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APPRAISAL OF THE STATE OF NATURAL ACCESS CONTROL IN GOVERNMENT-BUILT RESIDENTIAL ESTATES IN YENOGOA, BAYELSA STATE

By

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Abstract

Government-built residential estates in Yenagoa, Bayelsa State, Nigeria, often prioritize the rapid construction of physical infrastructure over the integration of Crime Prevention Through Environmental Design (CPTED) principles, particularly in managing access control, leaving them vulnerable to burglary, vandalism, and violence. This study addresses the gap in empirical evaluations of natural access control across Nigerian public housing by assessing all 11 Bayelsa State Government estates (total population 6,605) using a convergent mixed-methods design: structured questionnaires, n=378, calculated via Yamane's formula at 5% margin of error; proportionally stratified per estate population, on-site observations, and semi-structured interviews with key informants. Descriptive statistics ranked estates by perceived access control effectiveness; Old Commissioners Quarters, highest at 50.7% strong agreement; Civil Servants Quarters, Police HQ Road, lowest at 92.1% disagreement, corroborated by observations revealing differences in strong perimeter gating in New Commissioners Quarters, Opolo 2, contrasted with internal street disorganization elsewhere. Interviews highlighted maintenance failures and post-occupancy permeability as key undermining factors. Findings demonstrate inconsistent implementation; only 3/11 estates (27%) demonstrated robust natural access control across perception, observation, and interview data. Findings indicate CPTED's potential for retrofitting to enhance natural access control and guardianship in government-built residential estates. Recommendations include standardized entry and exit points, sustained government policies with annual boundary inspections, a mandatory CPTED audit for all estates, and sustained government policies for Bayelsa housing.

Keywords: *Bayelsa State, CPTED, Natural Access Control, Government-built, Residential Estates*

1. Introduction

In Nigeria, urbanisation has greatly changed housing patterns, population distribution, and social interactions (Deinne, 2024). As cities, especially state capitals like Yenagoa in Bayelsa State, grow rapidly, the need for government-built residential estates has increased. (Ebakpa & Brisibe, 2019). The development of these estates has raised concerns about crime and residents' safety, despite their initial aim to address or reduce housing shortages and foster urban expansion (Daukere, Ekpo, & Gbiri, 2021). Although government-built residential estates feature orderly layouts and careful planning, they remain vulnerable to criminal activity (Ebong, Zubairu, & Olagunju, 2017; Olajide, 2017). Residents report issues like burglaries, vandalism, assaults, and other crimes (Onyeneke, 2022). While crime analysis often emphasizes socio-economic factors and law enforcement, growing attention is paid to how architectural design and the physical environment influence criminal behavior in criminology and urban planning (Jeffery, 1971; Newman, 1972; Ceccato & Brantingham, 2024). In developed countries, architectural measures such as enhanced surveillance, territoriality, access controls, and maintenance have effectively reduced crime (Cozens & Love, 2015; Newman, 1972). Nonetheless, the use of such design strategies in Nigerian public housing remains limited and underexplored (Okunola, Ogunbodede, & Amole, 2025).

Despite several global findings, Yenagoa, a rapidly growing city and the capital of Bayelsa State, has received few, if any, empirical studies. Government-built residential estates, such as the Okaka Housing Estate, face rising incidents of burglary, vandalism, and youth violence, especially in areas with incomplete buildings, inadequate lighting, and unregulated access (Effiong et al., 2016). Given that these estates are

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products of deliberate state planning, they present a unique opportunity to embed principles from inception or through retrofitting. However, a gap remains in the literature and practice regarding the current state of natural access controls in these estates and their impact on crime control and prevention.

This study addresses this gap by examining the state of Natural Access control and its influence on crime in government-built estates in Yenagoa. It positions architecture and environmental design not merely as a shelter but as a potential instrument of crime control and prevention.

