

KADUNA STATE UNIVERSITY ENVIRONMENTAL SCIENCE JOURNAL (KESJ)



VOLUME 1 ISSUE 1 MARCH 2020



THE EDITORIAL BOARD

NAME	INSTITUTION	CONTACT DETAILS
Prof. Nghai Suleiman	Department of Architecture Kaduna State University Kafanchan, Kaduna State	08038086923 nghaisule@gmail.com nghaisule@yahoo.com
Prof. Leonard N. Moughalu	Department of Environmental Management Nnamdi Azikiwe University Akwa, Anambra State	leomuo2003@yahoo.com
Prof. Abel Olaleye	Department of Estate Management Obafemi Awolowo University, Ile Ife, Osun State	08033858591 aolaleye@oauife.edu.ng a_olaleye2000@yahoo.co.uk
Prof. Modupe Omirin	Department of Estate Management University of Lagos, Akoka, Lagos State	08037257773 mimirin@unilag.edu.ng omirin2@yahoo.co.uk
Prof. Augustine C. Eziashi	Department of Geography and Planning University of Jos, Jos, Plateau State	08036148105 eziashi2002@yahoo.com
Dr. Joy Joshua Maina	Department of Architecture Ahmadu Bello University, Zaria, Kaduna State	08186066933 joyaminal6@gmail.com
Dr. Hosea K. Mande	Department of Environmental Management Kaduna State University Kafanchan, Kaduna State	08130631666 hosea.mande@kasu.edu.ng
Dr. Amos Olaolu Adewusi	Department of Estate Management Federal University of Technology, Akure, Ondo State	08135631484 aoadewusi@futa.edu.ng
Dr. Mustapha Abdulrazak	Department of Quantity Surveying Ahmadu Bello University, Zaria, Kaduna State	08094300081 musteephd@gmail.com
Dr. Anita Adamu	Department of Quantity Surveying Federal University of Technology, Minna, Niger State	08037036163 ninadzi@yahoo.com
Dr. Bununu Yakubu	Department of Urban and Regional Planning Ahmadu Bello University, Zaria Kaduna State	08061606504 yaxbununu@gmail.com

TABLE OF CONTENT

Spatial Distribution and Perceived Environmental Health Impacts of Petrol Filling Stations in Ede, Osun State, Nigeria <i>Olanrewaju, S.O., Raheem, W.A., Ola, A.B., Ige, V.A</i>	1
Urban Renewal as a Tool for the Sustainable Development of Kaduna Urban Area <i>Auwalu Faisal Koko</i>	19
A Review of Unethical Practices Among Construction Professionals and Measures to Curb Them <i>Christiana Ada Adah</i>	31
Application of Modis-NDVI for Vegetation Change Detection Across Nigeria from 2000 to 2019 <i>Abdullahi Muktar and Sadiq A. Yelwa</i>	41
An Assessment of Planning Standards and Compliance Level of Petrol Stations in Kaduna Metropolis <i>Abubakar, S.A., Okere, D.C. and Usman, A.K.</i>	49
Identification of Key Barriers Against Implementation of Lean Principles in Construction Projects in Edo State <i>Osabhie Paul ESANGBEDO, Ahmed IBRAHIM, Dominic E. EALEFOH</i>	65
Evaluation of Market Prices of Building Materials for Proactive Cost Management in Nigeria <i>Dr. Yusuf Joe Gandu, Mr. Yakubu Micheal Zaki and Dr. Yakubu Gimson Musa-Haddary</i>	73
Simulation of Courtyard Buildings for Effective Thermal Performance in Temperate-Dry Climate of Nigeria <i>Markus, B.¹, Isa, A.A.² and Abdulmalik B.M.², Anifowose, K.J.³</i>	85
An Analysis of Rainwater Infiltration on Three Agricultural Land Use Surfaces in Peri Urban Akwanga, Nasarawa State, Nigeria <i>Adoga, Peter Adoga¹* and Muhammed, Ummi Khaltum²</i>	97
Competency Requirements for Real Estate Practice: The Nigerian Experience <i>Joshua Ugbede ADAMA¹ and Abel OLALEYE</i>	109
Assessment of Electrical Hazard Awareness and Risk Management in Buildings (A Case Study of Kano Metropolitans) <i>*Sule, H. J., Moyi M. Z., Auwalu B. A., Aliyu B. S., Bello D. Y., M. Abbas, Fareed L. Z.</i>	122
Predicting Academic Success of Architecture Undergraduates at Kaduna State University Using Logistic Regression Analysis <i>Joy Joshua Maina¹ & Henry Ojobo²</i>	132
Child Deprivation and Labour in Core Area of Akure, Nigeria <i>Gabriel, E.</i>	145

