# PROXIMITY OF HVOTLS AND RESIDENTIAL RENTAL VALUES IN THE METROPOLITAN LAGOS

***Akinjare, Omolade Adedoyin***
Department of Estate Mgt, School of Environmental Sciences, C.S.T, Covenant University, Canaanland, Ota, Ogun State, Nigeria

***Akinjare, Victoria Adeola***
Department of Banking and Finance, School of Business, C.D.S, Covenant University, Canaanland, Ota, Ogun State, Nigeria

***Oluwatobi, Afolasade Olubunmi***
Department of Estate Mgt, School of Environmental Sciences, C.S.T, Covenant University, Canaanland, Ota, Ogun State, Nigeria

**Abstract:**

High Voltage Overhead Transmission Lines (HVOTLs) otherwise referred to as power-lines have been thought to influence property values over the years. This study investigates the relationship between distance to HVOTLs and the rent of homes in metropolitan Lagos.

Questionnaires were distributed to estate surveying firms, residents within 200m to power-lines in Surulere and Alimosho areas of Lagos while an in-depth interview of managers and field officers of Akangba and Alimosho PHCN sub-station was conducted. Average response rate was 66.5% and collated data were analysed.

Findings revealed that residential property rents increased as distance from power-lines increased and the existence of a null effect on the rent of residential properties located over 100m away from power lines.

Finally, the study encouraged the burial of yet-to-be constructed power-lines and strict enforcement of ROWs within Lagos metropolis where power-lines already exist to abate the effect of power-line on property investments.

**Keywords:** Hvotls, Power-Line, Residential Property, Rental Value and Lagos Metropolis.

## 1. Introduction

Neighbourhood attributes have been known to influence the value of real estate. Where functional amenities such as tarred roads, electricity and groomed landscape exist, real estate values have being known to be on the rise but where disamenities such as landfills, poor drainage systems and disfunctional social infrastructure exist, the downslide of real estate figures have being noted. This current study tries to determine the effect of power line proximity on the rents payable for residential properties within Lagos metropolis. Where a negative effect is noted, the study is also geared at measuring and establishing the approximate range of distance where such effect erodes completely.

## 2. The Study Area

The history of Lagos is traceable to 1472, when the Portuguese first visited the old Yoruba settlement then and still known as "Eko" and named it a port for ferrying both human and material cargo to Europe. By 1861, it was annexed by the British who at this time opposed slavery sternly and governed it as a crown colony. In 1914, Lagos became the capital of the Colony and Protectorate of Nigeria. In 1960, the city became the capital of independent Nigeria and rapidly developed due to the oil boom in the early 1970s. Located between latitudes $6^0\ 21^1$N and $6^0\ 34^1$N and longitudes $3^0\ 01^1$ E and $3^0\ 27^1$E, Lagos State is located in the south western region of Nigeria and is bounded in the north and east by Ogun State, south by the Atlantic ocean and west by Benin Republic.

Located on a total landed area of 3,345 sq km (1,292 sq mi) on four principal islands and adjacent parts of the Nigerian mainland, the islands are connected to each other and to the mainland by bridges. This represents 0.4% of Nigeria's territorial landmass (Esubiyi, 1994). Major sections of the old city include Ebute-Metta, Yaba, Surulere, and Somolu, which now serve as the commercial district, on western Lagos Island; Ikoyi Island, situated east of Lagos Island; Apapa, the chief port district, located on the mainland; residential Victoria Island; and industrialized Iddo Island. Importantly, mainland suburbs which formerly were part of the old western region were incorporated as part of the city in 1967. These areas included Agege, Ikeja, Alimosho, Alakuko etc. (Microsoft Encarta, 2007)


**Fig. 1:** Map of Metropolitan Lagos.

**Source:** Lagos State Ministry of Information

Deductions from the result of the 2006 population census, indicates that Lagos state is believed to be the most populous state in Nigerian after Kano with a population of over 9 million people. Though, the result was contested by the then Lagos State Government, led by Asiwaju Bola Ahmed Tinubu, who by a state sponsored census exercise, declared its population as hitting the 14 million mark (Sandra Yin, 2007).

