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Building Compliance to Road Setback in Urban Area of Ile-Ife, Osun State, Nigeria: from Remotely Sensed Data

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Abstract

The effectiveness of physical planning is a function of developers' level of compliance to Physical development regulations provided by the planning authorities in charge of development control. This paper assessed the level of building compliance to road setback regulations and examined pattern of encroachment on major roads in Ile-Ife, Osun State, Nigeria using GIS and Remote Sensing. Ikonos 2019 of the study area was vectorised to identify contravention within setback zone on seven major roads in the study area. Questionnaire was also used to examine residents' level of awareness of development control in the study area. The findings showed that six thousand two hundred and eighty-four (6284) buildings contravened the road setback regulation along the federal and state roads with most of them concentrated at the centre of the city. Majority (3975) of the contravened structures were permanent while 2309 of the buildings were temporary structures representing 63.3% and 36.7% respectively. It was also revealed that the contraventions were linearly patterned along the roads in the study area. Majority (63.5%) of the respondents were aware of development control regulation but the situation of compliance to road setback was low. It is therefore recommended government should provide adequate support for the local planning authorities in terms of adopting modern geospatial based techniques for physical development monitoring and control.

Keywords: Building compliance, Road setback, Contravention, Planning, GIS

Mise en conformité des bâtiments à la marge de recul des routes dans la zone urbaine d'Ile-Ife, État d'Osun, Nigéria: à partir de données de télédétection

Resume

L'efficacité de la planification physique est fonction du niveau de conformité des promoteurs aux règlements d'aménagement physique fournis par les autorités de planification en charge du contrôle de l'aménagement. Ce document a évalué le niveau de conformité des bâtiments aux réglementations sur les marges de recul des routes et a examiné le modèle d'empiètement sur les routes principales à Ile-Ife, dans l'État d'Osun, au Nigéria, à l'aide des SIG et de la télédétection. Ikonos 2019 de la zone d'étude a été vectorisé pour identifier les contraventions dans la zone de recul sur sept routes principales de la zone d'étude. Le questionnaire a également été utilisé pour examiner le niveau de sensibilisation des résidents au contrôle du développement dans la zone d'étude. Les résultats ont montré que six mille deux cent quatre-vingt-quatre (6284) bâtiments contrevenaient à la réglementation sur les reculs de route le long des routes fédérales et d'État, la plupart d'entre eux étant concentrés au centre de la ville. La majorité (3975) des structures contrevenues étaient permanentes tandis que 2309 des bâtiments étaient des structures temporaires représentant respectivement 63,3 % et 36,7 %. Il a également été révélé que les contraventions étaient tracées de façon linéaire le long des routes dans la zone d'étude. La majorité (63,5 %) des répondants connaissaient la réglementation sur le contrôle de l'aménagement, mais la situation de conformité aux reculs routiers était faible. Il est donc recommandé au gouvernement de fournir un soutien adéquat aux autorités locales de planification en termes d'adoption de techniques géospatiales modernes pour la surveillance et le contrôle du développement physique.

Mots-clés : Conformité des bâtiments, Recul de la route, Contravention, Planification, SIG

INTRODUCTION

Physical planning standard and compliance is essential in any development control of urban area (Onaiwu, 2020). Planning standards builds a momentum to control spatial development (Omollo, 2020). Physical planning standard entails road reservation with their respective setback from property line. The width of the road varies from one urban centre to another, any encroachments by the public constitute a violation for which a restoration is necessary (Jibrin, 2013). The reservation is made with a view to providing for future expansion, and allowing a right of way to effectively give room for carriage way, side drains, street furniture and road side parking without distracting the traffic (Ojo-Fajuru and Adebayo, 2014). Various contraventions in Nigeria cities have taken different forms such as construction of permanent structures in open space or setbacks, front shops and much unsightly development on road and utility setbacks. Most of residential buildings and commercial activities in Nigeria cities are located within the right of way of the highway, through the use of temporary structures such as kiosks and other structures fronting the road (Aluko, 2011; Jonah, 2014). This reduces road spaces and thus increases traffic delay during peak hours and frequency of vehicle accident in such area where there is encroachment. For city to make a healthy and safe growth, there should be guidelines and regulations on the development especially as pertaining to urban planning laws which is mainly to regulate zoning practices, building height, and building setback to roads. Non-compliance to this regulation might result poor ventilation, inadequate access to road,