Editor-In-Chief

Dr. Henry Ojobo
Department of Architecture
Faculty of Environmental Sciences
Kaduna State University.
email: henry.ojobo@kasu.edu.ng

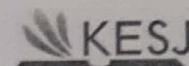
Editorial Secretaries

Ezra Lekwot Vivan
Department of Environmental
Management,
Faculty of Environmental Sciences,
Kaduna State University.
email: ezra.vivan@kasu.edu.ng
ezrav540@gmail.com.

Joshua U. Adama
Department of Estate Management,
Faculty of Environmental Sciences,
Kaduna State University.
email: mailjadamz@gmail.com

Ibrahim Ahmed Ade
Department of Building,
Faculty of Environmental Sciences,
Kaduna State University.
email:
ibrahimahmed7560@gmail.com

**SPATIAL DISTRIBUTION AND PERCEIVED ENVIRONMENTAL HEALTH
IMPACTS OF PETROL FILLING STATIONS IN EDE, OSUN STATE,
NIGERIA**



¹OLANREWaju, S.O., ²RAHEEM, W.A., ²OLA, A.B., IGE, V.A.³

¹Department of Urban and Regional Planning, Kebbi State University of Science and Technology, Aliero, Kebbi State, Nigeria

²Department of Urban and Regional Planning, University of Ilorin, Ilorin, Kwara State, Nigeria

³Department of Urban and Regional Planning, Crown Polytechnic, Ado-Ekiti, Nigeria

Corresponding email: olanrewajusamson9@gmail.com

Abstract

The environmental health risks associated with petrol filling stations (PFSs) requires maximum compliance with planning standards in siting them. However, people's awareness of the effects of PFSs on health and environment is germane to achieving efficient urban environmental health. This study, therefore, examined the spatial distribution of PFSs and the people's perception of the health and environmental implications of PFSs in Ede, a traditional city in Nigeria. Cross sectional survey design and simple random sampling technique were used for data collection. A structured questionnaire was used in collecting information from the residents. GPS was used in obtaining the coordinates of the PFSs while speedometer was used in determining the distance of the PFSs to each other and residential land use. Fifteen PFSs were identified and sampled in the entire township. The information was obtained from the managers of the PFSs through questionnaire. Also, a total of 150 pretested structured questionnaires were administered to randomly selected residents of adjoining neighbourhoods to the PFSs. Descriptive statistics (frequency and percentages) was used to obtain the residents' perception of the effects of PFSs on the environment and human health. ARCGIS 10.2 and Nearest Neighbour Analysis were used to establish the spatial distribution of PFSs. The people's perception of the PFSs effects was low. With the nearest neighbour index of 0.71, the PFSs were linearly clustered along the major roads that dissect the town. There was less compliance to planning standards by majority of the PFSs. Embarking on awareness programme among the residents and enforcement of planning standards in siting PFSs and other land uses will go a long way in addressing the problems of low perception and non compliance with planning standards.

Keywords: Development control; Petrol filling station; Planning standards; Spatial distribution.