## 3. Previous Studies

Numerous early studies such as those of Kinnard (1967), Wertheimer, N. and Leeper, E. (1979), Colwell and Foley (1979), Savitz D, et al (1988) and those of recent times such as Chalmers and Voorvaart (2009), have all sort to investigate both the impact of power lines on the property values, its probable effect on the health of residents within close range and have concluded with varying degrees of findings as would be noted below.

Hamilton and Caruthers (1993) analysed a six year property market data. They found a diminution value of 5% on properties within a proximity of 120 meters. Hamilton and Schwann (1995) surveyed 12,907 residential dwellings within four neighbourhoods in Vancouver, British Colombia within a period of 6 years (1985-1991). The two academics' analysed results also detected a 6.3% diminution effect on properties located 100 meters to a 230Kv power line and a 1.1% diminution effect on properties 200 meters from another 500Kv power line. Complete removal of the pylon and power lines increased value by a 6.3% margin. Rosiers (1998), agreed with the findings of Colwell (1990) which portrayed a diminution in property values as a result of the visual effects of pylons and power lines. After a survey carried out on 507 single family sales, analysis showed a lesser diminution value on a property physically close to a HVOTL but with its glare shielded by a wood. This was

unlike other properties with less proximity which had the direct view of the power lines unshielded.

In Sims (1996), professionals in the real estate industry were subjected to a psychometric test anchored on assessing their perception regarding contaminated land. Results showed that overhead power cables were perceived to be low risked. This differed from the study outcome of Slovic (1992) which indicated a greater perception of risk in this regard. According to Sims (2001), these studies enhanced media exposure on the issue of power-lines as they affect property values.

Des Rosiers (1998) studied the impact of high-voltage transmission lines on surrounding residential property values using a micro-spatial approach. The research was anchored on a sample of 507 single-family houses in the city of Brossard, Greater Montreal, Canada; 257 of these town cottages sold during the study period between February 1991 and November 1996. The study area comprised three distinct neighbourhoods (R, S, and T) with a 315 kV transmission power line traversing through the center. The data bank included 25 residential property descriptors relating to physical, environmental, neighborhood, access, fiscal and sales time attributes, as well as a series of power line related descriptors. Standard and stepwise regression procedures were successively used in the analysis. The model showed that a residential property both adjacent to an HVTL easement and facing a pylon would experience a drop in value due to visual encumbrance by approximately 9.6% of the mean house price. Residences located 1 to 2 lots away from a pylon were found to usually benefit from a market premium due to increased visual clearance and privacy. This premium, on average is within the range of 7.4% and 9.2% of the mean house price. A property located directly beneath the power line would suffer a decrease in value because of low minimal clearance of the lines fostering visual obstruction. This decrease is lesser and averages about 4.7% of the mean home price. Residences with a moderate rear or side view on a power line structure but not adjacent to the easement usually experience a market premium of 2.8% to 3.8% due to the improved visual clearance these residential properties benefit from. The net visual encumbrance defined as the difference between proximity obstacles and advantages was found to reach its peak at about 50 to 100 meters away the easements' external boundary. It also diminished quickly and thereafter, entirely faded away 150 meters and beyond. Luxury home prices were also found to be more sensitive to the visual encumbrances of power line structures. However, the methodology of this in-depth study was based only on sales value and not the passing rent of residential properties. This current study initiates and facilitates the use of residential rental values in measuring power line effects.

Wolverton and Bottemiller (2003), an assenting study of an earlier research work by Cowger et al (1996) investigated the possibility of the outcomes of the original study re-occuring while using more rigorous and analytical methodologies. Cowger's study used a paired sales analysis in determining observed differences in the sales price of properties adjoining transmission line ROWs in Portland, Vancouver, and Seattle, and similar properties located in the same cities but out of the view of power lines. Though, the original study did not control differences between the subject properties and their comparables, Wolverton and Bottemiller attempted to surmount that setback using regression analysis. Analysis of covariance (ANCOVA) was made use of to determine how adjoining power line short change sales price. The data provided by the models did not support any price effect on residential property from being located adjacent to any power line. This affirmed the conclusions of the original study of Cowger, that sales prices of properties were not momentously affected by the presence of a power line. Also, the data showed no discrepancy in appreciation rates between residences beside power line ROW and residences situated further away from the power line. This study was thorough in using paired sales analysis in line with regression in determining the impact of power lines on residential properties but this current study will be streamlined to utilising the passing rents of various cadres of residential properties in determining the effect of power lines on residential properties.

