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IMPACTS OF INADEQUATE SETBACKS IN THE LOW INCOME HILLSIDE NEIGHBORHOOD OF BOTSWANA
- IN THE CASE OF PELENG, LOBATSE -

Thabiso Seno[1], Nobuyuki Ogura[2]
Department of Civil Engineering and Architecture
[1]University of the Ryukyus
[2]University of the Ryukyus
Okinawa, Japan

***Abstract*— Setback distance is a pertinent building restriction that insures proper planning for infrastructure and land use especially in hillside developments. Since Peleng developed as a squatter settlement and there were and still there is no specific hillside regulations guiding hillside developments in Botswana, the paper analyzed the inadequacy of setback distance and how they hindered the improvements of low income hillside neighborhoods. The study then proposed hillside setbacks regulations as mitigation with the intention to influence relevant authorities to implements them.**

***Index Terms*—Inadequate setback distance, Environmental problems, Hillside, Regulations, Built Environment**

I. INTRODUCTION

The need to improve urban areas which emerged as squatter settlement has aroused in Botswana. The government of Botswana has been able to assist low income groups in Lobatse to access serviced land and improve their housing conditions and tenure security (Kalabamu at el, 2016). Unfortunately there has been some obstacles to exercise this improvements in Peleng neighborhood. The main obstacle hindering certain developments in this hillside neighborhood is the inadequacy of setback distance. This problem has been inherited from the squatter settlement period and will still persist in hillside developments until mitigation is proposed and implemented.

Due to inadequate setback distance it has been a challenge to improve the inherited problem by provision of shortage facilities such as storm water drains, sewer system and to improve access because there is no space for these facilities. Inadequate setback distance also has an impact on the living conditions of residents as it deprives them of conducive living environment necessities such as good ventilation, good natural lighting and private landscaped areas.

The paper will then discuss and analyze these impacts and the relationship of the inadequate setback distance in relation to obstacles hindering improvement of facilities, then propose an appropriate mitigation.

II. LITERATURE REVIEW

One of the major issues identified, which affects the environment and living conditions, is absence of rear and front setbacks between buildings and road; building and cut slope as in Kumar and Pushplata (2013). Although the study in Kumar and Pushplata (2013) is about India, he paper is relevant to this study as it discussed the various building regulations enforced in different hill towns for environmental protection to identify various problems responsible for environmental degradation in hill towns and discusses about setbacks. The feasibility of setbacks(s) in buildings on sloping sites is to be analyzed with respect to cutting of slopes (Kumar and Pushplata, 2013). These setbacks can be used to provide adequate natural daylight to buildings (which in turn reduces energy consumptions) and/or for growing vegetation's, which helps in environmental protection in hills (Kumar and Pushplata, 2013).

Another paper which had relevance to this study was in Olshansky (1998) where the study examined the range of issues concerning hillside developments in the United States. Hillsides developments are regulated for aesthetics, public safety, and environmental quality as in Olshansky (1998). The study investigated the regulations and used these reason for regulations. The study also mentioned that building setbacks accounted to 56% as in Olshansky (1998).

III. BACKGROUND/HISTORY

Inadequacy of building setback distance in Peleng has been a result of the fact that Peleng emerged as a squatter settlement. However, Peleng is no longer a squatter settlement. The introduction of the certificate of rights and land titles enabled Self Help Agency plot holders (including Peleng) to have access to secure tenure with options for upgrading to a common law lease (Kalabamu et al, 2016). When Peleng emerged there were no hillside building regulations to address unique situations of developments on the hillside. General building regulations were then enacted