2. Methodology

2.1. Study Design

This study employed a convergent mixed-methods design with triangulation to comprehensively evaluate natural access control, one of the core principles of Crime Prevention Through Environmental Design (CPTED), across all 11 government-built residential estates in Yenagoa, Bayelsa State, Nigeria. Quantitative data from structured questionnaires captured residents' perceptions of access control effectiveness, while qualitative data from on-site observations and key informant interviews provided explanatory insights into physical implementation and lived experiences.

2.2. Population and Sampling

The study population comprised all residents of the 11 residential estates built by the Bayelsa State Government, totaling 6,605 people across 1,321 housing units (Table 1). These estates, Opolo Commissioners' Estate (Old), Legislators' Quarters (Ekeki), Civil Servants' Quarters (Ovom), Civil Servants' Estate (Road Safety Axis), Civil Servants' Quarters (Police HQ Road), Agbura Housing Estate, New Commissioners' Quarters (Opolo 2), Okaka Civil Servants' Quarters, Victory Estate, Ekeki Housing Estate, and Judiciary Junior Staff Quarters Kpansia, cover all government-built residential estates rather than being selective.

Population estimates derived from field surveys assumed duplexes as one housing unit, bungalows as two units, and an average household size of five persons per unit, consistent with National Population Commission (2021) data for urban Bayelsa.

Sample size was determined using Yamane's (1967) formula for finite populations:

$$n = \frac{N}{1 + Ne^2}$$

where $N = 6{,}605$(total population) and $e = 0.05$(5% margin of error), yielding $n = 378$respondents. Proportional stratified sampling allocated questionnaires to estates based on their population share

Table 1: Estate Populations and Proportional Samples

S/no	Estate	Population (Table 3.1)	Sample Size proportional)
1	Old Commissioners' Estate, Opolo	1500	86
2	Old Legislators' Quarters, Ekeki	150	9
3	Civil Servants' Quarters, Ovom	75	4
4	Civil Servants' Estate, Road Safety Axis	270	15
5	Civil Servants' Quarters, Police HQ Road	1500	86
6	Agbura Housing Estate	600	34
7	New Commissioners' Quarters, Opolo 2	200	11
8	Okaka Civil Servants' Quarters	310	18
9	Judiciary Junoir Staff Quarters, Kpansia	150	9
10	Ekeki Housing Estate	1250	71
11	Victory Estate	600	34
Total		6605	377

(Source: Authors' field survey, 2025) questionnaires distributed; 312 returned usable (82.5% response rate).

2.3. Data Collection Instruments

a) Structured Questionnaires: A 5-point Likert scale (1=Strongly Disagree, 5=Strongly Agree) evaluated perceptions across six natural access control indicators (e.g., "Entry/exit points are clearly defined," "Movement is channeled without fortification"). Items were adapted from validated CPTED audit tools (Cozens & Love, 2015) and pilot-tested with 30 residents (Cronbach's α = 0.87 for internal reliability).

b) On-site Observations: A systematic checklist evaluated physical features on a 0-3 scale (0=absent, 1=deteriorated, 2=functional, 3=optimal) across three scales: perimeter boundaries, entry/exit points, and internal street hierarchy (maximum score: 12/12). Three visits per estate (morning, afternoon, evening) captured temporal variability; digital photography documented conditions (see Plates 1-3).

Semi-structured Interviews: Guides with 22 residents and estate managers (20-30 minutes each) probed experiences. Purposive sampling prioritized diverse tenure lengths and roles; sessions were audio-recorded with informed consent.

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Ethical protocols included institutional review board approval, voluntary participation, data anonymization in accordance with GDPR principles, and community entry permissions.

