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PROBLEMS RELATED TO POOR ACCESS ON THE UNPLANNED HILLSIDE BUILT ENVIRONMENT OF BOTSWANA
- IN THE CASE OF PELENG, LOBATSE -

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***Abstract*— It is a common practice in the built environment that prior to construction of a neighborhood settlement, pertinent infrastructures are physically planned and organized to facilitate future developments. In cases where services and facilities like roads, sewer connection and drainage systems are subsequent to housing developments, it will always remain a challenge to superimpose them on the existing. Peleng neighborhood in Lobatse suffers from this circumstances. The paper then analyzed these problems and proposed mitigation.**

***Index Terms*—Poor access, Hillside, Regulations, Built Environment, infrastructure**

I. INTRODUCTION

Peleng Township has grown from a squatter settlement to a permanent urban residential area which resulted from urban economic growth. Urban economic growth often implies the conversion of rural land to urban uses, Areola, Gwebu, and Sebego (2014). The fact that it was not initially planned has resulted in problems that the township carried form its initiative to the present. These problems aroused because pertinent planning initiatives of townships such as access, sewer lines, drainage systems and other infrastructure necessities were not given special considerations.

One of this major challenge that have hindered the government to improve the facilities in the township is access. In architecture access is a versatile word which describes the entry or approach into architectural spaces. These means that without proper access some spaces cannot be used, maintained and cannot be accessed hence defeating the purposes of these spaces. Access in architecture ranges from access to roads, access to open spaces, access to parking, access to maintain and access to load and offloading areas. Other forms of access include access by nature such as access of sunlight and access of fresh air. The study will then investigate the link between poor access in Peleng and how it has affected usage and maintenance of other spaces and facilities such as sanitary system (toilets and litter), drainage system and parking. The study will also suggest improvements of the building regulations in the quest to mitigate the problem.

II. LITERATURE REVIEW

Few research studies have been conducted on Lobatse in general but there seems to be no specific study about Peleng Township. Kalabamu, Bolaane, Lyamuya, Tema, Goabamang, and Phuthulogo (2016) produced Lobatse town profile which its objective was to seek to identify the extent of deprivation in low income neighborhoods within the town. Their conclusion included Peleng neighborhood as one of the neighborhoods which require assistance with sewage connections, house improvements and reduction in overcrowding but did not investigate about poor access.

Areola, Gwebu, and Sebego (2014) also used Lobatse as a case study when they conducted research about a spatio-temporal analysis of peri-urbanisation in sub-Saharan Africa. Their research was very rich with history of Lobatse. They concluded that there are clear social, economic and environmental consequences arising from history and physical growth of Lobatse that need to be addressed through a combination of policy instruments, development control and land conservation measures.

III. BACKGROUND/HISTORY

Peleng emerged during the times when few people owned vehicles and building technology was primitive. Since the residents were not considerate of what the future holds for their little township. They did not foresee their township being incompatible with modern technology where they will soon have to practice the use of indoor toilets using water to flush, the use of sewer trucks and fire trucks nor did they foresee the children and grandchildren owning cars. With these obscured vision as squatter settlers they focused more on getting as much plots as they could but a blind eye