Introduction

The phenomenal increase in urban population in Nigeria which can be traced to the post-independence economic boom occasioned by the discovery and exploitation of crude oil in commercial quantity has triggered unabated growing demand for petroleum products. This is as a result of increase in car usage due to lack of effective

urban public transport system, increase in domestic use due to ineffective public power supply and increase in small and medium scale industrial activities (NBS, 2018). For instance, the demand for petrol in Nigeria increased from 20 million litres in 2001 to 35 million in 2011 and further increased to 50 million litres in 2018 (DPR, 2019). To effectively meet the growing demand, both public and private enterprises have been

involved in the distribution of petroleum products to the citizens by establishing petrol filling stations in available locations of most urban centres (Blamah, Vivan, Tagwi and Ezemokwe, 2012).

Petrol filling station according to Ayodele (2011) refers to any land, building or equipment used for the sale or dispensing of petrol or oil for motor vehicles and includes the whole of the land, building or equipment whether or not the use as a petrol station is the predominant use or is only a part thereof. Similarly, Nieminen (2005) defined Petrol filling station as an area including fuel equipment and piping, storage tanks, forecourt and possible building premises for the sale of fuel (inflammable liquids) to customer's vehicles. Most petrol filling stations (PFSs) sell petrol or diesel; some carry specialty fuels such as liquefied petroleum gas (LPG), natural gas, hydrogen, biodiesel, kerosene, or butane while the rest add shops to their primary business (Hamid, Iman, Suriatini and Martin, 2009). Some of the variables considered when selecting location for any utility or some activity are proximity to population centers, distance from neighboring (PFSs), the easements of using existing utility, and the magnitudes of environmental pollution parameters. Other factors to take into account when making a decision about the location of business include customers, transport, the neighborhood, finances and the longer term future (Hamid et al., 2009; Mohammed, et al., 2014). All the highlighted factors point to one important consideration – location. As earlier observed by Mudambi (1994), location affects many aspects of petrol station operation. The observation of Mudambi appears to be supported by Sidaway (1998) when the author opined that, petrol stations are very vulnerable to closures resulting from petrol price competition, regulatory pressure and nonstrategic locations. However, in an

attempt to achieve strategic location for petrol stations, economic interests are usually placed above environmental effects (Sule, Shebe, Bichi, and Atiyong, 2006). Though the Federal Government and individual State Governments through their environmental protection institutions and agencies as well as urban and regional planning establishments have evolved their own planning standards and principles to guide petrol stations establishment, the incessant violation of these planning standards have been observed in recent times (Gbadamosi, 2014). A number of studies have identified the risks associated with location of petrol stations. As pointed out by Nieminen (2005), the release of petrol vapour into the air during the filling of the storage tanks by tanker delivery personnel and when customers refuel their vehicles pollutes the air and makes the inhabitants susceptible to a number of airborne infections. In addition, it is capable of releasing polluting agents into soil and water thereby destroying the neighbourhood ecosystem (Isabel et al., 2010). Studies have equally focused on the spatial distribution of petrol filling stations especially in urban centres (El Faleet, 2017; UBA, 2015).

However, despite the enormous risks associated with location of petrol stations as highlighted above, perception of the people who undoubtedly bear the consequences of petrol station location on these risks appear to have received less research attention. Risk perception refers to people's subjective judgments about the likelihood of negative occurrences such as injury, illness, disease, and death (Hove & Paek, 2015). It determines which hazards people care about and how they deal with them. Risk perception has two main dimensions: the cognitive dimension, which relates to how much people know about and understand risks, and the emotional dimension, which relates to how they feel about them (Oh et al., 2015). Risk

perceptions are important precursors to health-related behaviors and other behaviors that experts recommend for either dealing with or preventing risks. When people are conscious of the health and environmental implications of existence of certain facilities in their neighbourhood, attempts to minimise this effects will be high, thereby reducing the impact on the people and the environment. Thus, this paper examines the spatial distribution and perceived health and environmental implications of petrol filling stations in Ede.