Chalmers and Voorvaart (2009) also addressed the issue of power line impacts on residential property values and prices using a multiple regression framework. The study anchored on the sales of residential properties (between 1999 and 2007) abutting a 345 kV transmission lines in Connecticut and Massachusetts. The authors investigated the influence of actual distance proximity and encumbrance on sales price and found proximity to have an insignificant effect on sales price. They concluded that ''the only variable that appears to have any kind of systematic effect is the encumbrance variable,'' although its statistical significance varied and the effect was ''generally small.'' The authors also addressed potential effects due to the visibility of the transmission line structures and found no significant impacts on sales prices. Though no statistically significant effect was found on residential properties using sales price, this current study aims at determining effects via the use of rental values instead.

Lastly, Akinjare *et al* (2012) again addressed the impact of power lines on residential properties in highbrow metropolitan Lagos, Nigeria via ANOVA multivariate analysis. Within a perpendicular distance of 200m from abutting power lines, findings revealed that rents values increased as distance from power-lines increased averagely by =N=5,000.00 and

a mean value impact of =N=786 on neighbourhood rental value was ascertained. In a related study, Oluwunmi *et al* (2012) ascertained the pattern of rental values around power line facilities still within a 200m perpendicular distance of power lines in Lagos metropolis and also discovered a homogeneous trend in residential property value and neighbourhood characteristic. The studies urged the government to opt for buried armour cables instead of power-lines and the strict enforcement of ROWs within Lagos metropolis where power-lines already exist, in a bid to abate the effect of power line on property investments.

This current study identifies the absence of Nigerian literature on this subject and seeks not to only compliment existing studies internationally but also investigate the relationship between HVOTLs and rental values of residential properties in metropolitan Lagos.

## 4. Research Method

Primary data were collected through questionnaires distributed to 436 residents within 200m to power-lines in Surulere and Alimosho areas, 139 registered Estate Surveying firms in Lagos State to obtain data on rents between the period of 2005-2009. The study sampled every other residential building along power line routes and within a 200m perpendicular distance from the four power line routes totalling 31km in Surulere axis. These routes are namely: Akangba-Ojo (11km), Akangba-Isolo (7km), Akangba-Ijora (5km) and Akangba-Apapa (8km) routes. Within the Alimosho power line axis, residential sampling was accomplished along and within a 200m perpendicular distance to the 10km Alimosho double pylon track.

Response rates of 56.8% and 53.5% were achieved for Surulere and Alimosho areas respectively while a 76.2% response rate was gotten for registered Estate Surveying firms. In a bid to further understand powerlines, an in-depth interview with the Managers and field officers of the Akangba and Alimosho PHCN sub station was conducted for the purpose of this research. In all, the survey recorded an average response rate of 66.5% and collated data was analysed using the descriptive and analytical statistics.

Since the impact of power lines on the rents of nearby residential properties were not expected to be uniform as rents were presumed to increase with distance away from the power line, a four point distance range in the order of 0-50m, 51-100m, 101-150m and 151-200m was adopted as opined by Chalmers, J.A. et al (2009) in analysing the impact power line on the rents of residential properties.

## 5. Data analysis and Discussion

In establishing the relationship between distance away from HVOTLs and residential property values, frequency interval tables and percentages, for each category of residential property around Surulere and Alimosho were applied accordingly. The data obtained are as shown in Table 1.

**Table 1: Mean Rental Values and Distances of Properties around HVOTLs in Surulere (=N=000.00).**

| Dist (m) | Residential Property Type | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Tenement | 1bdrm Flat | 2bdr Flat | 3bdr Flat | 2bdrm bungalow | 3bdrm bungalow | 3bdrm Duplex | No of Ppties | % of Ppties. |
| | Rent | Rent | Rent | Rent | Rent | Rent | Rent | | |
| **0-50** | 46 | 152 | 230 | 466 | 354 | 714 | 884 | 33 | 15.5 |
| **51-100** | 70 | 176 | 254 | 490 | 378 | 712 | 912 | 47 | 22.1 |
| **101-150** | 94 | 250 | 276 | 530 | 410 | 770 | 970 | 68 | 31.9 |
| **151-200** | 96 | 250 | 280 | 550 | 425 | 800 | 1000 | 65 | 30.5 |
| **Total** | | | | | | | | 213 | 100.0 |

