and bottom of ramp. The maximum gradient should be 1: 12The hand rails should have bright contrasting Colour to surroundings for convenience of blinds.
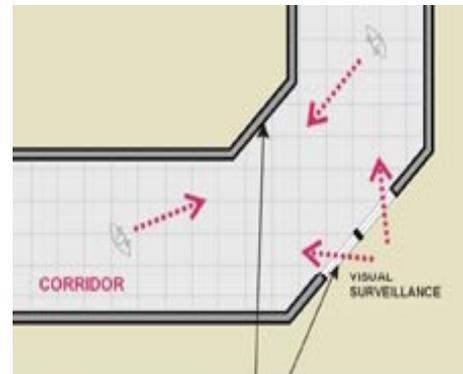


**Figure 27.** The corners should be chamfered to mitigate blind corners

### 4.3.5. Staircase and Stairwell

- Stair case should be located in highly viewing areas.
- Minimum stair width should be 1.5 meters.
- Riser should be reduced to 15 cm and treads should be reduced 30 cm.
- Height of the railing 900 and spacing 300 cm.
- Enclosed staircase should be avoided.
- Enclose entire area under all stairs.
- Stairs should be well lighted.
- Enclosed stairwells should have electronic surveillance.
- Stair handrails should be constructed so as to provide visual access from either side of the stairs. (Solid handrails can provide hiding places on stairs and landings.).
- Handrails should be designed to discourage sliding on them and horizontal rails should incorporate vertical supports that discourage climbing.
- Stairs should have handrail on both sides.
- Tactile flooring should be provided at the meeting edge of stairs and corridor
- Colour of the tread should be in contrast with the colour of the riser.



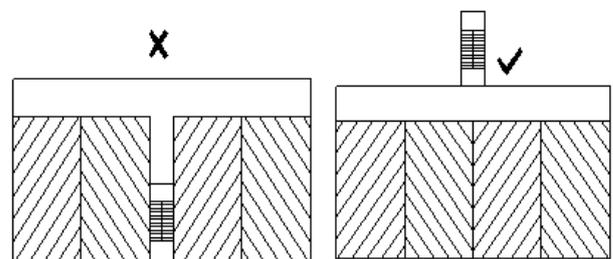**Figure 28.** The correct positioning of staircase in the building block

### 4.3.6. Toilets

- Toilet entrances should be located in places where natural surveillance can occur such as primary corridors and administration areas. They should be highly visible from recreational areas.
- Large-event toilet rooms should provide secondary access and should remain locked or should be reduced in size during normal school operation.

- Mirrors, windows, and light covers in toilet and locker rooms should be impact resistant.
- Toilet room hand dryers, vending equipment, and trash containers should be heavy duty, recessed, fire resistant, and lockable.
- Toilet room walls, floors, and ceilings should have a durable finish to withstand repeated cleaning of graffiti.
- In principal, 2% or more of toilet stall on each storey of toilet building should be toilet stall for wheelchair user.
- All water supply and drainage lines should be concealed to avoid the accidents.
- To prevent a client's being trapped upon becoming incapacitated in a toilet, toilet room doors in health rooms should swing outward into the main room.
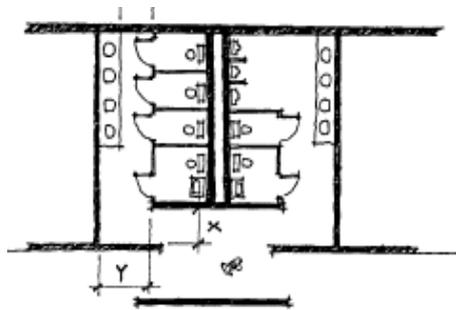- The floor should be non-slippery and there should be no obstacles for turning, or access to the seat.



**Figure 29.** The design of typical layout of a toilet block

### 4.3.7. Classrooms

Classrooms are a common location on school campuses for fighting, theft, and disorderly conduct. Therefore, it is important to design classrooms for easy monitoring and unobstructed visual supervision. Designs should include windows and glazing between hallways and classrooms to help increase surveillance.

