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Examining GITAM (Deemed to be University), Hyderabad Campus for Crime Prevention through Environmental Design Measures: A Foundation Towards a Safe CPTED Exterior Campus Model

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Abstract

In the present scenario, Campus violence in India is a significant public health issue that needs to be adopted. It affects the user groups physically and psychologically. On 6th February 2020, during the annual cultural fest of Gargi College in New Delhi, a group of men entered the campus and created violence (molestation) on a massive scale. Probable reasons investigated were lack of security, political issues, signal jammers placed on campus, etc. The paper attempts to highlight various frequently emerging problems occurring on various campuses and, as an architect, what has to be adopted while planning for spaces on campuses to prevent crime or violence through environmental designing in the future is explained. These are achieved by choosing the GITAM Hyderabad campus for examining and primarily conducting surveys based on users' perceptions during day and night times, along with the author's analysis of different spaces in the campus, thereby obtaining secondary data from published papers and finally, formulating findings from the best practices to prevent crime for future safe exterior campus model. The scope for future research would be a detailed study of interior campus CPTED measures. The result of this paper has important implications for any college

authorities in India to find practical solutions and plan student-friendly frameworks to prevent violence on a macro level on campuses.

Keywords: Safety, Natural surveillance, Crime, Lighting.

1. Introduction

GITAM (Deemed to University), is a private educational institute in Hyderabad, designed over 230 acres, located 1.8 kilometers from Mumbai highway, with around five thousand students and more than five hundred staff members. Students' safety and security problems have always been a challenge in the university environment. The reason for selecting GITAM to examine the base model is that significant issues have not yet arisen. The paper aims to propose preventive measures that can be adopted to avoid facing issues similar to those that occurred at Gargi College in the near future. Eventually, campuses have higher traffic than residential or commercial buildings. For a place to feel safer, broad interdisciplinary and interprofessional planning is required. Crime prevention through environmental design is a strategy that adopts appropriate landscape designing, fencing, lighting, building positioning, and planning to reduce criminal activity without active measures (Shariati & Guerette, 2019). CPTED is a cost-effective method that comprises four main principles: Natural surveillance, access control, territorial reinforcement, and space management or maintenance. Elements of CPTED Principles are depicted (Figure 1).

Territoriality	Natural Surveillance	Access control	Maintenance
Symbolic barriers	Placement of windows	Mechanical Access control	Routine maintenance
Real barriers	Design of street	Locks	Graffiti
Private parking	Location of entrances	Strong Windows	Vandalism
Sidewalks	Physical design	Entry Guards	Broken windows
Signs	Clear Sightlines	Number of entrances	Physical design
Landscaping	CCTV	Visibility of entrances	Street lighting
	Street lighting	Physical barriers	Baskets
	Guards		Landscape

Figure 1. Elements of CPTED Principles

The most essential aspects that commonly cause problems on a macro level on campuses are:

- Lack of structured and secured parking facilities
- Poor fencing, landscape, and lighting
- Multiple entrances during the day
- Reception area far from the main entrances
- Many independent buildings
- Isolated buildings/Occasionally used spaces etc.

1.1. CPTED principles

1.1.1. Natural surveillance: People can see what others are doing, thereby minimizing the would-be offenders from committing crimes. Examples: Security grilles and doors, Effective lighting and windows, street designing, Proper landscaping, CCTV monitoring etc. (Figure 2)

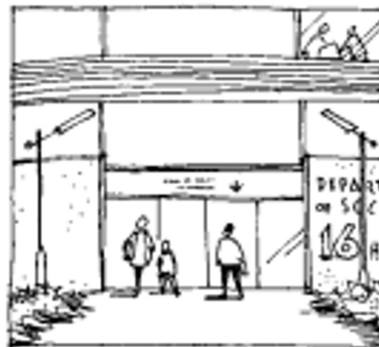


Figure 2. Clear sightlines for natural surveillance

1.1.1.1. Access control: Helps in denying targeted access. Examples: Bollards, fencing designing, Alarm systems, gates, etc. (Figure 3)



Figure 3. (left) Controlled access (right) clear sight lines on site

1.1.1.1.1. Territorial reinforcement: Explains transition of zones i.e. public, private, semi-private and private spaces for enhancing security. It sends a message of ownership. Example: Vegetation, fencing, decorative elements, water features,

signage etc. (Figure 4)



Figure 4. Clear identification of spaces

1.1.1.1.1. Maintenance: A well-maintained area attracts people and creates a sense of safety and security. Examples: vandal-proof and antiskid materials, Street lighting, removal of graffiti, etc. (Figure 5)