lack of outdoor spaces for vehicles to park, and unhealthy environment (Raji and Attah, 2017). For instance, Oyinloye, Oladosu and Olamiju (2017) observed that an encroachment to setback especially right of way might create problem on economy of region especially when communities encroach on pipeline right of way.

The development control is one of the major factors that determines the spatial structure of modern settlements. Lack of compliance to this development control may affect the structure of urban areas in term of physical, aesthetic, and economic developments. At time, misinterpretation of planning regulations among land surveyor and planners may also challenging (Onaiwu, 2020; Emamgholian, Pouliot and Shoejaei, 2021).

Tremendous efforts have been made in the pursuance of a more organized and orderly arrangement of land uses in many developing countries, and within Nigerian cities from the colonial era to date. In spite of such efforts, Nigerian cities still portray environmental problems arising from a gross disregard for development control which are evident in non-compliance to the extant laws as regarding setback to roads. Corruptions among the planning authorities and law enforcement agents contribute to non-compliance of urban residents to setback, thereby affect the structural development of urban areas (Okafor, 2020). World Bank (2015) reported that essential elements of regulating building in term of compliance are frameworks that entails are legal and administrative inclined with implementation mechanism.

With the advent of Geographic Information System (GIS) and remote sensing technologies, the process of urban planning in Nigeria received a new impetus. Capturing the spatial details by remote sensing either by satellite imageries or aerial photographs and organizing the data under GIS offered tremendous ease in undertaking urban planning activities. The integration of Geographical Information System (GIS) has provided a tool which can contribute to much clearer understanding of real planning problems as well as prescriptive planning scenarios to enhance the quality of urban planning and management. GIS and Remote Sensing becomes imperative for better and improved decision-making in urban planning and management (Mwanzia, 2014; Idhoko, Aguba, Emefeke, and Nwanguma, 2015).

There has been a growing literature both empirical as well as theoretical to analyze the use of GIS for spatial decision support system for physical development management in many countries of the world. For instance, Mwanzia (2014) adopted the application of GIS in physical planning of Mwingi Town, Kenya. It was revealed that Mwingi Town has grown in uncontrolled manner with all sorts of planning problems such as poor roads, drainage, housing, and garbage disposal among others. These problems result to a dysfunctional urban setup. The author used GIS to ameliorate the problems discovered and then produce a functional and versatile urban physical plan for use by public and private entities and also the Government of Kenya. Idhoko, Aguba, Emefeke, and Nwanguma (2015) used GIS to examine the use of digital road network for management of emergency services in Oyo

Town. Adeyemi et al. (2021) in studying of geographic information system application in flood risks observed that have observed that bad land use planning and non-compliance to setback has ignited the effects of flooding on built-up area around the watering area.

Ile-Ife like many other cities in Nigeria is faced with problem where developers have no regards for development regulations in which road setbacks have been taken over by temporary and permanent structures. In order to make proper evaluation of development control and to assess the compliance level of buildings to road setback regulations, effective technique is required. This study thus adopted remotely sensed data to assess compliance level of buildings to setbacks in Ile- Ife, Osun State.