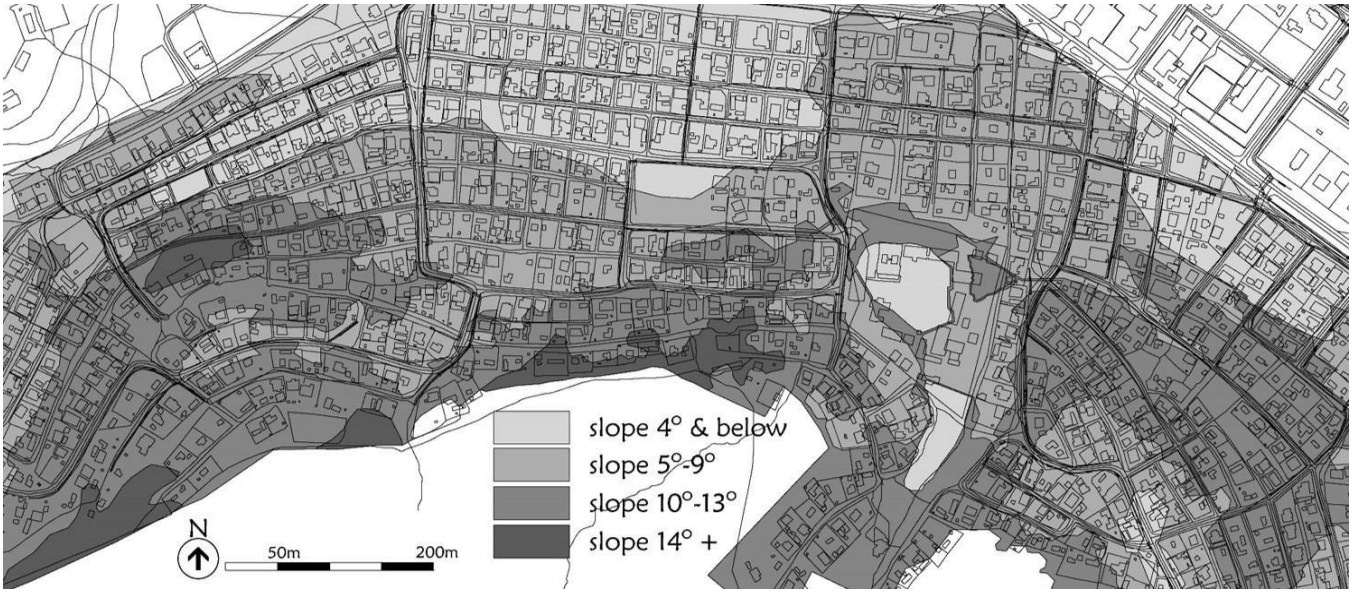

Fig.1. Part of area surveyed showing roads, plot boundaries and footprints of units per each plot

on the supporting infrastructure/facilities soon to be a vital necessity. This is the reason poor access became the resultant.

IV. METHODOLOGY AND AIM

The research method used to investigate these problems was through 160 house to house site inspection and inquiry from residents with open and close ended questionnaires. The investigation findings were then categorized as per the 3 slopes categories which were slope 4º & below, slope 5º-9º and slope 10º-13º. Slope 14º & above was not developed hence it is not included. To determine these slopes site coordinates obtained from Botswana department of surveys and mapping 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 below Seno and Ogura (2018). For the accuracy of these analyses equal number of answered questionnaires per each slope category for poor access, poor sewer system, litter and lack of parking were recorded in graphs and the results were tabulated.

The purpose of the study is to investigate the link between poor access in Peleng and how it has affected usage and maintenance of other spaces and facilities such as sanitary system (toilets and litter), drainage system and parking. Since Botswana building regulations does not have hillside regulations, the aim is to suggest mitigation of the problem from analysis through the perusal of Botswana Building Control Code (BCC) with the notion to improve the regulations by proposing hillside regulations in areas related to poor access.

V. PROBLEMS RELATED TO POOR ACCESS

Peleng residents reported about 9 forms of poor access that hindered good access of cars and pedestrians. As indicated on Table 1, the obstacles included narrow roads which can restrict some cars to use the road. Absence of cul de sac which can restrict cars or trucks from making U-turns hence making it difficult to go the other way or access certain plots. Roads close to houses can restrict pedestrian walkways, storm water drains and easy access of cars into the yard. Cars not able to enter the plot due to absence of entrance or due to small entrance hinders the cars from empting pit latrines or simply parking in the yard.

