

## **Crime Prevention through Environmental Design (CPTED) In Pakistani Construction Industry – Benchmarking of Stakeholders’ Awareness**

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### **Abstract**

While in Karachi, one cannot ignore the fortress-type homes transformed into cages. Nobody wants to live in a fortress but if the crime statistics for Pakistan are put into perspective, the need for physical security has become critical over several years. Physical security is addressed by the intricate operation of several components to provide a secure environment. It has been observed that crime prevention stresses upon the built environment attributes in which building design can be value-added to reduce susceptibility to offense. Therefore, this study aims to assess the level of perception and awareness of key stakeholders about Crime Prevention through Environmental Design (CPTED) concepts, within the geographical boundaries of Karachi city. For the study, Contractors, Consultants, and Architects are considered as the target audience for the primary data collection. From the analysis of the responses, it can be concluded that the stakeholders feel that by including certain attributes in the design stage, the built environment can be made safer from the start. Residents’ perception of safety depends on housing quality.

### **Keywords**

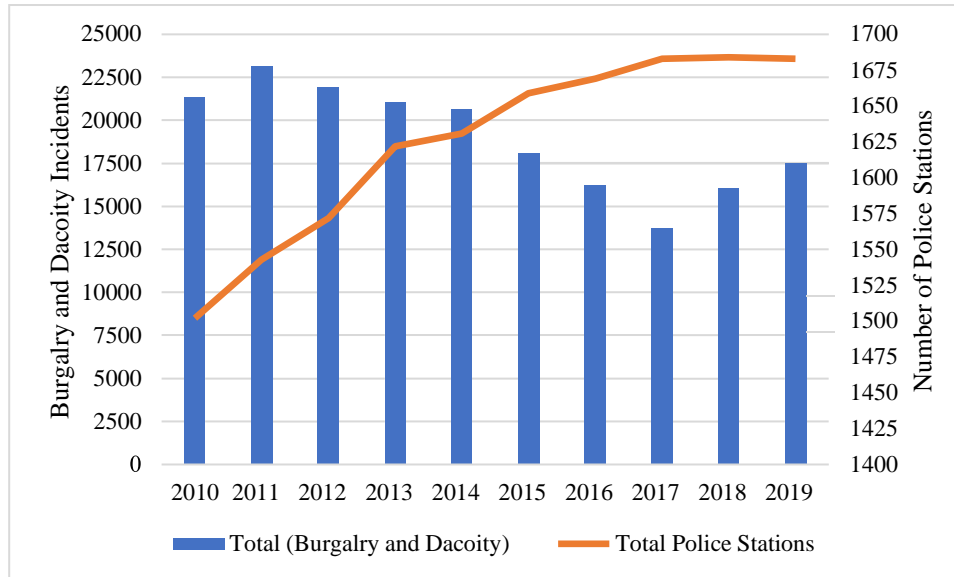
Crime Prevention Through Environmental Design, Crime Prevention, Secure Environment.

### **1. Introduction**

Like many similar cities to Karachi, one of the first things that any tourist will notice is the architecture and how the buildings appear on the skyline. Many buildings have multiple stories of caged windows, balconies, and doors; an issue that greatly reduces the aesthetic and suggests a high rate of crime in the city (Tabrizi & Madanipour, 2006).

If attention is drawn towards Pakistan, the data in Fig 1 has been extracted from Pakistan Statistical Yearbook (2019) namely Total Burglary-Dacoity incidents versus the Police Stations. Over the years, the government has invested large sums to improve the policing infrastructure. This has also been fruitful in reducing burglary crime to a certain extent. If the engineering community can join hands and address the challenge from an engineering point of view; it can play a vital role in a money scarce economy. One of such established approaches is termed Crime Prevention Through Environmental Design (CPTED), it is a pre-emptive method of crime prevention that aims to reduce the opportunities for crime to occur during the first phases of facility development (Sakip and Abdullah, 2012).