Study Area

Ile –Ife is one of the prominent towns of Osun State covers both Ife Central and Ife East Local Government areas with a population of 501,952. The study area is located within Latitudes 7°28' N and 7°46' N of Equator, and Longitudes 4°36' E and 4°56' E of Greenwich Meridian (Figure 1). Ile-Ife is an ancient Yoruba town in south western Nigeria. Ile-Ife is about 200km to Lagos, which was Nigeria's coastal capital city for over a century (Olupona, 2011). Evidence of the urbanization of Ile-Ife has been dated as far back as 500 AD (Mabogunje, 1968). Ile-Ife is an agricultural trade centre with the presence of various products such as yam, cassava, maize, orange, kola, cocoa and vegetables etc. Ile-Ife, centre for learning and culture, is the home to one of the largest universities in Nigeria, Obafemi Awolowo University (OAU), and it is about 40km

(25 miles) to Osogbo, the Osun State capital. Ile-Ife also has road networks to other cities such as Ede, Ondo and Ilesha. The main road in the city is the one leading from Ibadan to Ilesha and Ondo which cuts through Ile-Ife.

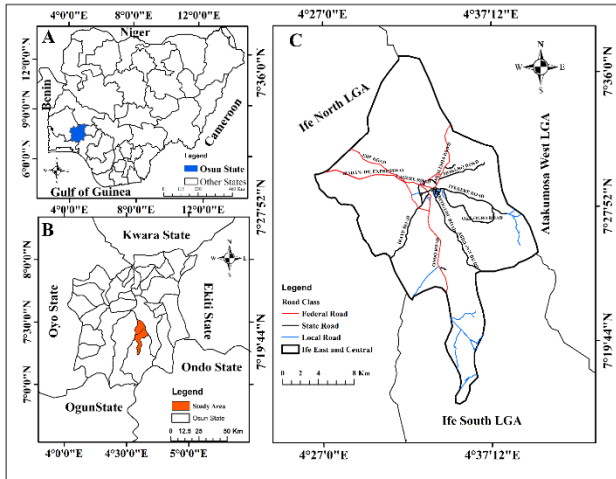


Figure: (A) Nigeria, (B) Osun State and (C) Ile-Ife Showing Roads

MATERIALS AND METHODS

Both primary and secondary data which contain both spatial and non-spatial attributes were used for this study. Responses from the owners of the randomly selected buildings within the setback along the selected major roads, and ground truthing of the contravened buildings constituted the primary sources of data. Secondary data were sourced from the Ikonos of 2019 of Ile-Ife. Buildings and roads were then vectorized from the imagery. Both descriptive and geospatial analytical techniques were performed using Statistical Package for Social Scientists (SPSS) and ArcGIS respectively. First, buffering analysis in ArcGIS 10.7 using 45 metres and 30 metres were performed on the selected roads (federal and state roads respectively) to identify contravention within the buffer. Based on this, 6284 buildings were found within the

buffer of 45 metres and 30 metres on both the federal and state road respectively. Second, 376 contravened buildings were sampled out of 6,284 contravened buildings using Slovin's formula at 95% confidence level. The questionnaires were administered to the owners or users of the buildings using systematic sampling techniques at a 10-building interval after the first building had been randomly selected. The data from questionnaire administration were analysed using SPSS.

RESULTS AND DISCUSSION

Level of Building Compliance to Road Setback Regulation in Ile-Ife

Considering the level of building compliance to road set regulation in Ile-Ife, Table 1 reveals seven segments of Federal and State Roads in the study area. According to the Federal and State Ministry of Works, Fajuyi Road to Ilesha Garage Junction was considered to be a state road while other roads selected for this study were Federal roads. The result from ArcGIS as presented in Table 1 shows that six thousand two hundred and eighty-four (6284) buildings were found within the buffer zone of 45 and 30-metres on both the Federal and State roads respectively, in which most of them concentrated at the city centre. In consideration along each of the selected roads: 934 encroached buildings were identified from Ede Road to Lagere Junction; 576 buildings from Oduduwa University Interchange to Mayfair Roundabout; 842 buildings from Mayfair Roundabout to Texaco Junction, Ondo Road; 1569 buildings from Obalufon-Fajuyi to Ilesha Road; 1150