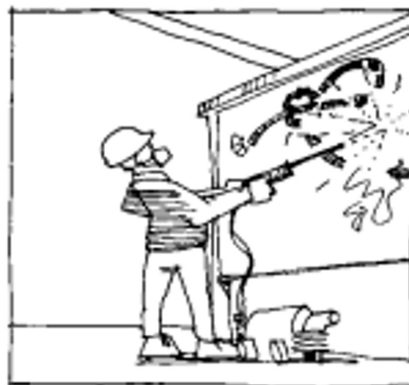


Figure 5. Removing graffiti

1.2. CPTED Design Considerations

1.2.1. Entrances: Entrances that are not visible from the public domain can provide opportunities for felons to hide or create violence. a.) Entrances should be at prominent positions b.) Proper directional signage to be provided c.) Minimize the number of entry points and provide higher security checks d.) Natural surveillance must be provided from streets e.) Avoid blank walls fronting streets f.) Offices should be planned to face the street activities g.) Security through RFID Card access into entries post working hours. (Figures 6,7)

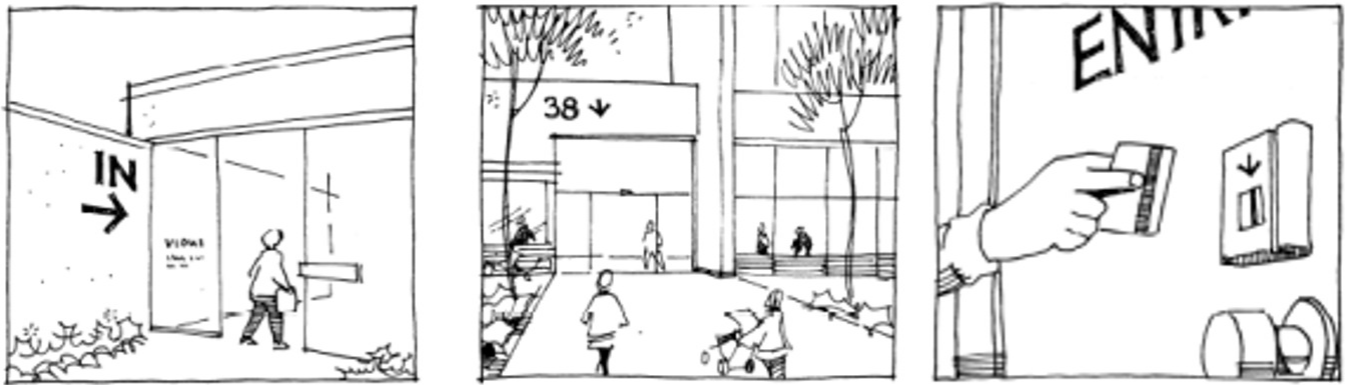


Figure 6. (left) Clear entrance visibility, (right) security access card at entries



Figure 7. Minimized entry points

1.2.1.1. Lighting: Pedestrian pathways, laneways, and access routes should be lit in accordance with the national lighting code (SP72: 2010) for adequate exterior illumination levels. Lighting should have a wide beam of illumination, which reaches the beam of the next light. Lighting should be designed to recognize the faces of passersby. Lighting should be vandal-tough. Illuminate possible places for intruders to hide. A face should be identifiable from 15m. Energy-efficient lights are to be adopted to save energy. (Figure 8)

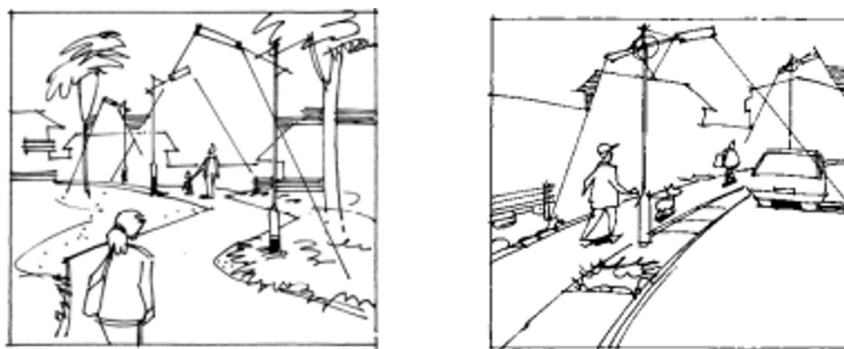


Figure 8. (left) well-lit pedestrian pathways (right) appropriate lighting over footpath and street

1.2.1.1.1. Fencing: If fencing is too high, natural surveillance of streets becomes difficult, this, in turn, can have larger chances of committing crime. Front fences should not be higher than 1.2m. A higher fence is acceptable if made of open materials example, wrought iron etc. If noise insulation is required at the building level, use double-glazed glass rather than a high solid fence (Figure 9).

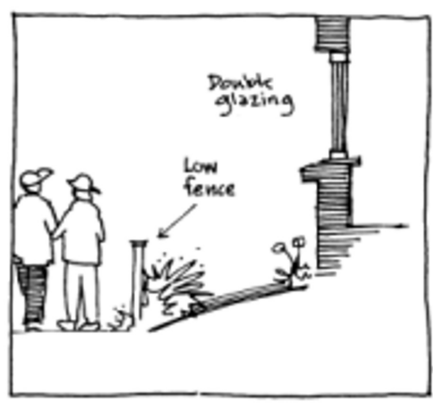


Figure 9. Double glazing at the building level to allow surveillance

1.2.1.1.1.1. Landscaping: Trees and shrubs inappropriately located can reduce natural surveillance and can form entrapment spots. Avoid medium-height vegetation with thick cylindrical foliage. Plants with low hedges and high canopied trees with clean trunks are suitable for natural surveillance. Avoid vegetation screening for public toilets. Use green screens to minimize graffiti (Figure 10).