Literature Review

The issue of health and environmental hazards associated with sitting of PFSs features within the literature. Volatile Organic Compounds including benzene and toluene along with toxic gases such as carbon monoxide and traces of soot has been observed to have deleterious effect on general health particularly on the respiratory system (Alam, et al., 2014). Volatile organic compound emission by PFSs was found to be responsible for groundwater contamination in the USA and Europe as a result of fuel spills and leaks that have actually been happening for several decades (EFOA, 2002). As observed by Nwanjo and Ojiako (2007), petroleum products contain aliphatic and aromatic organic compounds that are highly flammable causing fire hazards and air pollution. According to the Australian Transport Safety Bureau (ATSB) (2005), between 1993 and 2004, there were 243 reported incidents of fires breaking out at petrol stations. Also, some airborne organic compounds such as benzene which increases the risk of cancer have been recorded at PFSs at levels above the average for urban areas where traffic is the primary source of emission. (Miñarro et al., 2010).

One aspect of literature relevant and very significant for this study is the planning standards and principles, environmental criteria and conditions formulated by regulatory agency on siting of petrol stations. This is important because public's perception on the location of filling stations can be viewed with regard to the knowledge that the public has on standards and guidelines on filling stations locations. DPR (2010) stated that PFSs should be located within a growth centre or an urban area except in circumstances where it can be shown through appropriate studies that the need exists or otherwise. The criteria for the locations of PFSs by DPR among others include;

- Stations should be located at a minimum of 100 m from any public institution such as schools, churches, public libraries, auditoriums, hospitals, public playgrounds, etc.
- Distance between one petrol station and another should not be less than 1000m.
- Area of land to be developed should be sufficient to allow manoeuvring of vehicles within its cartilage but should not be less than 112 square meters with a minimum frontage of 91.44 meters on the primary street.
- Petrol Filling station not to be allowed on residential street, dead-end street and loop streets (crescent).
- Filling Stations shall not be allowed in any area where the traffic situation is such that it will cause obstructions in entering or leaving a station or on tight curves where visibility is not adequate.
- Buildings are to be located a minimum of 12m from road property boundaries to provide adequate area for manoeuvring of vehicles in the service area.

- Petrol pumps shall be located a minimum 100m from any residential building.
- Where the site adjoins the side or rear boundary of a residential lot, a solid wall 3 m in height should be constructed and maintained along that lot boundary.
- Signs should be in accordance with the Advertisement Regulations and should be located so as not to reflect the sun into the face of motorists and should be large enough so that they can be seen from a reasonable distance at a reasonable speed.
- Stations are to be equipped with fire-fighting and fire protection equipment installed in accordance with the national policies formulated by Federal Environmental Protection Agency and the Ministry in charge of disaster management.
- All volatile flammable liquid storage tanks shall be installed below ground in compliance with the requirements of the Ministry of Trade and Industry.
- Proper facilities for storage and disposal of used and waste oil and gas must be provided.
- Normally no access to or from a filling station shall be closer than 45m to any road intersection or 75 m from the intersection of two main roads.
- A minimum distance of 30 m should be maintained between Underground Storage Tank (UST) and water source.

Table 1: Setback of Petrol Filling Station

Type of abutting road	Set back in m from the centre of the road (m)
Outside city limit	
Trunk 'A'	30
Trunk 'B'	22.5
Trunk 'C'	18
Within city limit	
Major road	30
Collector road	21
Other road	15

Source: Obateru (2003)

The Study Area

The study setting is Ede Township in Osun State, Nigeria. Ede is one of the oldest towns of the Yoruba people. It was founded around sixteen century by Timi Agbale, a warrior from the old Oyo Empire. Located at

latitude 7°15" to 7°30" N and longitude 4°32" to 4°7" E. It lies about 180km southwest of Lagos (Figure 1). With the 2006 population of 80, 515 (N.P.C, 2006), the township's 2019 population stands at 274000. Ede is made up of two local government areas i.e.Ede North and Ede

South. The study covered the two local government areas.