buildings from Iremo Road to Moore Junction; 646 buildings from Aderemi Road to Omi- Okun; and 567 encroached buildings were identified from Texaco junction, Ondo Road to Ita- Osa. These are equivalent to 14.9%, 9.2%, 13.4%, 24.97%, 10.23%, 9%, 18.3%, respectively that were found to be in violation of road setback regulation along the selected roads in study area (Table 1). It was revealed that most of these buildings were partially within the buffer zone of 45-meters and 30-metres while some are wholly within the buffer zone (Figure 2). Thus, contraventions were more concentrated along Obalufon-Fajuyi to Ilesha Road (24.97%), followed by Iremo Road to Moore Junction (18.3%) then Ede Road to Lagere Junction (14.9%) respectively (Table 1). This was attributed to being the economic nerve centre of Ile Ife.

Table 1: Number of Encroached Buildings on the Road Setback

S/N	Routes	Number of encroached buildings	% of encroached buildings
1	Ede Road to Lagere Junction	934	14.9
2	Oduduwa University Interchange to Mayfair Roundabout	576	9.2
3	Mayfair roundabout to Texaco Junction, Ondo Road	842	13.4
4	Obalufon-Fajuyi Road to Ilesha Road	1569	24.97

5	Iremo Road to Moore junction	1150	18.3
6	Aderemi Road to Omi-Okun	646	10.23
7	Texaco Junction, Ondo Road to Ita-Osa	567	9
		6284	100

Total

Source: Fieldwork, 2019

Pattern of Building Structure along Road setback in Ile-Ife

Buildings in city could be inform of permanent structure majorly for residential purpose, or temporary structure majorly for commercial purposes. Figure 2 reveals that majority (3975) of buildings structures found within the buffer zone were permanent while 2309 of the buildings were temporary structures representing 63.3% and 36.7% respectively with a linear pattern along the road in the study area. Haphazard developments were observed along the roads with buildings and informal development such as kiosks, containers, and wooden shops dominated the right of way thereby leading to congestion within the city. This result can be likened to previous studies of Aluko (2011) and Ogbonna *et al.*, (2017) which revealed that the rapid growth of cities in developing country give rise to building springing up without formal planning or layout which also result to setback being taken over by front shops and a variety unsightly development. This has given rise to increased

environmental challenges as exemplified by traffic congestion, overcrowding, and waste pollution (Aluko, 2011 and Ogbonna *et al.*, 2017). The linear pattern of building along the roads in the study area was attributed to the presence of commercial activities like banking, retail/wholesale and concentration of activities which attracted consumers and ancillary service providers. This has partly caused an increase in demand for commercial space and concomitant effects on transportation along selected roads in the city.