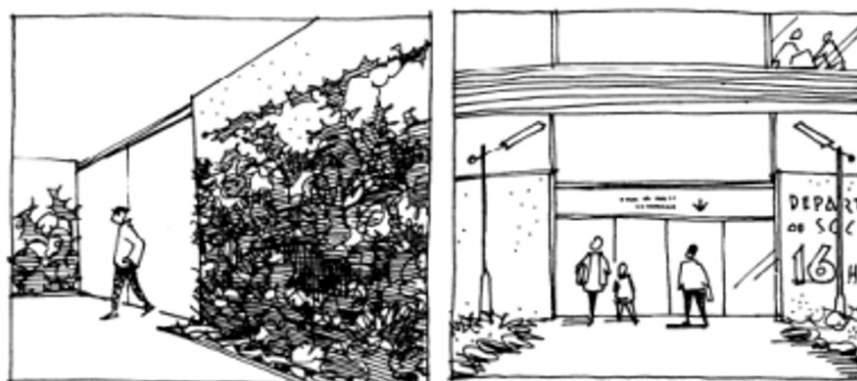


Figure 10. (left) green screen to minimize graffiti (right) clear building entrance with unobstructed vegetation

1.2.1.1.1.1.1. Car parking: Lighting and signage can make parking areas safer. Avoid pedestrian and vehicular movement conflicts. Passive surveillance is to be made possible. Car parks minimize dark areas through proper lighting. Large car parks to adopt telephones, emergency alarms, or intercoms. Appropriate signage at parking is to be adopted. All surfaces at the parking level are to be in light colors to reflect as much light as possible. All entrapment points to be avoided such

as blind corners, under stairs, wide columns etc. adequate lighting and mirrors to be provided where design features are unavoidable (Figure 11).

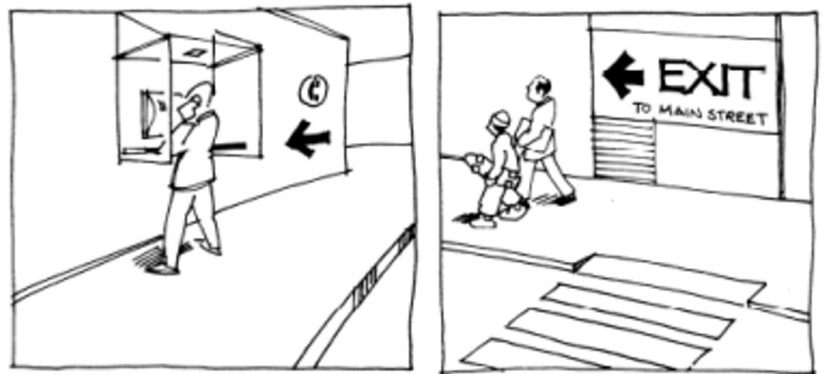


Figure 11. (left) phone within the car park (right) proper signage at the parking

1.2.1.1.1.1.1. Public areas: Playgrounds, car parking, or any open spaces should have natural surveillance from building windows. Communal areas like garbage bays to be well-lit and monitored. Elevators or stairwells are to be provided with open style or transparent over doors or walls. Waiting areas need to be visible from building entries. Seating spaces are to be designed to have natural surveillance (Figures 12,13).

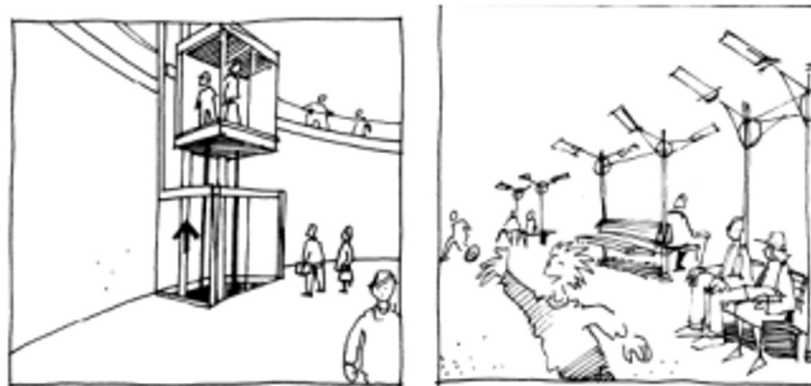


Figure 12. (left) transparent elevators (right) seating under natural surveillance zones