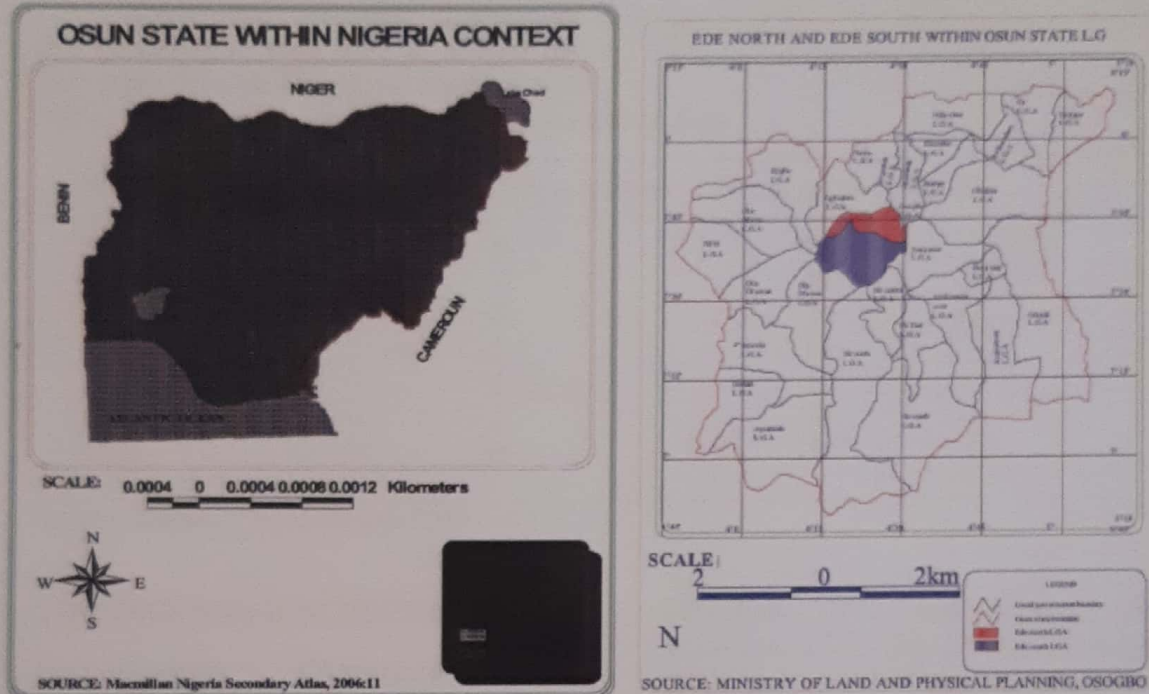


Fig. 1: Osun State within National Context Fig 2: Ede North & South LGAs within Osun State

Methodology

Primary and secondary data were used for the study. Primary data utilized comprises of both spatial and attributes. The attribute data such as socio-economic and land use data were obtained through a structured questionnaire while spatial data which include location of petrol station, setback to roads and other developments as well as the distance between filling stations were respectively obtained with the aid of Global Positioning System, Meter Rule and Speedometer. As a result of reconnaissance survey, fifteen petrol filling stations (PFSs) were identified in the study area. A total survey approach was adopted, thus, coordinates of all PFSs identified were obtained. Also, a set of pretested structured questionnaire (15 copies) was administered

to operators of the PFSs. To obtain information from residents, 200 meters was delineated around each identified filling station (considering the recommended minimum distance between petrol pumps and any residential building which is 100 m). Consequently, a total of 1484 houses fell within the demarcated area and 150 houses (10%) were randomly selected for survey. This falls within the purview of Neuman's (1994) postulation that a 10% sample size for a homogenous population of more than 1000 is suitable for a survey at 95% confidence level, assuming a $\pm 5\%$ error margin. Another set of pretested structured questionnaire was administered to adult members of the sampled houses. The distribution of the questionnaire across the

sampled neighbourhoods is presented in Table 2.

Descriptive statistics (frequencies and percentages) were used to analyse the data while Nearest Neighbour Analysis was

used to statistically determine the spatial distribution of the PFSs. Secondary data such as Development Regulations for PFSs was obtained from the Department of Petroleum Resources, Osogbo, OsunState.