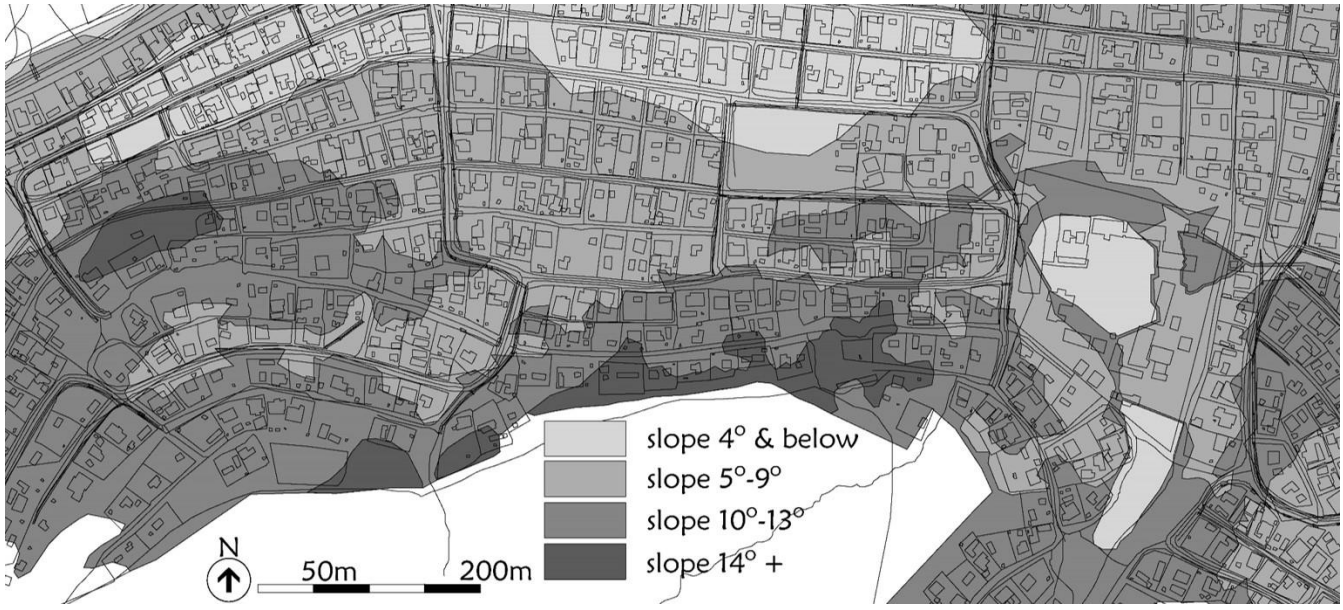

Fig.1. Map of Area surveyed zoomed in to show plots boundary, building footprints which were measured

but they still do not have specific hillside development guidelines until now. The guidelines mostly addresses flat land situations but there are towns and villages in Botswana developed on the hillside. That being the case, considerable setback distances were not considered during developments of Peleng.

IV. METHODOLOGY AND AIM

The site was surveyed and 160 houses were inspected and inquiry from residents with open and close ended questionnaires about living conditions of Peleng. Map of Peleng which shows property line of each plot, footprint of structures and roads was obtained from Botswana department of surveys and mapping. Through this map three types of setbacks were measured using AutoCAD software to determine whether they are inadequate. The setbacks measured were setbacks between building and property line, between buildings and between front building and road frontage as in table.1. The method used to determine whether the setbacks were inadequate was through using Botswana Development Control Code (DCC) standards for the minimum setbacks required per each setback.

The investigated findings were then categorized as per the 3 slopes categories which were slope 4° & below, slope 5°-9° and slope 10°-13°. Slope 14° & above was not developed hence it is not included. To determine these slopes site map coordinates were plotted on Revit software to create a model of the hillside. Then Dynamo Visual Programming was used to determine different slope categories. Map with plots and footprints of houses was then superimposed on top of the slope map to identify plots per each slope category and presented as in Fig.1. For the accuracy of these analyses equal number of results from answered questionnaires and inadequate setback distances were recorded in graphs and the results were represented and analyzed.

The intent of the study is to investigate the due impact of the inadequate setbacks and the improvement of facilities it has hindered such storm water drainage, sewer system and access. The study will then propose mitigation through perusal of the existing Botswana building regulations to improve setbacks regulation and propose setbacks that target mitigation for hillside setbacks related problems.