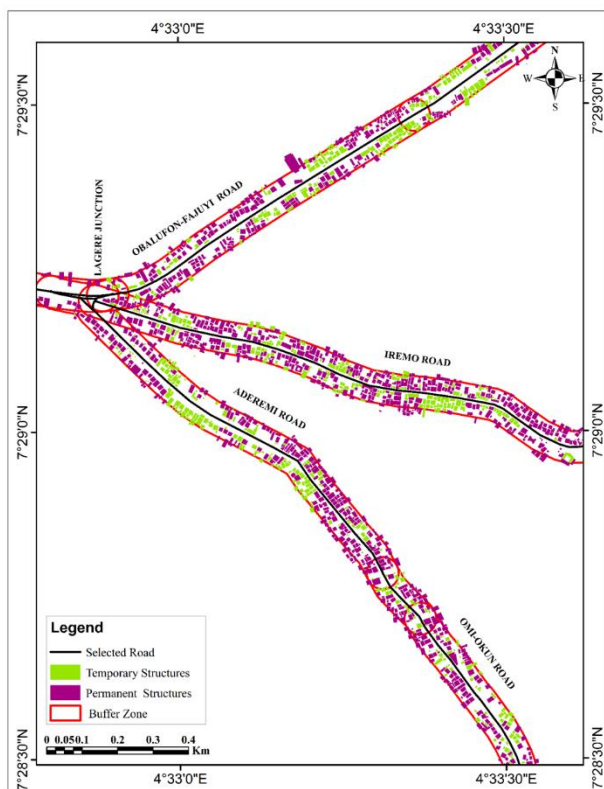


Figure 2: Pattern of Building Structure within the Buffer Zone

Source: Fieldwork, 2019

Uses of the Encroached Building Structures

Buildings in the study area has been found as being multi-functional. Figure 3 revealed that 24.5% of the buildings were used for residential purpose, 38.3% for commercial purpose, while 37.2% were used for both commercial and residential purpose. It was revealed that 38.3% of the encroached buildings were predominantly used for commercial purpose consisting of banks, street trading, corner shops, restaurants, hotels, computer centres, unorganized mini-market, and filling stations. This result resonates with that of Agbola *et al.*, (2001) and Orwa (2010) which posit that in urban areas, where population densities are relatively high, particularly in low-income residential areas, most human activities (especially commercial and industrial) tend to compete for space as close as possible to the road reserve, even some spill into the road reserves. This phenomenon has led to the formation of corridors along transport routes which are characterized by highly intensive informal commercial, residential, and other roadside human activities along the road reserves. From this study, it was inferred that majority of the residential building have been converted and used for commercial purposes, generating enormous human and vehicular traffic to the area, and therefore impeding the landscape elements along the roads in the study area.

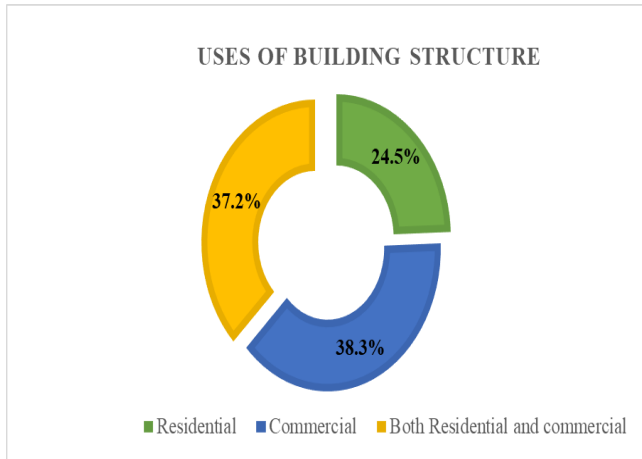


Figure 3: Uses of Building Structure
Source: Fieldwork, 2019

Table 2 reveals that 26% of encroached structures have been built for less than 5 years while 32% of the structures have been built for 5-10 years; 27% of the encroached structures have been built for 11-20 years, while 9%, of the structures have been built for 21-30 years and 6% of the structures have been built for 30 years above. It was deduced that majority (85%) of the encroached buildings in the study area have been built in not more twenty years. This was attributed to the influence of rapid population growth in the study area over time.

Table 2: Years of Building Structures

Years	Frequency	Percent
Less than 5years	98	26
5- 10years	119	32
11-20years	103	27
21-30years	35	9
31years and above	21	6
Total	376	100.0

Source: Field Research, 2019

Levels of Awareness and Compliance with Development Control Regulations

In term of awareness, 63.5% of the respondents rated that there was a very high level of peoples' awareness of development control regulations, 11.3% agreed that the level of awareness was moderate while 24.3% of the respondents rate the level of peoples' awareness of development control regulations was being low (Table 3). Despite the high level of contravention, it could be deduced that there was a high level of awareness of physical planning laws and regulations as regard to the obtainment of planning permits prior to any development. There are different means of awareness on development control regulations as 75.3% of the respondents were aware of development control through contravention notices while 12.5% of the respondents were aware through mass media, 8% of the respondents were aware through period of building collapse while 4.2% of the respondents are aware of developments control through demolition exercise. This indicates that many of building developers neglected the development control standard until the contravention notices are served to them. Table 3 also reveals that only 42% of structure possessed planning permission from the local planning authority, while 58% never had development permits. This indicates that more than half of structures in the study area were constructed without approved plans. It could be deduced that the level of compliance to physical planning regulations in the area did not correspond with the peoples' level of awareness.