This study assessed the level of awareness and perception of CPTED principles in the local construction industry. For the study, the Contractors, Architects, and Design Consultants were considered as the target audience for the primary data collection. The surveyed organizations operated within the geographical boundaries of Karachi city. To be able to address a problem, the first step is to understand the stakeholders in terms of their level of perception and awareness. And to that end, this study is the first attempt to minimize the research gap. The study had been undertaken to benchmark the awareness and perception of primary stakeholders of the AEC industry concerning CPTED. The outcomes of the study include convergence and divergence of perception and awareness of the selected stakeholders from the local industry.



**Fig 1:** Total Burglary-Dacoity VS Police Stations-Data Source: Pakistan Statistical Yearbook (2019).

## 2. Literature Review

The process of documenting minimum requirements for physical security combinations in a risk environment is labor-intensive (Garcia, 2001). Therefore, in recent years, crime prevention has gotten a lot of attention. It entails the management of the environment in which people live and work, as well as analysis of the elements that make some surroundings more vulnerable to crime than others. Criminal prevention lays some attention on the built environment's attributes and strategies to improve the layout to lessen crime vulnerability. The success of CPTED is based on five main components of (i) Natural surveillance, (ii) Access control (iii) Territoriality, (iv) Exterior maintenance, and (v) Activity Support (Sakip and Abdullah, 2012). Each one of the listed components will be elaborated in the succeeding sections and subsections.

### 2.1. Natural Surveillance

Residents and their agents can benefit from natural surveillance opportunities provided by the physical design, (Painter and Tilley, 1999). To maximize visibility, it encompasses the placement and usage of physical structures, mechanical and electrical systems, and people. If offenders believe they are being watched, the danger of being caught increases, and they are less likely to commit an offense (Weisel, 2002).

### 2.2. Access Control

The notion of 'access control' centers on limiting opportunities for crime by barring access to possible targets and instilling in offenders a heightened sense of danger. It focuses on entrance management and design tactics, as well as gardening, fencing, exits, and lighting, to direct walkers and vehicles in a smooth flow while deterring criminal activity (Cozens, 2002). This idea entails using design to control the flow of people into and out of a certain place (Parnaby, 2007).

### 2.3. Territoriality

Historically, territoriality has been defined as a tactic that uses reinforcing conceptions of property to instill a sense of proprietorship in lawful users of space, hence reducing criminal prospects and discouraging unauthorized users (Cozens et al., 2005; Ham-Rowbottom et al., 1999). According to studies, burglars choose more vulnerable properties in their decision-making process, and these environmental indicators help to safeguard privacy (Brown and Altman, 1981). Increased occupancy signs, together with dogs, alarms, and close neighbors, are powerful deterrents for intruders (Weisel, 2002).

### 2.4. Exterior Maintenance

The superiority of housing quality has an encouraging and substantial link with occupants' perceptions of safety, whereas victimization and housing quality have a negative relationship (Austin et al., 2002). Litter, vandalism, graffiti, burned-out lights, and unkempt trees and plants can all be blamed for maintenance issues. Maintenance efforts cover a wide range of activities aimed at keeping the home looking neat and tidy. In comparison to burgled residents, non-burgled residents exhibited more pride in the appearance of their homes in a previous study (Brown and Altman, 1983). Furthermore, another study discovered that poor care and a lack of outside décor were linked to crime susceptibility (Cozens, 2005, 2008; McKay, 2007).

## 2.5. Activity Support

The construction of a setting that makes it more likely for genuine users to use the space and, as a result, acts as extra surveillance. Although many people consider activity support to be a separate concept of CPTED, the goal is to improve surveillance, therefore the two principles can be merged (Armitage, 2013).

## 3. Research Methodology

Scanning pertinent secondary data in the form of research publications was the first step of this effort. Data was gathered for this purpose, as well as the creation of a knowledge base for the exercise. The investigation, however, necessitated a large amount of primary data. To do so, a survey was launched to collect more replies from the target audience. The survey results were then examined to draw conclusions and make recommendations for improvement.

To aid the gathering of data through primary sources a thorough literature review was needed. Hence, existing literature in Crime Prevention through Environmental Design formed the secondary data source. The questionnaire for the survey was formulated by screening and comprehending relevant literature within the CPTED domain. In particular, the research conducted by Marzbali et al., (2012) was especially concentrated upon. It was used to extract the checklist to establish definitions for each of the CPTED Aspects. The questionnaire structure was comprised of the following sections.