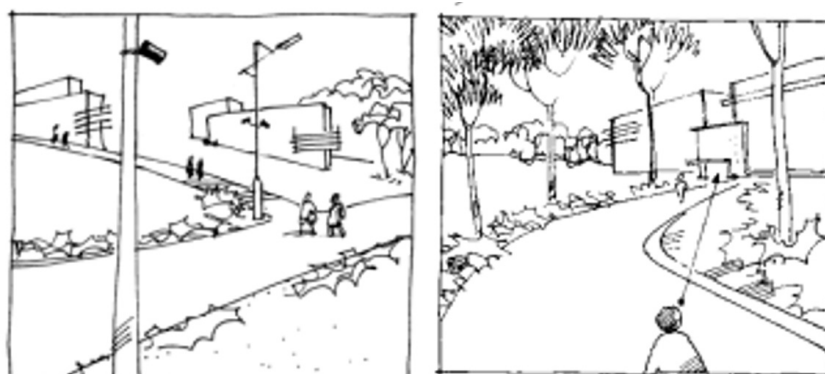


Figure 13. (left) CCTV's fit to street lights (right) clear sight lines (Tod Schneider et al.,

2000)

1.2.1.1.1.1.1.1.1. Blind corners: Pathways should be direct and straight. Installation of convex mirrors to allow users to see ahead at corners. Installation of glass panels in the stairwell is advisable. If entrapment spots are unavoidable, need to be well-lit or closed after hours. Avoid seating near ATMs, phone boxes, toilets, corridors, and isolated locations (Figures 14, 15).

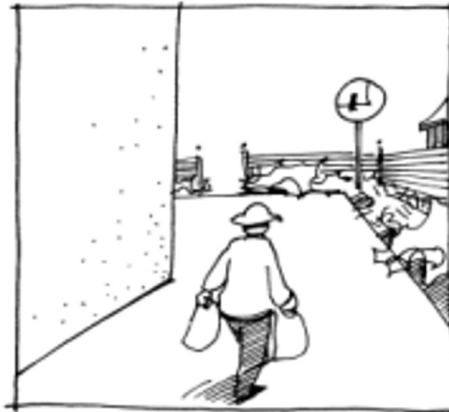


Figure 14. Mirrors installed at corners (Tod Schneider et al., 2000)

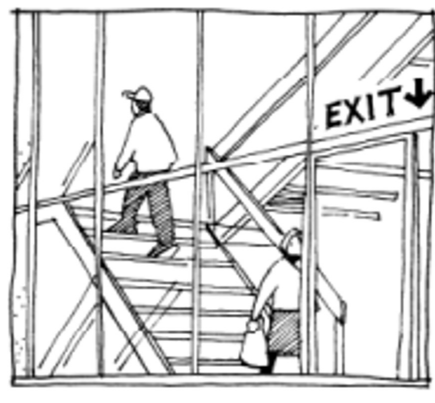


Figure 15. Glass panels at the stairwell for visibility (Tod Schneider et al., 2000)

1.3. Other Design Considerations

- Windows are critical for natural surveillance. Filmed glass, laminated glass-clad polycarbonates can be used.
- Swipe cards, intercoms for common announcements in public spaces, portable panic buttons etc., which help in tracking.
- Maintain lighting levels as per the SP72:2010 Lighting code (Figure 16).

Table 1 Recommended Values of Illuminance and Uniformity Ratio for Security Lighting
(Clauses 5 and 6)

Application	Risk Classification	Maintained average horizontal illuminance (lux)	Uniformity ratio E_{min}/E_{av}
Isolated remote strips	Low risk	5	0.15
	Medium risk	10	0.25
	High risk	20	0.25
Close-in strips	Low risk	10	0.25
	Medium risk	20	0.25
	High risk	50	0.30
Waterfront strips	Low risk	10	0.25
	Medium risk	20	0.25
	High risk	50	0.30
Storage zones	Low risk	5	0.15
	Medium risk	10	0.25
	High risk	20	0.25
Entrance zones	All	50	0.30
Traffic zones			
a) Walking	All	5	0.15
b) Traffic	All	10	0.25
Special security fences	High risk	50	0.30

Figure 16. Lighting levels as per SP 72: 2010

- Buildings with U, O and H profiles result in courtyards protected on three or four sides.
- Hidden alcoves or entrances serve as concealed areas for criminal activity. To improve visibility, chamfered corners are to be adopted (Figure 17).

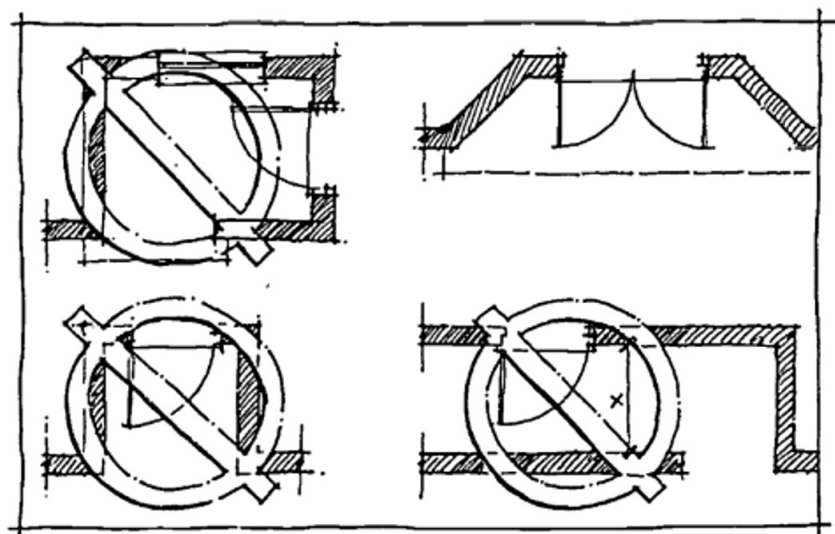


Figure 17. Chamfered corners for increased visibility (Tod Schneider et al., 2000)

- The courtyard can be used for play activities or as a seating zone (Figure 18).