Table 2: Questionnaire Distribution in the Study Area

S/No.	Name of the area	No. of filling stations	No. of questionnaires
1.	Oke Gada	4	40
2.	Total	4	40
3.	Oja-Timi	3	30
4.	Ode-Oke	1	10
5.	Agip Area	1	10
6.	Oyatoki	2	20
Total		15	150

Source: Authors' field survey, 2019

FINDINGS AND DISCUSSIONS

Socio-economic Characteristics of Respondents

Evidence as summarized in Table 3, revealed that, 53.3% of the respondents were traders (engaging in hawking and petty trading at nodal areas and filling stations), while 10% of the same were farmers and 10% were students. Analysis of the income structure of the respondents indicated that majority were low income earners with 54.0% earning below ₦20,000 monthly while 26.7%, 8% and 11.3% respectively earn between ₦21,000 – ₦40,000; ₦41,000–₦60,000 and above ₦60,000. The low income status of the respondents reflected in their house ownership status as 54.7% were tenants, while 45.3% of the respondents were landlords (Table 3). Literacy level among the respondents was low as 34% had no formal

education, 28% had primary (basic) education, 22.7% had secondary education while 15.3% had tertiary education (Table 3). Majority of the respondents had lived more than ten years in the area with 32.7% living between eleven and twenty years, 18.0% living between twenty-one and thirty years, while 13.3% had lived above thirty years in the area (Table 3). This relatively long residency of the respondents makes them ideal candidates from whom information can be obtained. The low socio-economic status of these respondents makes them more vulnerable to economic shocks and consequently susceptible to sale of their houses which may give room for emergence of incompatible physical developments, such as petrol filling stations in residential neighbourhoods. It should be noted that such commercial developments can effectively compete for land in such built-up areas.

Table 3: Socioeconomic Characteristics of Respondents

Variables	Frequency	%
Educational Qualification		
Tertiary education	23	15.3
Secondary education	34	22.7
Primary education	42	28.0
No formal education	51	34.0
Total	150	100
Income Level		
Below 20,000	81	54.0
21,000- 40,000	40	26.7
41,000- 60,000	12	8.0
Above 60,000	17	11.3
Total	150	100
Occupation		
Civil servant	15	10.0
Trader	80	53.3
Student	15	10.0
Farmer	40	26.7
Total	150	100
House Ownership Status		
Landlord	68	45.3
Tenant	82	54.7
Total	150	100
Duration of Stay Within the Area		
Below 10 yrs.	54	36.0
11-20yrs	49	32.7
21-30yrs	27	18.0
Above 30yrs	20	13.3
Total	150	100

Source: Authors' field survey, 2019

Ownership and Services Rendered by the Petrol Filling Stations

As stated earlier, fifteen (15) standard filling stations were identified and examined in the study area. All the filling stations were owned by private individuals, therefore, their principal interest will be to attract customers

and maximise profit. In order to optimise the land utilization and open other sources of income, 80% of the filling stations used the remaining parts of their land for other commercial developments that to some extent complimentary to petrol filling station. These include shopping centres, mini marts

and auto alignment workshops. Only 20% solely sold petroleum products such as petrol, diesel, kerosene, cooking gas.

Land Use Characteristics around Petrol Filling Stations

Residential development constituted the dominant adjoining land use to the filling stations by accounting for about 60% of the total adjoining land uses to the filling stations. This is distantly followed by mixed

land use (24.7%) which was a combination of residential and light commercial developments, while commercial land use accounted for 15.3% of the total adjoining land uses to the filling stations (Table 4). From the foregoing, it is evident that petrol filling stations were located within residential areas hence potential source of hazard for residents.