V. INADEQUATE SETBACKS AND THEIR IMPACTS ON THE LIVING CONDITIONS

Residential setbacks provides space for private yards and building separation for fire protection/security, building maintenance, sunlight and air circulation (MLH, 2013). The study focused on 3 types of inadequate setbacks being; inadequate setbacks between building and property line, inadequate setbacks between buildings and inadequate setbacks between front building and road frontage.

TABLE.1. Number and percentage of types of inadequate setbacks studied

Types of problem	No.	Percentage
Between building and Property line	344/450	76%
Between Buildings	205/450	45%
Between front building and road frontage	165/300	55 %

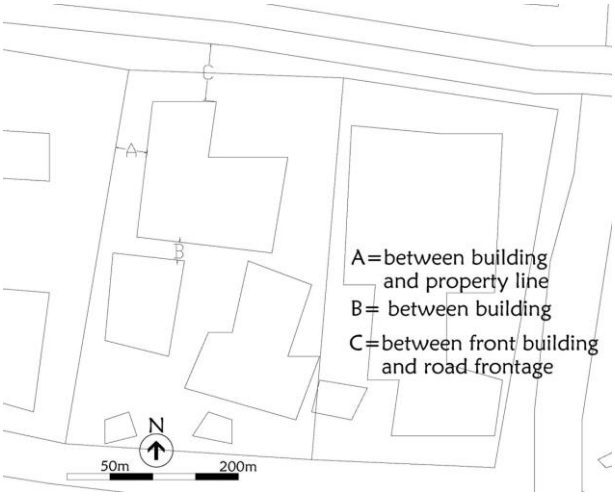

Fig.2. Images showing types of setbacks discussed

A. Inadequate setbacks between building and Property line

The purpose of setbacks between building and property line is to segregate the building in one plot from the neighboring building so as to hinder transfer of fire, and to provide circulation, access and gardening space within the plot. However in Peleng neighborhood the purpose has been compromised. The study ignored front setback minimum and used the side and rear minimum setbacks required by DCC to determine the inadequacy of the setbacks between building and property line. Rear and side setbacks for all residential buildings shall be minimum 1.5m (MLH, 2013). Table.1 indicates that 76% of 450 plots had setbacks between building and property line being less than 1.5m. Fig.3 indicates that slope 10º-13º recorded a high number of inadequate setbacks than slope categories.

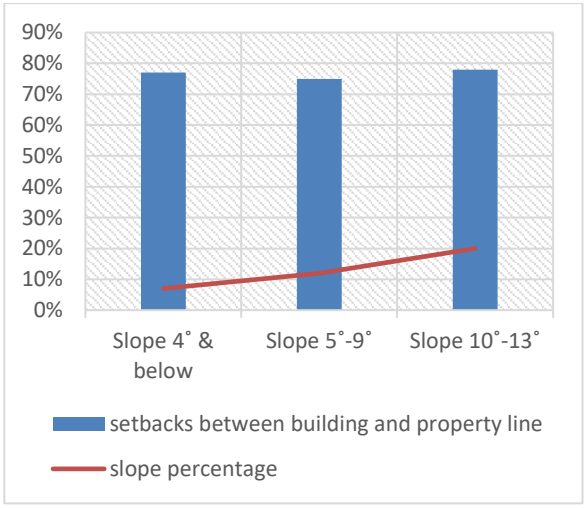

Fig.3. Record of inadequate setbacks between building and property line per each slope category

Fig.4. Image showing setback between building and property line

B. Inadequate setbacks between buildings

Setbacks between buildings can allow air circulation and sunlight. The study used the minimum setback required as per DCC requirements to determine the inadequacy of the setbacks between buildings in Peleng neighborhood. Building lower edge shall be located 1.5m from any other building or eave (MLH, 2013). Table.1 indicates that 45% of 450 plots had setbacks between buildings measuring below 1.m. Fig.5 indicates slope 5º-9º category recorded the highest number of inadequate setbacks between buildings.