TABLE.1. Number and percentage of access problems reported by residents

Types of problem	No. of reports	Percentage
Narrow roads	33	21 %
Difficult to drive up	24	15 %
No Cul de sac	8	5 %
No speed humps	14	8.8%
Roads are close to houses	12	7.5%
No walk way for pedestrian	12	7.5%
Big cars cannot enter	22	13.8 %
No entrance	2	1.25 %
Normal cars cannot enter	11	6.9%

A. Poor sewer system

It is challenging to improve sewer system in Peleng and poor access is one of the obstacles. The hillside developments of Peleng are associated with high number of usage of Pit latrines with a record of 79% of 160 people reporting the use of pit latrines, Seno, Lyamuya and Ogura (2018). These pit latrines needs to be emptied regularly because residents reported that they become full easily whereas other residents reported that they are currently full (Seno et al, 2018). That being the case the need for sewer trucks to access these pit latrines is very important but in Peleng roads are narrow, trucks cannot enter the yard and in some plots there is no entrance hence making it impossible for the trucks to empty the pit latrines. 5.6% of residents reported that there is no access for trucks to empty the pit latrines. The situation has led the area to be famous for bad odors from the pit latrines and thus causing air pollution. Other environmental problems caused by this pit latrines include land pollution resulting from leaking pit latrines. In Botswana tradition, pit latrines were placed at the back corner of the yard due to odors it produces, now they cannot be accessed by trucks.

Fig.2. Inaccessible pit latrines due to poor access

B. Litter

The environmental problem of litter in Peleng is linked to poor access just as for poor sewer system. The upper part of hillside residents reported that garbage collector trucks cannot come regularly because of narrow roads and other access obstacles.

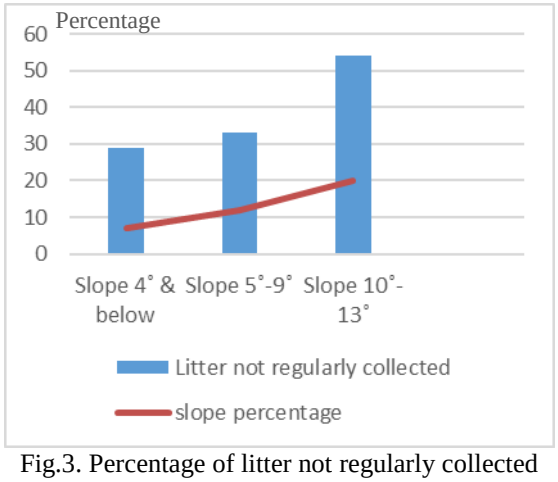

Fig.3. Percentage of litter not regularly collected per each slope category

Fig.4. Uncollected litter due to poor access

C. Lack of Parking

Poor access has been linked to insufficient parking in Peleng. One of the reasons is because cars cannot access the plots from the road. This is due to the difference in levels, where the road level is above the plot level. It was observed, recorded and reported by the residents that due to poor access into their plots, residents park their cars along the roads. In some plots there was no opening of the carb stone paving from main road to allow cars to enter, only stairs were provided for pedestrian as seen in fig.4 below.

Fig.4. Car parking on the road due to poor access

D. Poor Storm Water Drainage

Poor access has been linked to poor storm water drainage due to the fact that the roads are narrow hence there is no space for storm water drains on the sides of the roads. Storm water then runs on the road creating portholes and as it flows, it collects and transports soil, pet waste, salt, pesticides, fertilizer, oil and grease litter and other pollutants into people`s yards, Seno and Ogura (2018). The main effect of poor storm water drainage is soil erosion as seen in fig.5. Flowing storm water eats the base of foundations and exposes the rocks. The storm water drains that exists are too narrow because they are just forced on the side of the road and most of them have been blocked.

Fig.5. Effects of poor storm water drainage

VI. ANALYSIS OF THE RELATIONSHIP BETWEEN POOR ACCESS AND THE PROBLEM

After identifying the problems related to poor access, they were then analyzed in relation poor access per each slope category to seek whether or not the problems are related to poor access.