- Part A: Assessing the awareness and perception of primary stakeholders of the AEC industry concerning CPTED. The data was collected on a five-point Likert Scale where 1 represented, 'Lowest Agreement' and 5 represented, 'Highest Agreement' respectively. Part A was subdivided into five CPTED aspects. The list developed by Marzbali et al., (2012) has been referred to for this benchmarking study. The statements for each of the five CPTED Aspects are as follows:
  - Aspect-I: Natural Surveillance      Number of Statements: 10 (A1-A10)
  - Aspect II: Access Control              Number of Statements: 08 (B1-B8)
  - Aspect III: Territoriality                Number of Statements: 10 (C1-C10)
  - Aspect IV: Exterior Maintenance      Number of Statements: 08 (D1-D8)
  - Aspect V: Activity Support              Number of Statements: 06 (E1-E6)
- Part B: Demographic information of the respondents and the participating organizations.

The collected data was analyzed qualitatively with the calculation of weighted averages as per the Likert Scale (Highest Agreement to Lowest Agreement). Based on the values, the factors were ranked to meet the objectives set for this study

## 4. Data Results, Analysis and Discussion

The study had been undertaken to benchmark the awareness and perception of primary stakeholders of the AEC industry concerning CPTED. The data was collected on a 5-point Likert Scale; where 1 represented, 'Lowest Agreement' and 5 represented, 'Highest Agreement' respectively. For the data collected, a weighted average was calculated (the same have been presented in Table 2 to Table 6. The three highest agreed (weighted average) factors that define each CPTED Aspect are plotted in Figure 2 to Figure 6 respectively. The summary of response rate is summarized in Table 1.

**Table 1:** Survey Response Summary

Target Audience	Total Sent	Total Responses
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Contractors	30	13
Design Consultants	30	09
Architects	30	09
Total (%)	90 (100%)	31 (34%)

#### 4.1. Awareness and Perception Concerning CPTED

The awareness and perception concerning CPTED are evaluated based on five elements (as discussed in Section 5.1 to 5.5. They are Aspect-I: Natural Surveillance; Aspect II: Access control; Aspect III: Territoriality; Aspect IV: Exterior Maintenance; Aspect V: Activity Support respectively. Using the responses received, an agreement weighted average (W.A) was calculated for each of the statements for all three stakeholders. The analysis included sorting the statements with respect to their respective weighted averages in descending order, this was carried out for all three stakeholders. Once the sorting was complete, the top three statements were selected to be presented in Table 2- Table 6 below.

Each of the analyses presented in succeeding tables is looked upon in two aspects. Firstly, what are the common top three statements among the stakeholders. Secondly, based on the agreement weighted averages, is there any deduction that can be drawn for awareness and perception threshold for the three stakeholders surveyed.

##### 4.1.1. Aspect-I: Natural Surveillance

The top three agreed statements and respective weighted average that define the Natural Surveillance aspect is presented in Table 2 below.

**Table 2: Stakeholders' Top 3 Agreement Statements to Define, 'Natural Surveillance'**

Rank	Contractor	Architect	Consultant
1 <sup>st</sup>	A3. The physical design has the capacity to promote natural surveillance opportunities for residents (*W.A=3.53)	A1. By including certain principles in new construction, from the design stage, we can make the built environment safer from the start (*W.A=2.07).	A6. If offenders perceive that they can be observed, they may be less likely to offend (*W.A=1.93).
2 <sup>nd</sup>	A4. Surveillance (such as neighborhood Watch) is part of the capable guardianship (*W.A=3.47).	A10. The flow of activities can be channeled to put more people/ observers near a potential crime area (*W.A=1.93).	A8. Landscape elements which remove or reduce visibility opportunities can provide concealment places for offenders (*W.A=1.86).
3 <sup>rd</sup>	A1. By including certain principles in new construction, from the design stage, we can make the built environment safer from the start (*W.A=3.33).	A3. The physical design has the capacity to promote natural surveillance opportunities for residents (*W.A=1.80)	A9. Failure to trim trees and shrubs around a building has no contribution in providing opportunities for burglars (*W.A=1.86).