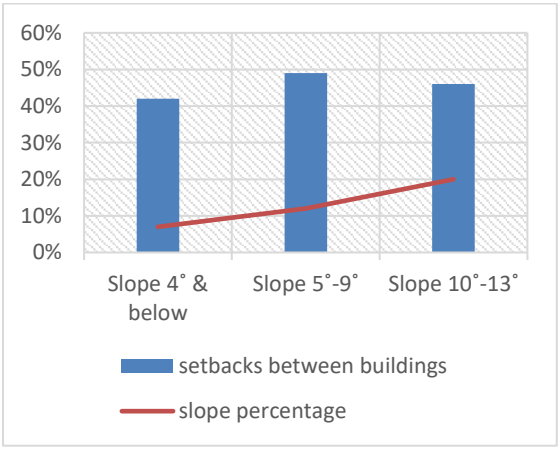

Fig.5. Record of inadequate setbacks between buildings per each slope category

Fig.6. Image of inadequate setbacks between two buildings

C. Inadequate setbacks between front building and road frontage

Setbacks between building and road can provide space for access, storm water drains, sewer drains and pedestrian walkways. Setbacks shall be reserved as servitude areas to enable provision and maintenance of central utilities (MLH 2013). The study used the minimum required setbacks between front building and road frontage by DCC to determine the inadequacy of setbacks between front building and road frontage. Garages and carports shall be set back on in-line with the main building façade (front) of the dwelling house, and set back not less than 5.5 meters to the road frontage (MLH, 2013). Table.1 indicates that 55% of 300 plots had setbacks between front building and road frontage measuring less than 5.5 meters. Fig.7 indicates that slope 10º-13º category recorded the highest inadequate setbacks between front building and road frontage.

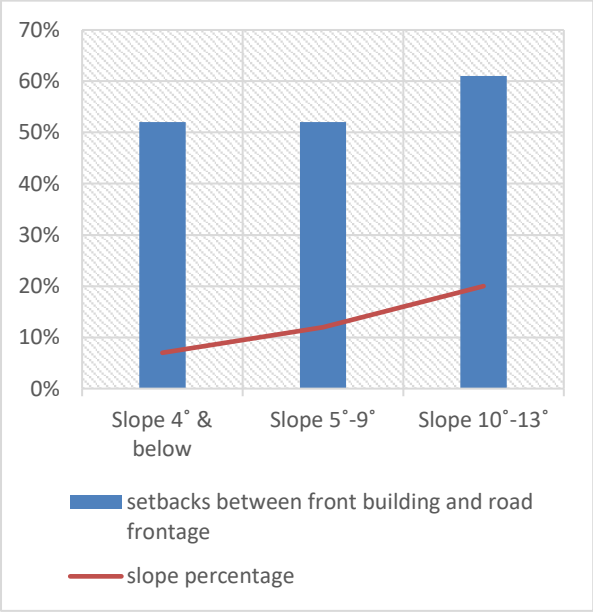

Fig.7. Record of inadequate setbacks between front building and road frontage per each slope category

Fig.8. Image showing inadequate setbacks between front building and road frontage

VI. ANALYSIS OF THE RELATIONSHIP BETWEEN INADEQUATE SETBACKS, LIVING CONDITIONS AND HINDERED IMPROVEMENT OF FACILITIES

A. Relationship between inadequate setbacks between building and property line and poor access

Analysis from fig.10 implies that inadequate setbacks between building and building property line had impact on the improvement of poor access and poor sewer system because the highest record of poor access and poor sewer and the highest record of inadequate setbacks between building and property line were both recorded in slope 10º-13º.