2.4 Data Analysis

Quantitative: SPSS v.27 generated descriptive statistics (means, frequencies, percentages) and estate rankings by composite Likert scores (Table 1, Figure 1). Inferential analyses comprised one-way ANOVA for inter-estate differences ($p<0.05$) and Spearman's rho correlations between perceptions and observation scores. To ensure a balanced interpretation of residents' perceptions, estate rankings were derived using a net agreement score. This was computed by subtracting the proportion of negative responses (Strongly Disagree and Disagree) from positive responses (Agree and Strongly Agree) for each estate. This approach accounts for both positive and negative perceptions, thereby providing a more robust measure of overall performance.

Robustness threshold: Estates were classified as having "robust natural access control" if meeting all three criteria across triangulated sources:

a. top-3 perceptual ranking (combined Agree/Strongly Agree on defined entries, boundaries, permeability)
b. Observation score ≥8/12 (strong perimeter gating + internal hierarchy)
c. Confirmatory interview themes.

This identified 3/11 estates (27%): Old Commissioners Quarters (Opolo), New Commissioners Quarters (Opolo 2), and Old Legislative Quarters (Ekeki)

Qualitative: NVivo 14 facilitated thematic analysis and initial inductive coding followed by deductive mapping to CPTED constructs. Triangulation integrated findings: for instance, low Police HQ Road perceptions aligned with observations of uncontrolled entries.

3. Crime Prevention through Environmental Design (CPTED)

As an applied theory, CPTED extends the ideas of defensible space and integrates them into a broader criminological understanding. C. Ray Jeffery's (1971) original formulation of the theory was rooted in psychology and biology. However, modern CPTED, popularised by Crowe (2000), is firmly situated in environmental criminology (Cozens & Love, 2015).

Studies widely recognise crime prevention through environmental design as the key concept connecting architecture with crime prevention. Crime Prevention Through Environmental Design (CPTED) was first introduced by C. Ray Jeffery in 1971, marking the foundation of a design-based approach to crime prevention. CPTED is a crime prevention strategy that aims to reduce crime opportunities and citizens' anxiety about crime occurrence by improving urban environments through architectural design and urban planning, ultimately enhancing quality of life (Jeffery, 1971). It is a proactive strategy that aims to reduce crime by thoughtfully designing and managing physical environments. By focusing on principles such as natural surveillance, access control, and territorial reinforcement, this theory seeks to create spaces that deter criminal behaviour and enhance community safety. This approach is particularly relevant in urban settings, where crime rates are high, as it integrates environmental design with traditional security measures to foster safer public spaces.

CPTED is most effective when incorporated at the planning stage; however, it can also be applied to existing environments through retrofitting measures such as improved lighting and surveillance systems. Studies show that interventions such as CCTV and street lighting help reduce fear of crime and enhance safety perceptions. Nevertheless, contemporary CPTED approaches emphasize that physical design alone is insufficient and highlight the importance of community engagement and social cohesion in achieving sustainable crime-prevention outcomes. At its core, CPTED is structured around key principles including surveillance, territoriality, and environmental management (Cozens & Love, 2015).

Key Principles of Crime Prevention through Environmental Design

I. Natural Surveillance: Enhancing visibility in public spaces to deter potential offenders by ensuring that they are easily observed (Fennelly & Perry, 2024). The principle is applied by designing spaces to maximise visibility and the line of sight so that legitimate users can observe their surroundings and potential offenders feel exposed. A typical example is the positioning of windows, lighting, and low or transparent barriers such that public areas are under constant informal watch (Armitage & Monchuk, 2011).
II. Access Control: Designing spaces to limit entry points and thereby reduce opportunities for crime is a key principle of CPTED (Fennelly & Perry, 2024). Entry and exit points, as well as circulation paths, should be designed to discourage intruders. This may involve the use of physical design, strategically placed entrances, fences, and landscaping to channel or restrict movement and indicate when someone is in a private or controlled area (Armitage & Monchuk, 2011). Clear delineation of access without resorting to fortification (Jegede et al., 2024).