\* W.A= Weighted Average

From observing the analysis presented in Table 2, it can be observed that the two stakeholders (Contractors and Architects) consider physical design to provide natural surveillance opportunities and buildings can be made safer by including certain parameters from the start. Although statements A3 and A1 occur in the top three for both stakeholders, the disparity in the weighted average score (W.A) suggests weak awareness of Architects. However, the Consultants do not have the same perception; in fact, neither of their top three statements are common with the other two stakeholders. This hints at vastly different awareness levels between Consultants and Architect-Contractor group. In addition, for Consultants, the top three statements lie within the 'Lower Agreement': respective Likert Scale of '2'. This itself suggests lacking awareness about related concepts.

##### 4.1.2. Aspect II: Access Control

The top three agreed statements and respective weighted average that define the Access Control aspect is summarized in Table 3 below.

**Table 3: Stakeholders' Top 3 Agreement Statements to Define, 'Access Control'**

Rank	Contractor	Architect	Consultant
1 <sup>st</sup>	B7. Properly located entrances and exits can direct both foot and vehicular traffic in ways that decrease criminal opportunities (*W.A=3.33).	B1. Opportunities for crime can be tremendously reduced by denying access to potential targets (*W.A=2.40).	B8. Proper landscaping and lighting can subtly direct both foot and vehicular traffic in ways that decrease criminal opportunities (*W.A=2.13).
2 <sup>nd</sup>	B2. A high perception of risk to offenders can be achieved by denying access to certain places (*W.A=3.27).	B8. Proper landscaping and lighting can subtly direct both foot and vehicular traffic in ways that decreases criminal opportunities (*W.A=2.06).	B4. The design of a facility can be managed to control the ingress and egress of persons to and from a specific space (*W.A=2.06).
3 <sup>rd</sup>	B6. Access control to and from a building facility is sufficiently achieved in individual dwellings or commercial establishments using adequate locks, doors, and window barriers (*W.A=3.27).	B4. The design of a facility can be managed to control the ingress and egress of persons to and from a specific space (*W.A=1.67).	B1. Opportunities for crime can be tremendously reduced by denying access to potential targets (*W.A=1.53).

\* W.A= Weighted Average

As summarized in Table 3, Architects-Consultants share some common perceptions regarding the Access Control Aspect that denying access can lead towards reduction in opportunities. However, both Architects-Consultants selected that through landscaping, provisions can be made that provide opportunities for pedestrian and vehicular traffic to decrease criminal opportunities, but the disparity in the respective weighted averages (W.A of 2.40 VS W.A of 1.53) hint at a lacking awareness amongst the Consultants. However, an interesting finding to note is that none of the statements are common for Contractors, it seems that they perceive the Access Control Aspect of CPTED very differently from the other two stakeholders.

#### 4.1.3. Aspect III: Territoriality

The top three agreed statements and respective weighted average that define the Territoriality aspect is shown in Table 4 below.

**Table 4: Stakeholders' Top 3 Agreement Statements to Define, 'Territoriality'**

Rank	Contractor	Architect	Consultant
1 <sup>st</sup>	C10. Territorial reinforcement can work because of users' familiarity with each other and the surroundings (*W.A=3.33).	C10. Territorial reinforcement can work because of users' familiarity with each other and the surroundings (*W.A=2.67).	C9. Territorial reinforcement can work even with its ambiguous directness (*W.A=2.40).
2 <sup>nd</sup>	C4. Surveillance and access control may be, contributed toward fostering territorially (*W.A=3.27).	C1. Landscape planting is ineffective in marking the difference between private and public spaces, is used to define property lines (*W.A=2.33).	C6. Increasing occupancy signs is an effective device to deter burglars (*W.A=2.20).
3 <sup>rd</sup>	C5. Reinforcing notions of property that bring a sense of ownership in legitimate users of space (*W.A=3.07).	C9. Territorial reinforcement can work even with its ambiguous directness (*W.A=2.27).	C1. Landscape planting is ineffective in marking the difference between private and public spaces, is used to define property lines (*W.A=2.07).