**Source: Author's Field Survey (June-November, 2010.)**

Table 1 shows that on the average, the number of houses along Surulere's HVOTL axis increase as distance away from the power line increase. Inclusively, rental values of all property cadres increased outwardly. The analysis in the above Table reveals that 15.5% of the houses were located within 0-50m, 22.1% were located within 51-100m, 31.9% were located within 101-150m while 30.5% of the properties were located within 151-200m of the power line.

It can therefore be concluded that rental values of residential properties vary with distance away from the power line and that the concentration of houses also increase away with distance from the power-line. It further portends that people prefer to reside away from the immediate vicinity of HVOTLs and therefore choose to pay more for the same property provided the impact of the power line is minimal or non existent.

### 5.2 Alimosho Area.

For the Alimosho power line axis, the study was resolved using frequency interval scale and percentages for each category of residential property as shown in Table 2.

**Table 2: Mean Rental Values and Distances of Properties around HVOTLs in Alimosho. (=N=000.00)**

| Dist (m) | Residential property Type | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Tenemnt | 1bdrm Flat | 2bdrm Flat | 3bdrm Flat | 2bdrm Bungalow | 3bdrm bungalow | 3bdrm Duplex | No of Ppties | % of Ppties. |
| | Rent | Rent | Rent | Rent | Rent | Rent | Rent | | |
| -50 | 35 | 8 | 0 | 05 | 96 | 120 | 80 | 3 | 0.6 |
| 1-100 | 54 | 0 | 5 | 20 | 107 | 136 | | 0 | 4.4 |
| 01-150 | 60 | 0 | 15 | 50 | 125 | 160 | 00 | 9 | 1.7 |
| 51-200 | 60 | 0 | 25 | 50 | 130 | 160 | | 8 | 0.9 |
| oid | | | | | | | | | .4 |
| otal | | | | | | | | 23 | 00.0 |

**Source: Author's Field Survey (June-November, 2010.)**

Table 2 shows the analysis of rental values for the above cadre of residential property within the neighbourhood of Alimosho power line axis. The general pattern of residential property distribution revealed that the number of houses increased as distance from the power line increased, though this was not so for properties within the 101-150m perimeter. This must have been due to the tarred road constructed within the first 15m measured from the outer fringe of the power line axis leading to office of the African Independent Television (AIT), Agbado crossing as observed by the researcher. In-depth interview with the residents confirm that a 10m ROW exists commencing from boundary between the road and the development line for adjacent plots. Notably, this axis had two different HVOTLs side by side running from the PHCN substation located in Alimosho, Ipaja, Lagos State with an existing 25m ROW between them. Only makeshift structures housing the activities of artisans in the day were noted to occupy the 25m ROW separating both HVOTL installations. Unlike the Surulere axis, where properties where sometimes a meter or two from the power line, due to intensive development, the Alimosho axis seemed to accommodate the decorum of the use of ROWs being a suburb of the every busy Lagos metropolis fraught with much commercial and low profile housing development. Analysis from the Table shows that 10.6% of properties were located within 0-50m of the power line, 24.4% within 51-100m, 31.7% within 101-150m, 30.9% accommodated within 151-200m from the base of the power-line. 2.4% representing 3 questionnaires where void in the aspect of residential type. In appraising

the rental values in relation to distance away from the HVOTL as shown in the above Table, it was observed that value increased with distance away from the power line.

### 5.3 Percentage Distribution of Residential Properties within 200m from HVOTLs.

The study attempted to examine the distribution (%) of all categories of residential properties within 200m from each of the HVOTL in the study areas.