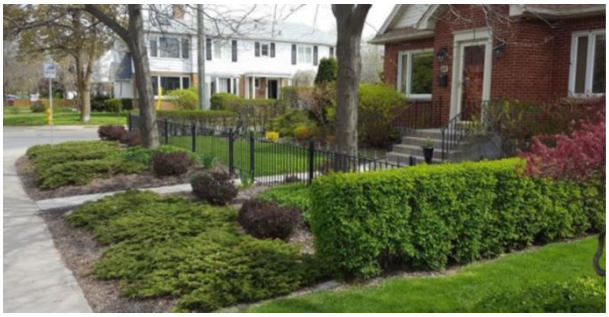

Plate 1: Regulated Access to Certain Areas (housing complex) (Source: Cozens, 2008)

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I. Territorial Reinforcement: Using design features to create a sense of ownership among community members, which can discourage criminal activity (Fennelly & Perry, 2024). This may include boundary markers such as fences and hedges, changes in paving or landscaping to distinguish private/semi-private zones from communal spaces that encourage resident ownership. A well-defined territory signals that a space is being cared for and monitored by its owners or community, thereby discouraging illegitimate use (Ebong, 2017).

II. Environmental Maintenance: Well-maintained areas indicate community care, which can deter crime (Fennelly & Perry, 2024), as shown in Plate 2.3. Ensuring that the physical environment is well-maintained, clean, and orderly sends cues that the area is monitored and that abnormal behaviours will not go unnoticed. This concept relates to the "broken windows" theory, which posits that visible disrepair or neglect, such as graffiti, vandalism, and dilapidation, can invite crime by signaling weak guardianship (Cozen & Love, 2018), as shown in Plate 2. Conversely, regular maintenance, prompt repair of broken fixtures, and good landscaping promote a sense of order and safety, reinforcing both real and perceived securitisation.

Plate 3: Badly maintained Image

Plate 4: Well-maintained Environment

(Source: Macano, Duda-Banwar, & Klofas, 2018)

I. Integration with Security Strategies: Combining these features with traditional security measures enhances overall effectiveness, particularly in high-risk areas (Kyaagba et al., 2024).

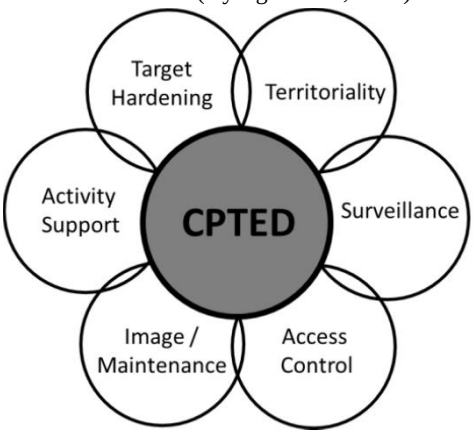

Figure 1: Illustrates the six key principles of Crime Prevention Through Environmental Design (CPTED)

(Source: Macano, Duda-Banwar, & Klofas, 2018)

CPTED mainly contributes by making it harder and riskier for offenders to commit crimes via physical design and by reducing provocations by minimising disorder and conflict zones. The key idea of this study is that estates that employ principles such as natural surveillance, access control, territoriality, and maintenance will have lower crime rates and higher resident safety perceptions than those without such design features.

In this study, CPTED provides the theoretical foundation and evaluative framework for assessing natural access control specifically. Each of the 11 selected estates was examined based on how their physical and spatial characteristics align with natural access control principles defined entry/exit points, boundary articulation, and controlled permeability.

This research extends the standard CPTED access control evaluation by incorporating two additional dimensions: multi-scalar spatial analysis (perimeter vs. internal street hierarchy) and residents' perceptions of access control efficacy. These additions provide a comprehensive understanding of the implementation of natural access control and its impact on perceived safety in Yenagoa's government-built residential estate.