\* W.A= Weighted Average

As per the analysis of the data collected, it can be observed that Architects-Consultant share a common perception because they have commonly selected landscaping planting and territorial reinforcement as statements to define the Territoriality aspect. However, the lower value of weighted average for agreement for the statement establishes a lacking of Consultants' awareness thresholds. Whereas Contractors and Architects share a moderately common perception as they both share one common statement amongst themselves. According to them the top statement to define Territorial Aspect is the functionality of territorial reinforcement because of the user's familiarity with it. With the weighted averages closer to each other, it can be deduced that the awareness level is similar.

#### 4.1.4. Aspect IV: Exterior Maintenance

The top three agreed statements and respective weighted average that define the Exterior Maintenance aspect is presented in Table 5 below.

**Table 5:** Stakeholders' Top 3 Agreement Statements to Define, 'Exterior Maintenance'

Rank	Contractor	Architect	Consultant
1st	D1. Enhancement, maintenance, and management of the built environment encourage the users of the area to respect their surroundings (*W.A=3.60).	D1. Enhancement, maintenance, and management of the built environment encourage the users of the area to respect their surroundings (*W.A=2.20).	D5. There is a positive relationship between victimization and housing quality (*W.A=2.27).
2nd	D4. Housing quality has a positive and significant relationship with residents' perception of safety (*W.A=3.40).	D4. Housing quality has a positive and significant relationship with residents' perception of safety (*W.A=2.20).	D4. Housing quality has a positive and significant relationship with residents' perception of safety (*W.A=2.13).
3rd	D3. The quality of the home environment has a persistent effect on the individual's quality of life (*W.A=3.40).	D3. The quality of the home environment has a persistent effect on the individual's quality of life (*W.A=2.13).	D8. Experience has revealed that poor maintenance and lack of exterior decoration were associated with vulnerability to crime (*W.A=2.07).

\* W.A= Weighted Average

As per the data collected, the initial analysis suggests a similarity of perception between Contractors and Architects for the Exterior Maintenance Aspect. This can be asserted by observing the fact that for both stakeholders the top three statements to define the respective aspect of CPTED is the same. However, a closer inspection reveals the fact that both stakeholders' awareness thresholds are vastly different. Contractors' perception is comparatively on a higher side since weighted averages being greater than 3.00 and for Architects the same statements have a weighted average on the lower side of the Likert Scale. In addition, housing quality and its relationship with resident safety is rated at a medium importance level by Architects and Consultants and at higher importance by Contractors. However, housing quality and its relationship with resident safety is rated by all three stakeholders as one of the top three significant parameters to define CPTED in general and the Exterior Maintenance Aspect of CPTED; in particular.

#### 4.1.5. Aspect V: Activity Support

The top three agreed statements and respective weighted average that define the Activity Support aspect is depicted in Table 6 below.

**Table 6:** Stakeholders' Top 3 Agreement Statements to Define, 'Activity Support'

Rank	Contractor	Architect	Consultant
1st	E1. The design of the space, besides fulfilling functional objectives, should create an aesthetically pleasing environment that a person can enjoy (*W.A=3.60).	E1. The design of the space, besides fulfilling functional objectives, should create an aesthetically pleasing environment that a person can enjoy (*W.A=1.93).	E6. Bright and vibrant finishes create a sense of safety (*W.A=2.27).
2nd	E3. Unused and unusable "dead spaces" should be avoided (*W.A=3.40).	E3. Unused and unusable "dead spaces" should be avoided (*W.A=1.80).	E1. The design of the space, besides fulfilling functional objectives, should create an aesthetically pleasing environment that a person can enjoy (*W.A=2.13).
3rd	E2. The security aspects should be considered as part and parcel of designing the space and fulfilling aesthetic values (*W.A=3.33).	E4. The design of the space should address nighttime use (*W.A=1.73).	E3. Unused and unusable "dead spaces" should be avoided (*W.A=1.87).