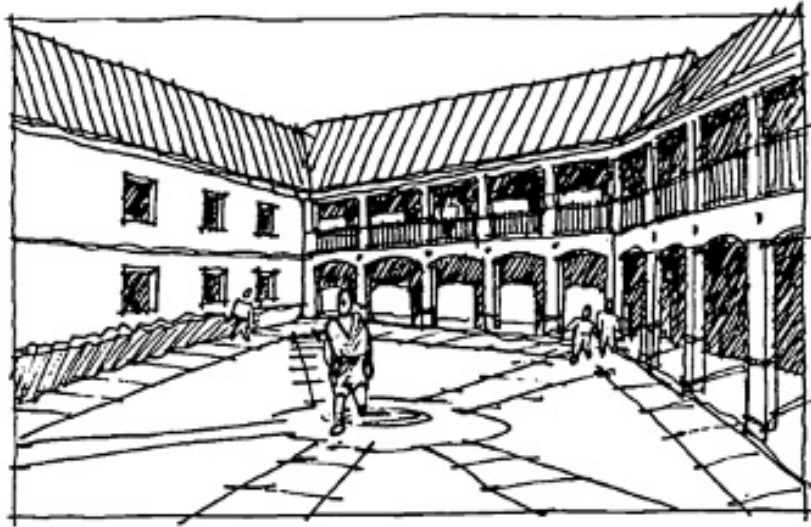


Figure 18. Courtyard (Tod Schneider et al., 2000)

- Reception areas need to be purposefully designed to aid visual supervision of entries, stairs and hallways (Figures 19, 20).

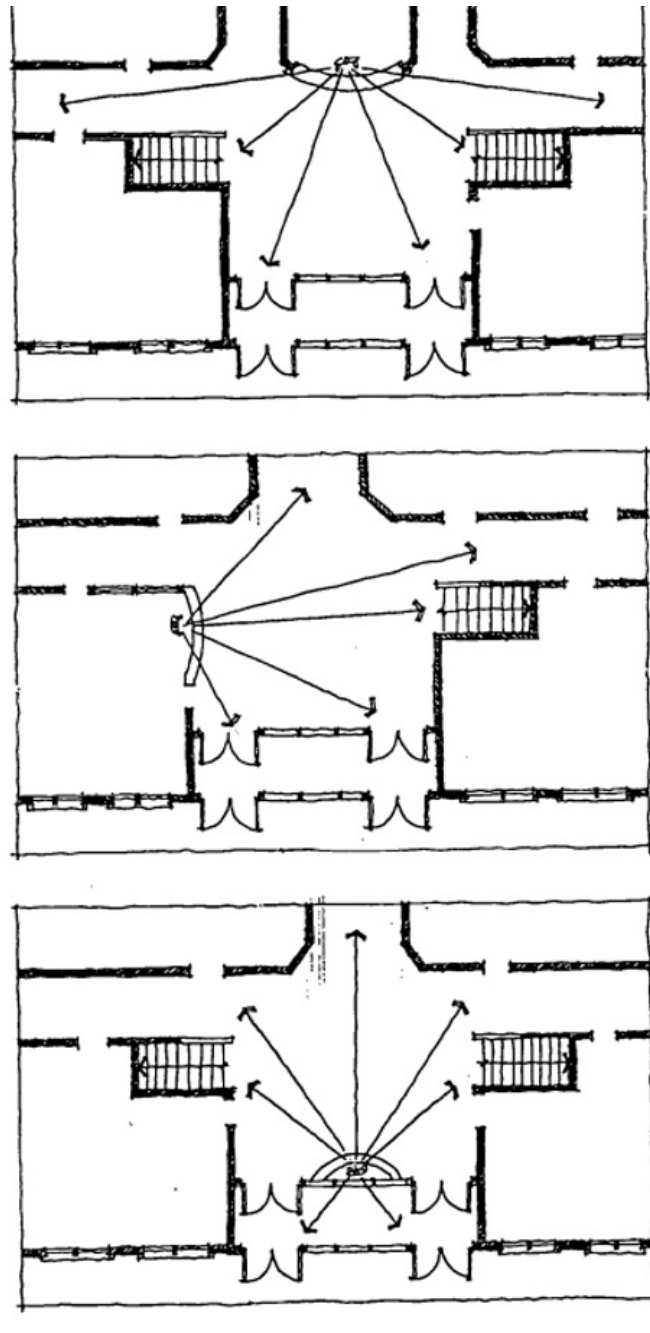


Figure 19. Impact of placement of reception desk location improving natural surveillance (Tod Schneider et al., 2000)