4. Findings

4.1 Questionnaire Survey Findings

The questionnaire results reveal some level of variation in the effectiveness of natural access control across the selected estates (Table 2). The Old Commissioners' Quarters recorded the highest levels of positive perception, with a combined majority of respondents indicating agreement and strong agreement regarding the presence of defined entry and exit points. This suggests that access control mechanisms in this estate are clearly structured and effectively implemented.

Similarly, estates such as New Commissioners' Quarters (Opolo 2) and Old Legislative Quarters show relatively strong positive ratings, indicating functional access control systems characterised by identifiable entry nodes and controlled circulation.

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In contrast, Civil Servants' Quarters (Police Headquarters Road) exhibits overwhelmingly negative perceptions, with the majority of respondents strongly disagreeing or disagreeing that access points are well defined. This suggests weak or absent access control mechanisms, likely characterised by multiple uncontrolled entry routes and poor boundary articulation.

Ekeki Housing Estate shows a mixed response pattern, with both high disagreement and moderate agreement. This indicates inconsistent access control, varying across different sections of the estate.

Other estates, including Agbura Estate and Civil Servants' Quarters, also demonstrate notable dissatisfaction, suggesting deficiencies in spatial organisation and access definition.

Table 2: Comparative Distribution of Residents'

Rank	Name of Estate	Strongly Disagree (%)	Disagree (%)	Neutral (%)	Agree (%)	Strongly Agree (%)
1	Old Commissioners' Quarters	0.0	0.0	24.6	25.0	25.7
2	Ekeki Housing Estate	28.6	19.2	11.5	20.4	18.4
3	Judiciary Junior Staff Quarters, Kpansia	0.0	7.7	8.2	8.3	13.2
4	Civil Servants' Quarters Road Safety Axis (Main)	7.1	7.7	9.8	9.3	11.8
5	Okaka Civil Servants' Quarters	0.0	3.8	1.6	10.2	4.6

Table 3: Ranking of Estates Based on Responses on Natural Access Control (Highest to Lowest)

Rank	Name of Estate	Positive (%) (A+SA)	Negative (%) (SD+D)	Net Score
1	Old Commissioners' Quarters	50.7	0.0	**+50.7**
2	Judiciary Junior Staff Quarters (Kpansia)	21.5	7.7	**+13.8**
3	Old Legislative Quarters (Ekeki)	12.9	0.0	**+12.9**
4	Okaka Civil Servants' Quarters	14.8	3.8	**+11.0**
5	New Commissioners' Quarters (Opolo 2)	10.3	0.0	**+10.3**
6	Civil Servants' Quarters Road Safety Axis (Main)	21.1	14.8	**+6.3**
7	Victory Estate	8.3	3.8	**+4.5**
8	Civil Servants' Quarters	8.2	14.3	**−6.1**
9	Ekeki Housing Estate	38.8	47.8	**−9.0**
10	Agbura Estate	0.7	14.3	**−13.6**
11	Civil Servants' Quarters (Police HQ Road)	12.8	93.4	**−80.6**

(Source: Fieldwork, 2025)

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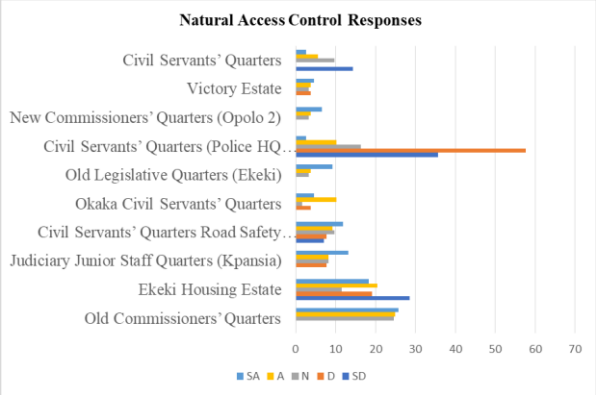

Figure 2: Comparative Distribution of Residents' Perceptions of Natural Access Control Across Estates, Showing Positive, Neutral, and Negative Responses

(Source: Fieldwork, 2025)

II. On-Site Observations

On-site observations do not fully align with the questionnaire results; however, they provide some explanatory background for the patterns observed across the estates. Estates that recorded relatively high positive ratings in the survey were generally characterised by identifiable access control features, including defined entry and exit points, the presence of gates and, in some instances, security posts, as well as structured street networks that limit unnecessary permeability. These estates also exhibited clearer boundary definition through fencing, contributing to a more legible and controlled environment.