- Provide extensive exterior windows from classrooms to enhance surveillance of school campus.
- Provide interior windows and glazing between the classroom and the corridors to promote surveillance both into and out of the classroom.
- Classrooms should be organized for easy monitoring by staff. Visual access to the corridor, and to the building's exterior, is desirable.
- There should be at least two exits in each classroom.

### 4.3.8. Labs and Computer Rooms

Clear organization and unobstructed surveillance of work spaces is essential in the design of rooms where special equipment is being used. Since theft is a primary security issue associated with labs, shops, and computer rooms, faculty and staff should have direct visual access to workrooms and entries.

- Locate labs, shops, and computer rooms with minimal direct access from the exterior whenever possible.
- Entry and workstation should be visible from staff/Faculty chamber.
- Provide a lockable room for storing equipment and supplies.
- To maximize security and minimize theft, rooms with computers and other costly equipment should have a limited number of windows.
- Fire extinguishers should be located in all laboratory areas.
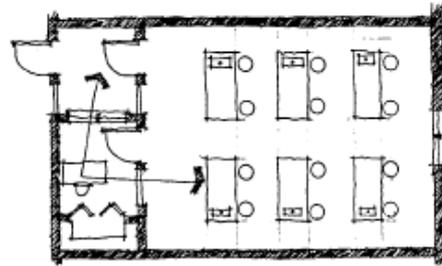- Chemistry lab should be located on ground floor.



**Figure 30.** Direct visual access and surveillance required in laboratories

### 4.3.9. Libraries and Media Center

- Locate circulation desk or reception area near the main entrance.
- Maintain unobstructed lines of sight throughout library/media center.
- A control point at the main entrance should have unobstructed surveillance of entire library/media center.
- Design a separate lockable area for audio-visual and computer equipment to control access.
- Low stacks that are well spaced and placed parallel to the circulation librarian's line of sight will aid in visual control as well as reduce hiding places.
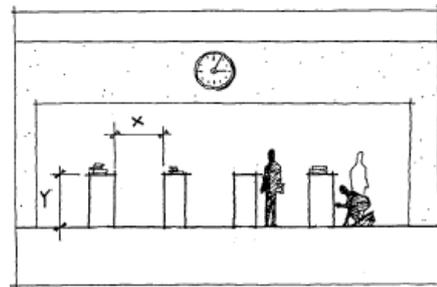


**Figure 31.** Direct visual access and surveillance is required in a library

### 4.3.10. Music Room

- Entrances to the music room should be able to be easily secured and located in a highly visible area.
- Provide unobstructed view of entrances to music room for access control.
- Isolation of the music room on campus may be avoided.
- Provide a lockable room for equipment and supplies.
- Mirrors in dance classrooms should be shatterproof.
- Dance classrooms should utilize suspended wooden floors or floor covering systems, which provide adequate resilient surfaces.
- Storage units, built-in furniture, or similar accessories associated with music and band practice areas should not create places to hide or obstruct surveillance of any portion of the room.

### 4.3.11. Cafeterias

Cafeterias have been cited by educators and school resource officers as the primary location on school

campuses for fighting. Overly cramped and crowded designs can irritate and frustrate students. Because large groups of students move in and out of cafeterias at the same time, it is critical to design circulation patterns that eliminate traffic-flow problems.

- Locate a well-defined control point near main entrance of cafeteria.
- Design kitchen and serving area so that they can be secured both during and after school hours.
- The control point at the main entrance should have unobstructed surveillance of entire cafeteria.
- Design cafeteria to eliminate traffic-flow conflicts and overcrowding. One entry and exit door avoids overcrowding and promote efficient traffic flow in cafeterias by providing ample space between serving counters and between dining tables.
- Since cafeteria restrooms may be used after hours, they should be designed to prevent unauthorized access into other areas of the school building.

### 4.3.12. Auditoriums

Like any large school assembly area, auditoriums should provide clear sight lines and easy traffic flow. Niches along walls should be eliminated, and if the auditorium is subdivided for dual use as classrooms, the partitions should fully recess into the wall.