**Table 3: HVOTL-Distance Percentage Distribution of Residential Property.**

| HVOTL Axis | Distance (m) | | | |
|---|---|---|---|---|
| | 0-50 | 51-100 | 101-150 | 151-200 |
| Surulere | 15.5 | 22.1 | 31.9 | 30.5 |
| Alimosho | 10.6 | 24.4 | 31.7 | 30.9 |

**Source: Author's Field Survey (June-November, 2010.)**

Table 3 shows the distribution of residential property in the two study areas in relation to distance away from the power-lines. The pattern of distribution shows that Surulere had more properties (15.5%) located within the first 50m while Alimosho axis had more residential properties (24.4%) located within 51-100m of HVOTLs. In a close tie, residences within the 101-150m range in Surulere exceeded those of Alimosho by 31.9% to 31.7%. In the same vein, residences within the 151-200m distance range in Alimosho axis surpassed those of Surulere by a margin of 30.9% to 30.5%.

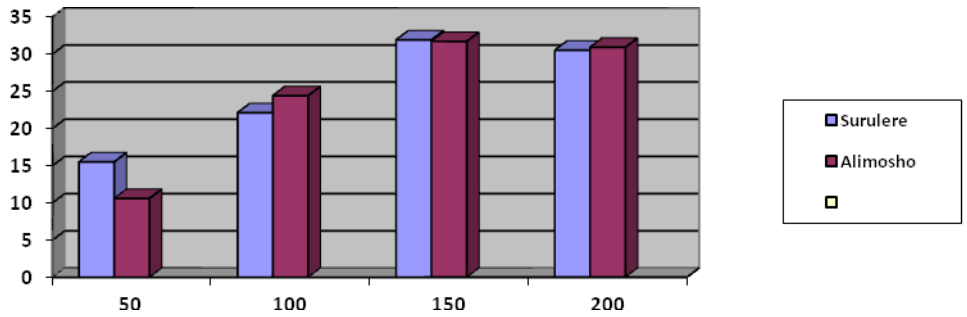


**Fig. 2: HVOTLs–Distance Percentage Distribution of Residential Property**

Key: y = 5% and x = 50meters

The pattern of residential property distribution within the 200m perimeter from the HVOTL shows clearly that rental values increased with distance away from the various HVOTL axis and were highest within the 101 and 150m perimeter. The pattern is represented in graphical illustration as shown in Fig. 2.

## 6. Findings

A detailed analysis of the survey conducted across the neighbourhoods of the two HVOTL neighbourhoods showed that foremostly, as distance increased away from the HVOTLs, there is an increase in residential property rental values.

Secondly, the highest rents recorded for properties occurred between the 151m-200m away from the HVOTLs. Also, HVOTLs do not have any negative effect on residential property rents once located over 150m away. Lastly, 31.7% of the residential property within the two HVOTLs neighbourhoods were located between 100m-150m away from the HVOTLs while 30.7% of residential properties were located between 151m-200m.

## 7. Recommendations

The findings above have a number of policy implications that must be addressed by the government. The following recommendations are hereby put forward for consideration by government and other stakeholders, as might be applicable. The Federal Government of Nigeria should seek the use of alternative and more creative channels of bulk electric energy transfer. Though HVOTLs appear to be the cheapest option, redesigning pylons into more environmentally appealing forms may further reduce the impact of its imposing nature on the built and natural environment. Also, the sub-surface mode of electricity transfer should be encouraged as it obtains in the petroleum industry where sub-surface pipeline is employed in transferring oil products from on part of the country to another. Effective periodic maintenance should be carried out by the PHCN on HVOTLs with a view of replacing them with insulated wires. Also, the emforcement of the ROWs throughout the Lagos State must be implemented forcefully. ROWs would aid effective monitoring which in turn would keep vandals at bay and promote safety consciousness in residents living at proximal distances.

Furthermore, it is recommended that the Nigerian Institution of Estate Surveyors and Valuers (NIESV) fund research efforts into new valuation techniques for measuring the impact of power lines on the values of various property types.

Finally, the Departments of Estate Management in the various tertiary institutions should be encouraged to review their curiculum to take into account of environmental challenges such as those from HVOTLs.

## 8. Conclusions

This study has established that there is a negative correlation between HVOTL and the rental values of residential property values. In order to mitigate the adverse impact of HVOTLs on residential property values, machinery should be set in motion to enhance the neighbourhoods through the provision of health centers, boreholes and street lighting facilities.

Finally, it is hoped that the findings contained in this research work will be of particular interest to the academic community, Power Holding Company of Nigeria, Estate Surveyors and Valuers and other stakeholders in diaspora.

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