The questionnaire survey indicates that Old Commissioners' Quarters ranked highest in overall performance, while New Commissioners' Quarters was positioned fifth (5th). However, on-site observations reveal a clearer reality when access control is examined as a physical item.

Specifically, New Commissioners' Quarters demonstrates stronger access control at the estate level, with more clearly defined and identifiable entry and exit points that enhance regulation of movement into and out of the estate. This reflects a more deliberate approach to managing permeability at the macro scale.

In contrast, Old Commissioners' Quarters, despite its high perception ranking, exhibits relatively open access conditions at its entry points, with less pronounced control over ingress and egress. However, at the internal scale, the estate performs better in terms of spatial organization. Its street networks are more clearly defined and structured, improving legibility, circulation clarity, and internal movement control. This suggests that while perimeter access control may be weaker, internal spatial order positively contributes to residents' perceptions of safety and overall environmental quality.

Furthermore, New Commissioners' Quarters demonstrates comparatively stronger boundary definition and spatial enclosure, reinforcing territorial clarity at the estate perimeter. When considered together, these findings highlight a multi-scalar distinction: Old Commissioners' Quarters performs better in terms of internal street network organization, whereas New Commissioners' Quarters exhibits stronger control at entry points and along the estate boundary.

In contrast, estates with low questionnaire ratings, particularly Civil Servants' Quarters and those along Police Headquarters Road, consistently exhibit weak access control characteristics in the field. These include the absence of clearly defined entry points, poorly articulated or missing perimeter boundaries, or detoariated entry and exit points. Such conditions allow unrestricted movement in and out of the estates, reducing the capacity for monitoring and control.

This underscores the importance of integrating perceptual data with physical assessment in evaluating access control, as effectiveness operates across multiple scales from estate entry points to internal street configuration and boundary definition (Plates 4-6).

Plate 4: New Commissioners' Quarters Controlled Entrance with Defined Gate and Perimeter Fencing, Enhancing Access Control

(Source: Fieldwork, 2025)

Plate 5: Deteriorated Gate Structure Reflecting Poor Access Control Entry at Old Legislative Quarters, Ekeki

(Source: Fieldwork, 2025)

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Plate 6: Defined entry point with gate and security post in Old Commissioners' Quarters, indicating controlled access into the estate

(Source: Fieldwork, 2025)

III. Interview Findings

The interview data provide some insight into how access control operates in practice. Respondents consistently identified gates, security posts, and boundary definition as critical elements of access control, often describing them as "effective" and "really good" when properly implemented.

However, several key issues emerged;

a. Inconsistent boundary definition
b. Reliance on individual measures
c. In estates where collective control is weak, residents resort to individual fencing, indicating failure of estate-level planning.
d. Estates with strong access control were consistently described as "safe," "peaceful," and "secure," while those with weak boundaries reported higher insecurity concerns

IV. Discussion

The findings reveal clear differences in the effectiveness of natural access control across the selected government-built residential estates, reflecting differences in how architectural design, layout, and boundary definition have been implemented and maintained over time. These differences largely align with established CPTED literature.