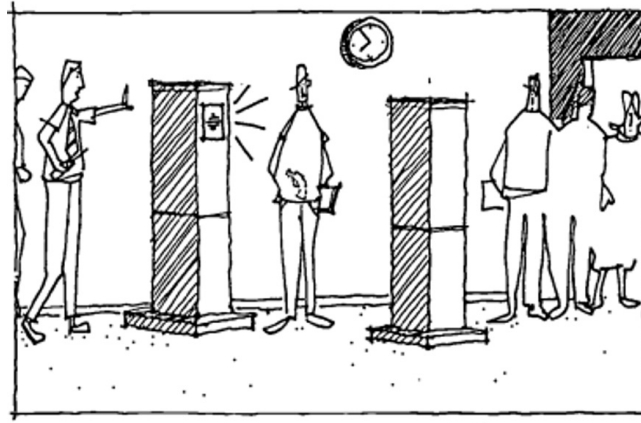


Figure 20. Metal detectors at entrances (Tod Schneider et al., 2000)

- Place K-rated planters and bollards for safety purposes and aesthetics.

2. Methods

- **Step 1** – Two types of survey questionnaires are created for study using parameters from CPTED qualitatively and quantitatively online and offline for different user groups. The measures for assessing each parameter are listed. The data was entered through a 5-point Likert scale, with 1- strongly disagree (0%), 2-disagree (25%), 3-neither agree nor disagree (50%), 4- agree (75%), and 5- strongly agree (100%). Lux levels at critical areas have been calculated during nighttime using the lux meter app. The average value is considered to analyze spaces toward safety for obtaining optimum CPTED solutions. Students were asked to mark any four unsafe locations.
- **Step 2** – Photos of exterior spaces have been shot during day and night times to support the research base.
- **Step 3**- Analyzing the loopholes in terms of safety and security
- **Step 4**- Recommendations for exterior safe campus model.

3. Results

	Respondent 1	Respondent 2	Respondent 3	Respondent 4	Respondent 5	Average
What are your gut reactions to this place?	100%	75%	50%	0%	-	75%
How comfortable do you feel being on the campus?	100%	100%	50%	50%	75%	75%
Does the campus lighting evenly illuminate the area?	100%	100%	100%	100%	100%	100%
Do trees/bushes obscure lighting?	100%	75%	100%	100%	100%	95%
Are you able to identify any face 25 meters away?	100%	50%	0%	0%	0%	75%
Does lighting illuminate direction signs or maps?	0%	0%	50%	50%	100%	67%
Are there any signages? If so, do they show how to seek emergency assistance?	0%	0%	0%	0%	100%	100%
Are there any hiding spaces? Does landscaping block sightlines?	100%	0%	100%	100%		100%
Is it easy to predict when will people be around?	100%	100%	0%	100%	100%	100%
How far is the nearest person to call for help?	0%	25%	100%	100%	25%	62.5%
Is the area designed for natural surveillance?	100%	100%	100%	100%	0%	100%
How easy would it be for an offender to disappear?	25%	25%	100%			75%
Is there more than one exit?	100%	100%	0%	0%	100%	100%
Are there any activities after college timings? If so, do these levels provide passive surveillance?	0%	100%	0%	0%	100%	100%
Does the place feel cared for?	0%	100%	0%	0%	50%	75%
Is the site clearly defined? Is there any definition between public and private space?	0%	0%	100%	100%	100%	100%

{LEGEND: Strongly agree- 100%, agree- 75%, neutral- 50%, disagree- 25%, strongly disagree- 0%}

	Respondent 1	Respondent 2	Respondent 3	Average
1. I feel safe while walking to and from my vehicle on the parking ramp	0%	75%	100%	88%
2. I think it's possible for offenders to hide in the parking area	100%	0%	0%	100%
3. I think it's possible for offenders to hide within the landscape	100%	0%	0%	100%
4. The parking ramp is well-lit	0%	25%	0%	25%
5. I feel safe using stairs anytime	0%	100%	50%	75%
6. I feel safe using elevators.	0%	100%	100%	100%
7. I feel that my car may be vandalized anytime	100%	100%	75%	92%
8. My car or bike has been vandalized before	100%	0%	0%	100%
9. I park in the parking space due to:	NA	NA	NA	
Safety proximity Weather protection Only parking available				
10. If you were being threatened, do you think other people would notice you?	0%	100%	75%	88%
11. Do you think people would assist you if they noticed a crime taking place	0%	50%	0%	50%
12. Are properties protected with security systems?	50%	25%	25%	33%
13. Are security systems functioning and are people aware of them?	0%	25%	50%	38%
14. Is the campus free from places where criminals could hide?	0%	75%	75%	75%
15. Is the campus clean from rubbish/graffiti?	50%	100%	50%	66%
16. Is the area free from nuisance activities	0%	100%	75%	88%
17. I worry about my personal safety on campus	0%	0%	25%	25%
18. I feel safe going anywhere around campus in the dark/daytime	0%	100%	75%	88%
19. Is wayfinding easy on the campus?	0%	25%	0%	25%

{LEGEND: Strongly agree- 100%, agree- 75%, neutral- 50%, disagree- 25%, strongly disagree- 0%}