A. Relationship between poor sewer system and poor access

The analysis from fig. 5 below indicates that the reports for poor sewer system increased simultaneously with the reports for poor access per each slope category. It can also be derived from the analysis that slope 5º-9º and slope 10º – 13º are experiencing almost the same problem of poor storm water drainage as shown in fig.8. This means that the higher the slope the poorer the sewer system is.

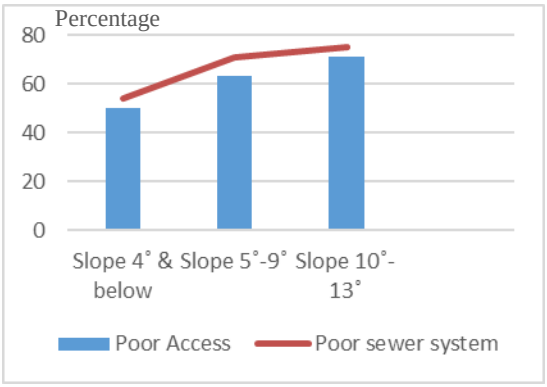

Fig.5. Percentage of poor access per each slope category against air pollution

B. Relationship between poor access, litter and litter not regularly collected

The analyses from fig.6 indicates high record of poor access as the slope increased and high record of litter not regularly collected was simultaneous to the high record of poor access, and that the increase record of litter was responding to both situations. It can also be derived from fig.6 that slope 4º & below and slope 5º-9º has less similar record of litter not regularly collected whereas slope 10º – 13º has high percentage record. This indicates that litter collecting trucks has better access on the lower slope and middle slope category than on the upper slope category.

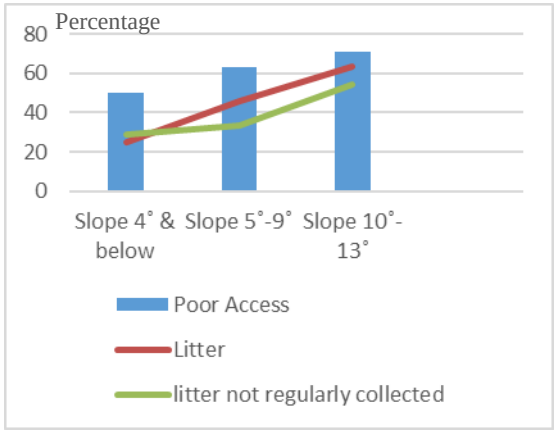

Fig.6. Percentage of Poor Access per each slope category against litter not collected and its impact

C. Relationship between poor access and lack of Parking

Between slope 4º & below and slope 5º-9º less percentage increase in lack of parking was recorded hence indicating that lack of parking problem is almost the same in this slopes categories. High percentage of poor access was recorded in slope 10º-13º more than other slope categories. The analysis indicate that high cases of poor access per each slope category can be linked to high cases of lack of parking as in fig.7.

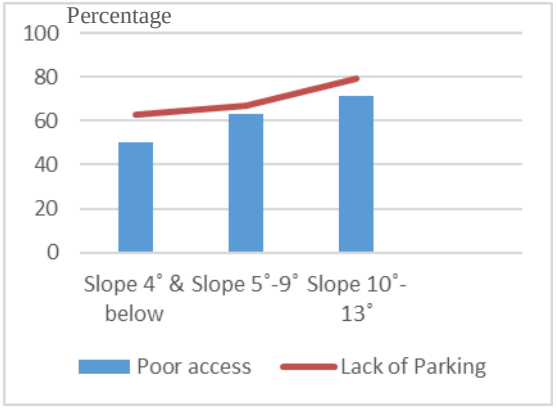

Fig.7. Percentage of poor access per each slope category against lack of parking.