Estates such as Old Commissioners' Quarters, New Commissioners' Quarters (Opolo 2), and Old Legislative Quarters (Ekeki) show strong natural access control. In these estates, access is managed through well-defined entry and exit points, supported by organized circulation systems and clear boundaries. Movement within the estates seems controlled rather than haphazard, with a distinct transition from public to semi-private and private spaces. The particularly high level of agreement recorded in Old Commissioners' Quarters supports findings by Armitage (2013) and Cozens and Love (2015, 2017), who argue that areas with limited permeability and organized access systems tend to improve territorial control and perceived safety. These estates demonstrate the principles of defensible space, where spatial hierarchy and controlled access promote a stronger sense of ownership and informal surveillance.

In contrast, estates such as Ekeki Housing Estate, Civil Servants' Quarters Road Safety Axis (Main), and Okaka Civil Servants' Quarters exhibit moderate performance, characterised by mixed resident perceptions. In these cases, access control mechanisms are present but inconsistently applied. Some sections of the estates maintain identifiable entry points and boundary definition, while others have become more permeable due to spatial fragmentation and informal alterations. This uneven pattern suggests that the issue is not simply the presence or absence of permeability, but rather the lack of structured, coherent control over movement. This observation is consistent with the work of Johnson and Bowers (2010) and Davies and Johnson (2015), who note that permeability can either support or undermine safety depending on how it is organised. Furthermore, the internal variations observed within these estates align with Hillier (2012) and Sharifi (2019), who demonstrate that differences in street configuration and connectivity within the same environment can produce uneven safety outcomes and perceptions.

A different pattern emerges in estates such as Civil Servants' Quarters (Police Headquarters Road), Agbura Estate, and parts of Civil Servants' Quarters, where natural access control is largely ineffective. Multiple entry points, weak or absent boundary definitions, and high permeability characterise these estates. The overwhelmingly negative perception recorded in Civil Servants' Quarters (Police Headquarters Road) supports Reynald's (2011) findings, which highlight the importance of visibility and structured control in facilitating effective guardianship. Similarly, the conditions observed in Agbura Estate support Cozens and Love's (2015) argument that the effectiveness of CPTED strategies diminishes when access controls are not maintained or when planning intentions are undermined over time.

However, the findings also extend this perspective by demonstrating that in the Nigerian context, the effectiveness of natural access control is not determined solely by initial design. Instead, it is significantly influenced by post-occupancy transformations, weak enforcement of planning regulations, and inadequate maintenance of spatial and security infrastructure. These factors collectively alter the intended logic of estates, often increasing permeability and reducing the effectiveness of access control mechanisms over time.

Conclusions

This study demonstrates a lack of consistency in natural access controls across Yenagoa's 11 government-built estates, with only 3/11 (27%) achieving robust performance, as measured by Net Score rankings from resident questionnaires (n=312). Old Commissioners Quarters (+50.7), Judiciary Junior Staff Quarters (+13.8), and Old Legislative Quarters (+12.9) emerged as top performers, exhibiting defined entry points, clear boundaries, and controlled permeability that align with CPTED principles. In contrast, Civil Servants Quarters Police HQ Road (−80.6) and Agbura Estate (−13.6) represent critical failures, validating the role of architectural

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design in determining perceived safety in Nigerian public housing.

Recommendations

1. Immediate retrofitting for the low-performing estates with the standardized entry gate mode
2. Sustained government maintenance policies with annual boundary inspections
3. A mandatory CPTED audit for all estates, and sustained government policies for Bayelsa housing.
4. Bayelsa State housing authorities must institutionalize mandatory Net Score CPTED audits (≥+12.9 threshold) for all government estates to ensure minimum access control standards.

Limitations

The cross-sectional design captured current perceptions but did not consider crime statistics. Self-reported data may be subject to response biases, though a large sample size (82.5% response rate) enhanced reliability. These findings are specific to government-built residential estates in Yenagoa only and would require a broader context for nationwide validation.

Future Research

Longitudinal studies should track crime reductions post-retrofit in low Net Score estates. Expanding the framework to other CPTED principles and conducting comparative studies across Nigerian state capitals will strengthen generalizability.

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