Table 3 also presents the reasons why residents did not have development plans, as

majority of the respondents (54.5%) claimed that the cost of development plan was high while 29.8% of the respondents claimed that development plan processing was time consuming. It was further revealed from Table 3 that 15.7% of the respondents claimed development plan was not necessary in the construction process. The function of the local planning authority was viewed by 39.6% as development control agencies; pinpointed by 37.5% as only to approve development plan, identified by 22.9% of the respondents as to enforce laws related to planning. The performance of town planners in ensuring compliance to road setback was poor based on 72.9% of the respondents, fair by 18.4% of the respondents, and 8.8% of the respondents rated the performance of town planners in ensuring compliance to road setback as being good (Table 3). It was summarized that the development control authority was not performing well in its effort to curb encroachment on road setback. They only approved development plan without ensuring compliance to the development plan.

Various solutions have been suggested to road setback contravention as 32.4% of the respondent's recommended demolition of the encroached buildings, and 22.1% of the respondents suggested a strong public participation in development control activities. While 19.9% of the respondents submitted that public awareness programme for developers should be conducted; 14.6% of the respondents agreed that offenders should be punished, perhaps this could serve as a deterrent to others; and 10.9% of the respondents suggested a redevelopment approach (Table 3).

Table 3: Levels of Awareness and Compliance with Development Control Regulations

Activities	Variables	Frq.	%
level of people's awareness of physical planning	Very low	41	10.8
	Low	51	13.5
	Moderate	43	11.3
	High	68	17.9
	Very high	173	45.6
	Total	376	100
Sources of information	Demolition exercise	15.8	4.2
	Contravention notices	283	75.3
	Period of building collapse	30.2	8
	Mass media	47	12.5
	Total	376	100
Property with building permit	Yes	158	42
	No	218	58
	Total	376	100
Reason for not preparing building plan before construction	High cost of plan approval	205	54.5
	Not necessary	59	15.7
	Delay in plan approval	112	29.8
	Total	376	100
View of the function of Local planning authorities	Control development	149	39.6
	Approve development plan	141	37.5
	Enforcement	86	22.9
	Total	376	100

Performance of local planning authorities In ensuring compliance to road setback	Very poor	158	42
	Poor	116	30.9
	Fair	69	18.4
	Good	23	6.1
	Very good	10	2.7
	Total	376	100
Suggestions to road setback contravention	Demolition of encroached buildings	122	32.4
			14.6
	Punish the offenders	55	19.9
		75	22.1
	Public awareness	83	10.9
		41	100
	Total	376	
	Strong public participation		
	Redevelopment approach		
	Total		

Source: Fieldwork, 2019

CONCLUSION

This study revealed the distinctiveness of Remote Sensing and GIS in evaluating cases of infringements on road setback in the city spatial structure of Ile-Ife. The study concluded that there was high level of contraventions on the road setback in Ile-Ife. Haphazard developments were linearly patterned along the road corridor dominated by buildings constructed spontaneously. The road setbacks were dominated by informal development such as kiosks, containers, and wooden shops, which were located within the right of way thereby leading to congestion within the city. Despite the high level of awareness on development control regulation, developers still contravened road

setback without regards to approved development plan. To ameliorate this challenge, the study recommended that the government should provide adequate support for the local planning authority in term of technical and man-power; and demolish the contravened structures. The state government should adopt geospatial technique in timely monitoring of development control activities and this will serve as a routine check and prompt discovery of all contravention within the city. This would ensure the smart city in Ile-Ife and Nigeria as a whole.

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