Campus during day and night times:



Figure 21. Visibility behind canteens



Figure 22. 25 lux in front of the central library

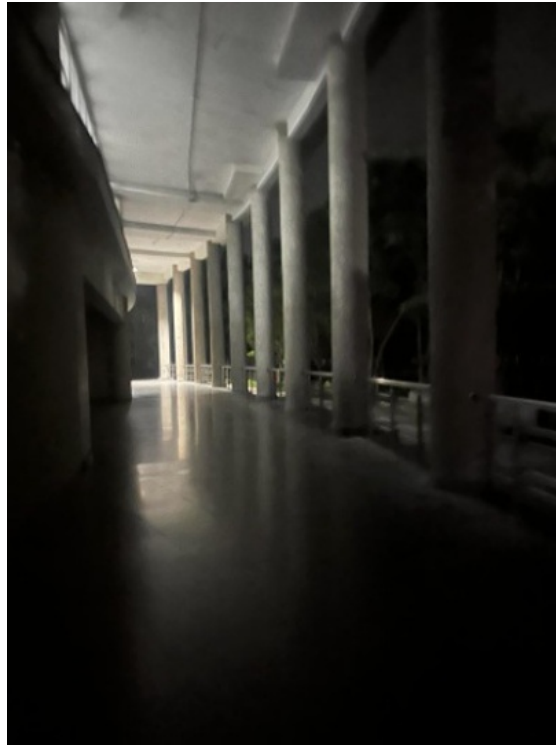


Figure 23. Walkway on the ground floor



Figure 24. Ramp area leading to an open courtyard, a shade above basement parking (left-nighttime, right-daytime)



Figure 25. Road leading to blocks, canteens and main road off campus

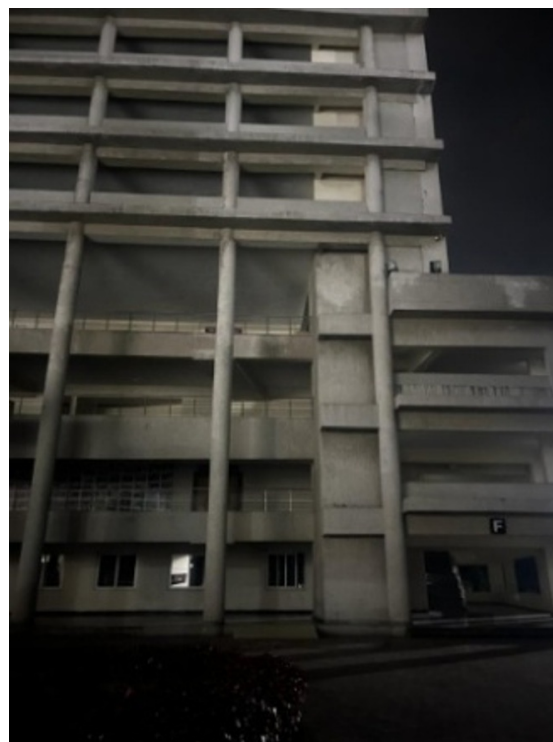


Figure 26. F Block at night been lit from the opposite block and side light



Figure 27. Darkness in landscape zone



Figure 28. Zero to Seven lux at Road between A block, ATM, canteens and main road off campus



Figure 29. Zero lux behind canteens



Figure 30. Space between canteens



Figure 31. Seven lux below light till 25'-30' diameter coverage on the Road leading to the block and canteens



Figure 32. Road leading to parking with zero lux(left), same area(daytime)