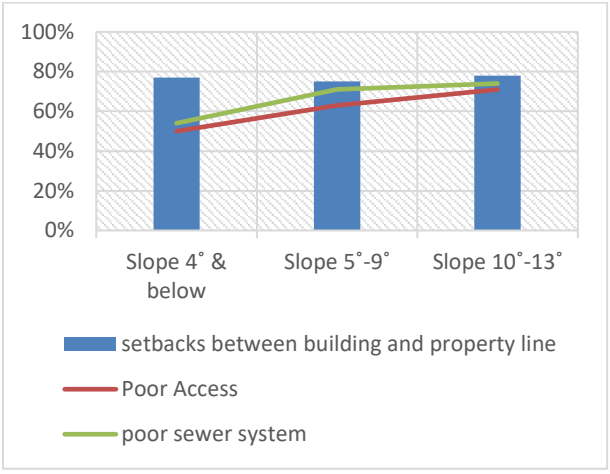

Fig.9. Analysis between poor access, poor sewer system and inadequate setbacks between building and property line

B. Relationship between inadequate setbacks between buildings and poor ventilation, poor natural lighting and poor storm water control.

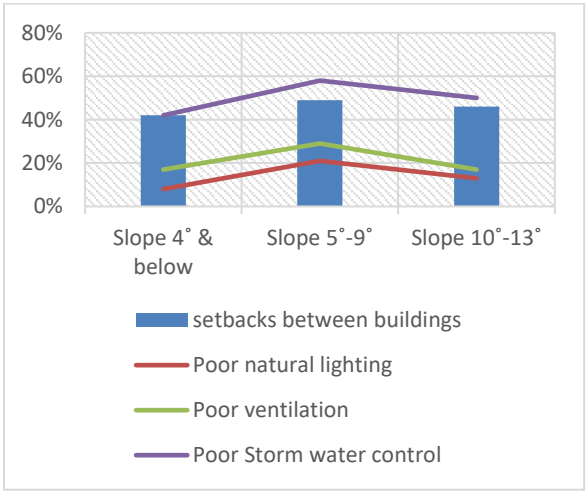

Fig.10. Analysis between Poor natural lighting, poor ventilation and inadequate setbacks between buildings per each slope category

The analyses from fig.10 indicates that inadequate setbacks between buildings had impact on the improvement of poor natural lighting, poor ventilation and poor storm water control because the highest record of poor natural lighting, poor ventilation and poor storm water control and the highest record of inadequate setbacks between building and property line were both recorded in slope 5º-9º.

C. Relationship between services and inadequate setbacks between front building and road frontage

Fig.11 indicates that setbacks between front building and road frontage had impact on the improvement of poor access and poor sewer systems because the highest record of poor access and poor sewer system and the highest record of inadequate setbacks between front building and road frontage were both recorded in slope 10º-13º. Analysis indicated the storm water retaining wall on the upper hillside contributed in reducing poor storm water control problems (Seno & Ogura, 2018). This shows on fig.11 as the record for poor storm water control declines in slope 10º-13º.

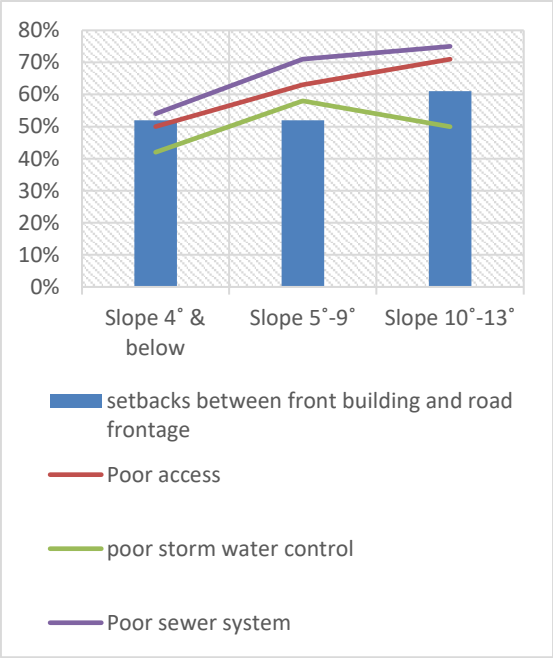

Fig.11. Analysis between services and inadequate setbacks between front building and road frontage

VII. MITIGATION PROPOSAL FOR INADEQUATE SETBACKS

The study seeks to suggest a mitigation proposal for hillside low income residential improvements where regulations were not followed and where the situation cannot be reversed. The idea is to propose mitigation to improve the hillside neighborhood with minimal cost incurred within both the government and the residents through improving DCC.