\* W.A= Weighted Average

From the overview of Table 6, it can be deduced that Contractors and Architects share a common perception of the Activity Support Aspect of CPTED (two out of three common statements) but after a closer inspection of the agreement weighted averages, it becomes apparent that Contractors have a better awareness threshold in comparison

to Architects. Similarly, for the Architects and Consultant group, they too share two common statements amongst them but with a smaller difference for the agreement weighted averages. This indicates a similar level of awareness for the Architects and Consultants. In addition, with varying degrees of agreement, all three stakeholders agree that dead spaces should be avoided to promote the activity support aspect of CPTED. This hints at a similar awareness level for the Architects and Consultants.

## 5. Conclusions

From the analysis of the collected data, the summary of the results is presented in Table 7. The thought process in formulating the table is the presentation of Common Perception Group of Stakeholders, Moderately Common Perception Group, and Majorly Different Perception Stakeholder. following conclusions can be drafted for each of the five aspects of CPTED. For inferential statistics, 1 tail heteroscedastic t-test b/w Common Perception Group was carried out at the level of significance 0.05.

**Table 7: Summary of Analysis**

CPTED Aspect	Common Perception Group	Moderately Common Perception Group	Majorly Different Perception Stakeholder	Remarks	Inferential Statistics
Aspect-I	Contractor-Architect	-	Consultant	2 out of the top three statements common between Contractor-Architect; No statement is common for Consultants.	The t-test is significant to establish Contractors' perception to be better than Architects
Aspect II	Architect-Consultant	-	Contractor	2 out of the top three statements common between Architect-Consultant; No statement is common for Contractor.	The t-test is insignificant to establish Architects' perception to be better than Consultants.
Aspect III	Architect-Consultant	Contractor-Architect	-	2 out of the top three statements common between Architect-Consultant; 1 out of top three statements common between Contractor-Architect	The t-test is insignificant to establish Architects' perception to be better than Consultants.
Aspect IV	Contractor-Architect	Architect-Consultant	-	All three statements are common between Contractor-Architect; 1 out of the top three statements common between Architect-Consultant	The t-test is significant to establish Contractors' perception to be better than Architects.
Aspect V	Contractor-Architect - Architect - Consultant	-	-	2 out of the top three statements common between Contractor-Architect and Architect-Consultant respectively.	The t-test is significant to establish Contractors' perception to be better than Architects. The t-test is insignificant to establish Architects' perception to be better than Consultants.

The study had been undertaken to benchmark the awareness and perception of primary stakeholders of the AEC industry concerning CPTED. Based on data analysis, the following conclusions are drawn.

Aspect I- Natural Surveillance: Based on the top three common agreement factors defining Aspect-I, Contractor-Architect shared some commonality of awareness and was tested statistically that Contractors' awareness threshold was better than its comparison stakeholder. Consultants had been found to have a different perception owing to the non-commonality of any of their top three statements with either of the other two stakeholders.

Aspect II- Access Control: On the basis of the top three common agreement factors defining Aspect-II, Architects-Consultants shared some commonality of awareness and were tested statistically to establish that Architects do not have a better awareness threshold. Contractors had been found to have a different perception owing to the non-commonality of any of their top three statements with either of the other two stakeholders.

Aspect III-Territoriality: Driving upon the values of the top three common agreement factors that were used to define Aspect-III; Architect-Consultant shared some cohesion of awareness. Upon statistical testing, it was insignificant to state that Architects' perception was better than Consultants.

Aspect IV- Exterior Maintenance: Centered around the top three common agreement factors defining Aspect-IV, Contractor-Architect were observed to converge into a common awareness about Aspect-IV. When it was tested, the result suggests that it is significant to establish Contractors' perception to be better than Architects.

Aspect V- Activity Support: Examined based on top three common agreement factors defining Aspect-V, Contractor-Architect, and Architect – Consultant shared a commonality of awareness for the factors defining Aspect-V respectively. Statistically speaking, it is significant to establish Contractors' perception to be better than Architects and insignificant to institute Architects' perception to be better than Consultants.

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