- To eliminate the potential for accidental falls, orchestra pits should be avoided. Several rows of removable seats at the front of an auditorium should be considered as an alternative.
- To eliminate potentially serious injuries from falls, fly lofts or working stages are discouraged.
- Large assembly areas, such as auditoriums, should provide clear sight lines and easy traffic flow.
- While stage curtains can be left open to allow visual surveillance, electrical and lighting controls should be located in a locked panel or room.
- Locate roof openings as far away as possible from catwalks, platforms, and scaffolding to prevent access from roof into auditorium.
- Provide a secure area for controls, equipment, props, and tools.
- Limit and control student access to catwalks, scaffolding, and upper level platforms.
- Design auditoriums to eliminate traffic flow conflicts.

## 4.4. Maintenance and Material

This is related to the neighborhood's sense of 'pride of place' and territorial reinforcement. The more dilapidated an area, the more likely it is to attract unwanted activities. The maintenance and the 'image' of an area can have a major impact on whether it will become targeted. Maintenance starts with the selection of material and finishes. The selection of materials and finishes will impact on the types of maintenance regimes that can be sustained over time.

### 4.4.1. Facade Material

- Permanent exterior finish with rough texture avoids graffiti.
- Natural and permanent finishes are easy to maintain,

merges with surroundings and controls graffiti.

### 4.4.2. Pathways

- Use hardy, easily replaced and standard size materials.
- Avoid removable materials such as paving bricks.

## 4.5. System and Electronic Equipment

### 4.5.1. Elevators

- Locate elevator adjacent to main circulation where they can be observed.
- Provide the electronic surveillance with in elevators cab when possible.
- Provide vandal resistance convex mirror in elevator cabs.
- Elevator's lobby should be well lit to enhance surveillance and security.

### 4.5.2. HVAC and Mechanical Equipment

- Locate HVAC/mechanical equipment in a secured area, accessible to authorized person.
- Provide lockable enclosures for equipment.
- Locate these structures in areas where general site lighting is used will make the night time surveillance easier.
- Spacing of vent slots should not allow persons to reach in or to pass objects through them, potentially causing damage to exhaust fans.

### 4.5.3. Water Fountain

- There should be at least one accessible fountain per floor for wheel chair user.
- Locate water fountain near group toilet in areas with natural surveillance.
- Utilize wall hung type of water fountain to prevent vandalism when possible.

### 4.5.4. Controls

- Electric controls should be in the zone 900mm to 1200mm from the floor for the disabled.
- The height of window controls for operation should be maximum 1200mm from the floor.

### 4.5.5. Fire Fighting System

- Overhead tanks.
- Static storage tank.
- Fire hydrants.
- Portable fire extinguisher. Hose reel.
- Automatic sprinkler system.

### 4.5.6. Technology

Advances in security technology have allowed us to provide and enhanced the level of protection in our residential environment.

- Electronic equipment like CCTV etc. should be used to keep a vigil on strangers.
- Alarm working with backup power should be installed between neighbors, to communicate in case of danger.
- Card access system should be used to take the entry in a school campus.

# 5. Conclusion

This paper studies the fact that the design of the built environment has the capacity to influence behavior either positively or negatively. Architects can use the defensible space concepts of territorial control, access control and surveillance, among other methods, to enforce behaviour that can counter crime. The design and layout of spaces and the physical arrangement of site and building elements is the key to influencing behaviour for crime prevention. The goal of the architect should be to design secure and safe buildings. This can only be carried out effectively if the architect has knowledge of crime prevention design concepts, theories and principles, the basic technology and types of crime prevention systems and the process involved in integrating security and design to influence behaviour [10]. We must bear in mind that if planning is about making places better for people, then it has to address those elements that make places problematic for people, and crime and the fear of crime are high up in this list [11]. There are no school safety measures that are hundred percent reliable. Some safety and security incidents can still occur in spite of any and all precautions. However, while no school can assure school safety, there are many opportunities to significantly enhance school safety, security, climate, culture and emergency preparedness and thus reduce the opportunity for the risk of crime and accidents through thoughtful planning and design. With these concepts in mind, we must always remember that schools are not courthouses, airports, or corporate buildings. To enhance safety and security, a school should visibly and distinctly give the appearance of a place of learning, even after safety and security measures are implemented. The concepts that work in other settings or other built forms might fail to improve security in schools or even reduce the level of security.

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