A. Setbacks between building and property line

Analysis determined that compromise of this setback affected access in the neighborhood. The problem can be mitigated by allowing residents to open one side of the setback opposite the entrance gate by at least 2.5m between building and property line for cars to enter and park. This is because according to DCC, vehicle parking space shall be at least 2.5m in width and 5m in length (MLH, 2013). The minimum proposed access opening for hillside regulations shall be 2.5m because many hillside plots are narrow (Seno and Ogura, 2018). Residents with inadequate setback between building and property line shall provide for servitudes such as sewer and storm water drains along the inside of the property line.

B. Setbacks between buildings

Setbacks between buildings hindering ventilation and sunlight can be mitigated by permanently closing all the openings in between buildings and creating openings where there are no adjacent buildings. Poor storm water control hindered by inadequate setbacks between buildings can be improved by providing concrete apron drains around the house and in between the buildings. For new buildings on the hillside, they shall be attached to each other to control storm water and minimize possible landslides.

C. Setbacks between front building and road frontage

Where inadequate setbacks between front building and road frontage hinder access, residents shall be permitted to remove the front boundary wall or fence to enable access and parking. In cases where servitudes such as sewer and drains are hindered by inadequacy of this setback then they shall be provided underground.

VIII. CONCLUSION

Uncontrolled developments in Peleng have resulted in inadequate setbacks hence influencing the investigation of the link between inadequate setbacks and poor living conditions as well as obstacles for improvements of services and facilities. The study then analyzed the relationship between the impacts and proposed forms of mitigation. This was achieved through analyzing Peleng map and questioning residents and surveying the area.

Three types of inadequate setbacks were studied, namely setbacks between building and property line, setbacks between buildings and setbacks between front building and road frontage. It was discovered that due to inadequate setbacks there is no space for servitudes such as sewer and drains and access for cars, air and sunlight was also compromised. Analysis identified a trend between;

i) Inadequate setbacks between building and property line with poor access and poor sewer system.

ii) Inadequate setbacks between buildings with poor ventilation, poor natural lighting and poor storm water control.

iii) Inadequate setbacks between front building and road frontage with poor access and poor sewer system.

The study found it pertinent to propose a mitigation that addresses the hillside developments that already exist in poor neighborhood so as to seek solution solutions that will come at minimal costs. The study also suggested hillside development guidelines for future developments in hillside low income neighborhoods.

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REFERENCES

[1] A. Kumar, and Pushplata. "Building Regulations for Environmental Protection in India hill towns", International Journal of Sustainable built environment (HBRC Journal), pp. 224-231, 2013

[2] R.B. Olshansky, "Regulation of Hillside Developments in the United States", Environmental Management Vol. 22, No. 3, pp. 383-392, 1998.

[3] F. T. Kalabamu, B. Bolaane, P. K. Lyamuya, N. L. Tema, G. Lethugile, and B. Phuthulogo, "Lobatse Town Profile", UN-Habitat, p. 9, 2016.

[4] Ministry of Lands and Housing (MLH), Botswana Development Control Code, pp. 77, 81, 93, 2013.

[5] T. Seno, and N. Ogura, "Problems Related to Poor Access on the Unplanned Hillside Built Environment of Botswana –in the Case of Peleng, Lobatse-", International Journal of Technical Research and Application, Vol.6, pp. 22-26, 2018.

[6] Seno, Lyamuya, and Ogura. Effects of Unplanned Multifamily Dwellings on the Hillside Built Environment of Botswana: Focusing on Sanitary Problems in Peleng, Lobatse (Case of Peleng, Lobatse), the 12th International Symposium on Architectural Interchanges in Asia (Pyeongchang Alpensia, Korea), pp. 506-509, 2018.