Figure 33. Wire mesh fencing edged by tall trees



Figure 34. Open spandrel space below stairs leading to the central library

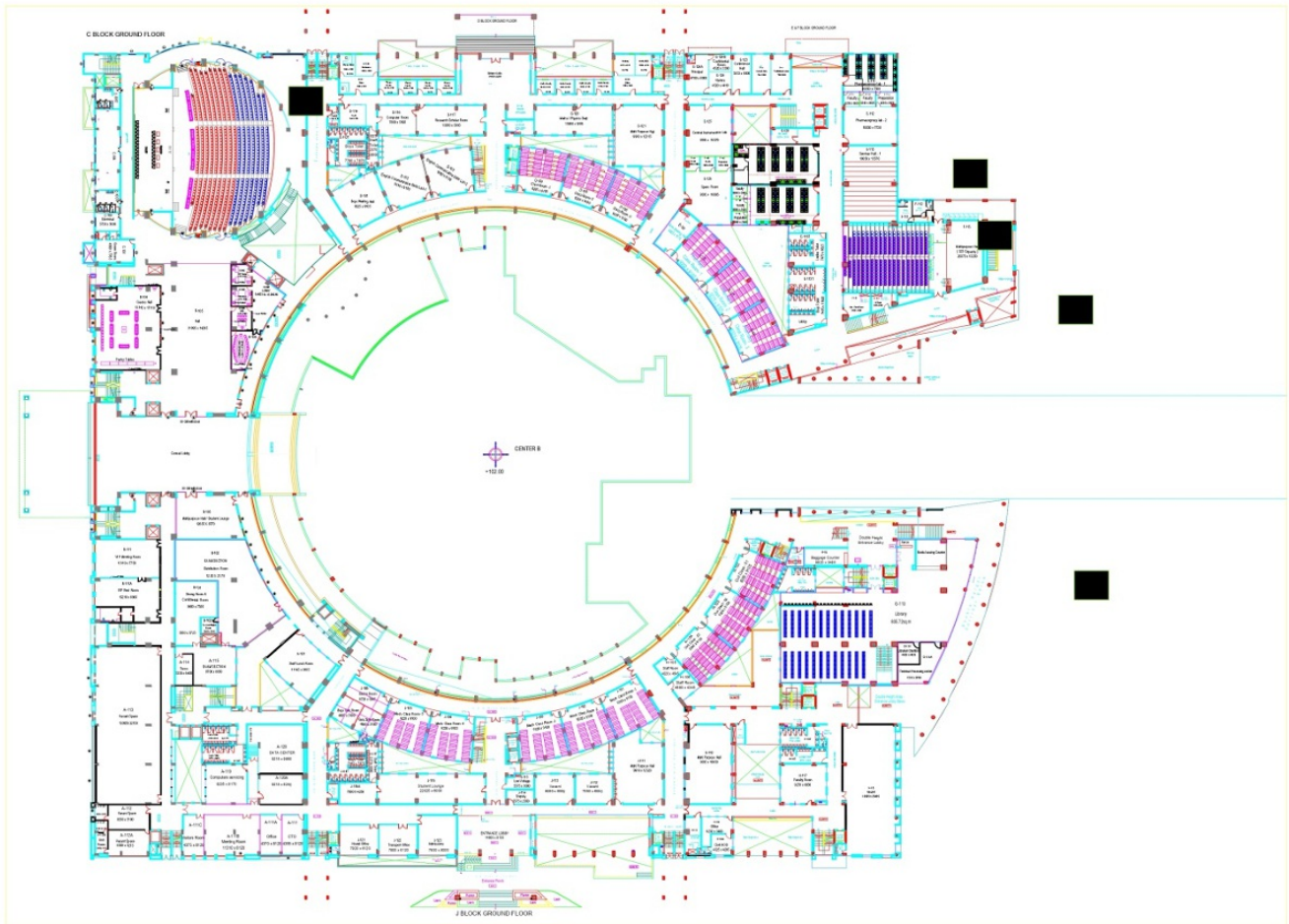


Figure 35. Unsafe spots marked by the user group

4. Discussions

Following are the observations as per the survey analysis: The campus is evenly illuminated at street level, signages have less lighting, there are numerous hiding spaces on campus, fewer chances to call for help, easy access for offenders to disappear, more than one exit is provided, pedestrian safety is lesser near ramps, higher stakes for offenders to enter parking areas and landscape zones, loss of vehicles previously occurred and obtained, Lack of security systems functioning, campus wayfinding is difficult.

Other physical observations: Few unsafe spots are as follows: F block, Entrapment spots below staircases, Niches at ground floor semi-open corridor, Lack of monitoring and lighting behind canteens, Basement and students off campus Parking areas, Lack of proper fencing, Wired fencing provided, Multiple entrances, Higher isolated places, trees have tall trunks but Lack of lighting, ficus plants bordering the building has higher chances for offenders to hide. An abnormality in survey ratings has been observed due to the cultural or fear factor in the understanding of the response to a feeling of safety, Lack of streetlights provided and neighborhood spaces being industries (Figures 21-35).

To obtain an exterior safe campus model following are the changes that need to be adopted:

- Signages with legible text size and lighting to be provided
- As filmed glass has been utilized on the facade, natural surveillance is easier. However, each façade has a restricted angle of surveillance.
- Offices need to be placed on the perimeter of the building facing street-level activities and parking zones
- RFID cards are to be used for restricted access after working hours.
- Emergency SOS call boxes are to be installed at prominent places.
- Fencing to be higher and made of wrought iron where surveillance is easier, and vandal-proof.
- Thick foliage shrubs to be trimmed, so that offenders' actions can be monitored.
- Appropriate lighting level to be maintained at the parking level.
- Niches at the parking level to be well-lit and unused spaces in the basement need to be well-lit and locked if not used.
- Blind corners at the parking level need to be avoided.
- Playgrounds to be visible from maximum windows of the building.
- Stairwell zones can be designed with maximum transparency.
- Blind corners should be provided with convex mirrors.
- All entrances are prone to criminal activity and have less visibility, therefore, the corners need to be chamfered for visibility.
- The reception area needs to be relocated to aid visual supervision of entries, stairs and hallways.
- Entrapment spots below staircases need to be closed or well-lit.
- Streetlights need to be increased to at least 2, including building floodlights
- Surveillance at semi-private and public parking off campus needs natural surveillance and access control through fencing.

Above mentioned are CPTED recommendations for GITAM Campus, post-survey analysis. The above-mentioned optimum strategies are for a safe exterior campus model. The scope for future research is a detailed interior study of campuses for a safe interior model.

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