D. Relationship between poor access and poor storm water drainage

Analysis shows that there is high increase between slope 4º & below and slope 5º-9º of lack of poor storm water drainage recorded than there is between slope 5º-9º and slope 10º – 13º. It can be derived from the analysis that slope 5º-9º and slope 10º – 13º are experiencing almost the same problem of poor storm water drainage as shown in fig.8.

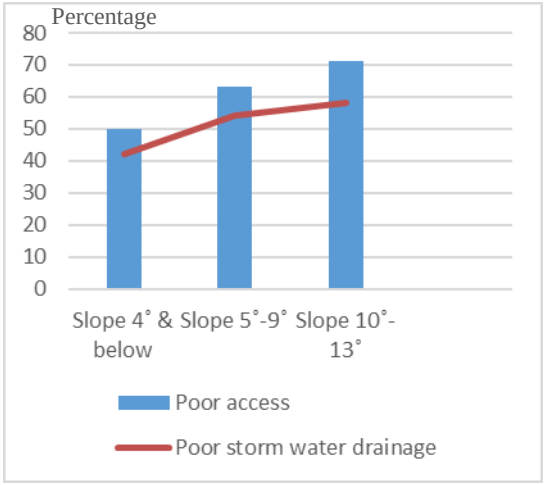

Fig.8. Increase in Poor Access recorded result in increase in poor storm water drainage recorded

TABLE.2. Indicate the effects of poor access and the reasons linked to the effects

	Effects of Poor Access			
Poor Access Reasons	Poor Sewer System	Litter	Poor Storm Water drainage	Lack of Parking
Narrow Roads	o	o	o	o
Difficult to drive up	x	o	x	x
No Cul de sac	o	o	x	x
Roads are close to the house	o	x	o	o
Big cars cannot enter	o	o	x	o
Normal cars cannot enter	x	x	x	o
No entrance	o	o	x	o

Key:
Affected by specified poor access = o
Not affected by specified poor access = x

VII. MITIGATION PROPOSAL FOR POOR ACCESS

Botswana Building regulations focus on the flat hence the proposed mitigation is to improve this regulations to suit the hillside developments. Below is the related existing flat land regulations and proposed hillside regulations for access.

A. Roads and storm water drains

Each lane shall have a minimum width of 3 meters, MLH, (2013). For hillside regulations this regulation can be maintained for access for service vehicles like trucks. As for normal cars each lane should have a minimum 2.5m because of the challenging topographical conditions. Storm water drains shall be constructed along the side of the road and shall also run behind the plot and on either side of the plot to prevent storm water from entering and eroding plots.

B. Fire, Sewer and Litter trucks access

Cul de sac shall contain unobstructed adequate aisle width 5-7 meters and turn around area for emergency MLH, (2013). For hillside regulations the aisle should be minimum 4m due to inadequate space. Litter collection areas should be constructed in adjacent areas close to wider roads for easy access by litter trucks because most of the roads are too narrow for litter trucks to access them resulting in uncollected litter.

C. Entrance and Parking

Front yard fences and walls shall have 1 access opening a minimum of 3m-4m in width, MLH (2013). The minimum proposed access opening for hillside regulations shall be 2.5m because many hillside plots are narrow. The side setbacks of buildings on the side of the entrance shall minimum of 3m to allow cars to park inside as opposed to the 1.5m setbacks for the flatland regulations. Where the plot is rocky and it is an obstacle for cars to enter, concrete paving shall be done for easy access.

VIII. CONCLUSION

The study was investigating the link between hillside problems and poor access and analyzing the reasons causing the problems then proposing forms of mitigation. Problems linked to poor access were poor sewer system, litter, lack of parking and poor storm water drainage. Analyses findings were that the reason for poor access is narrow roads, difficulty to drive up, and lack of cul de sac and because there is no entrance or it is not wide enough for fire, sewer and litter trucks to enter and provide service. The mitigation proposal was through suggesting improvements for the current building regulations which are specifically for flatland regulations. Hillside regulations were suggested as a form of mitigation.

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