Table 4: Adjoining Land Use to Petrol Filling Stations

Land Use	Freq.	%
Residential	90	60.0
Commercial	23	15.0
Mixed	37	24.7
Total	150	100.0

Source: Authors' field survey, 2019

Compliance with Planning Standards

As revealed in Table 5, 63.3% of the filling stations have a setback below 50 meters to adjoining land use while 29.3% have a setback of between 50 and 100 metres. Thus 92.6% of the sampled filling stations did not comply with the planning standards on setback to adjoining land use (Plates 2 and 3). Note that the minimum setback to residential land use is 100 m while to other public and semi-public uses is 900m. Also, 93.3% of identified filling stations maintained a setback of 30 meters from the road intersection, against the prescribed

minimum standard of 100 meters (Table 6) (Plate 4). The non-compliance of most of sampled the petrol filling stations to physical planning standards calls to question the effectiveness of development control officials in the town. More occurring are questions bordering on the granting of development permit for such development. This prompted the researchers to ask the filling stations operators whether necessary planning approvals, were obtained from Osun State Ministry of Physical Planning before the commencement of development. All of them answered in affirmative.

Table 5: Distance of Filling Stations to Adjoining Landuse

Distance (m)	Freq.	%
Below 51	95	63.3
51 – 100	44	29.3
101 – 150	10	6.7
Above 150	1	0.7
Total	150	100.0

Source: Authors' field survey, 2019

Table 6: Setback from the Road Intersection

Plot size	Freq.	%
Below 30m	14	93.3
31 – 60m	1	6.7
Total	15	100.0

Source: Authors' field survey, 2019

Internal Spatial Organization of Filling Station

Space is an important element in Petrol filling station. It includes parking space, garage, service area and fuel loading units which makes the overall size of the filling station. With an average plot size defined as 30 meters by 30 meters (900m²), more than half (53.3%) of the sampled filling stations have a land area that is less than 1800m² (two plots) (Table 7). Considering

the recommended land area of 12,000m² for PFSSs, majority of the PFSSs had limited land area for efficient and convenient service delivery. This explains the existence of vehicular queues for fuel along the roads leading to some of these filling stations because they lack adequate space to accommodate a substantial number of vehicles during operation as observed by the researchers during field work.

Table 7: Plot Size of the Petrol Station

Plot size	Freq.	%
Below 2 plots	8	53.3
3-5 plots	5	33.3
6-9 plots	2	13.3
Total	15	100.0

Source: Authors' field survey, 2019

Spatial Analysis of Petrol Filling Stations in Ede

Having acquired the spatial information (latitude, longitude) and distance (Table 8) of all Petrol filling stations in the

study area, the distance parameters were first used to calculate the spatial pattern of the filling stations in the town using First Order Nearest Neighbor Analysis. The analysis is presented below.

Table 8: Distances between Filling Stations

Petrol Filling Station	Nearest Filling Station	Distance (m)
Kasoil station	Lord's Glory	478
Lord's Glory station	Nayog	30
Nayog station	Akaje	97
Akaje	Fatson	1236
Fatson station	Omo- ade	22
Omo- ade station	Total	1467
Total station	Naacons	1583
Naacons station	A.P	1365
A.P station	Admus	130
Admus	M- ruthad	118
M-ruthad	Mascot	303
Mascot	Mabjay	932
Mabjay	Oando 1	1046
Oando 1	Oando 2	511

Source: Authors' compilation, 2019

$$\text{Mean Distance} = \frac{\text{Total mean distance}}{\text{Number of the stations}}$$

$$\frac{478+30+97+1236+22+1467+1583+1365+130+118+303+932+1046+511}{15} = 621.2 \text{ m}$$

$$\text{Density of a point in the area} = \frac{\text{total number of petrol filling stations}}{\text{Total area of Ede town}}$$

$$\frac{15}{42765469.4} = 0.0000003508$$

$$\text{Expected Mean Distance} = \frac{1}{\sqrt{0.0000003508}} = \frac{1}{2 \times 0.0005923} = \frac{1}{0.001185} = 843.88$$

$$\text{Nearest Neighbour Index (Rn)} = \frac{621.20}{843.88} = 0.74$$

It should be noted that the decision values for Nearest Neighbour Analysis ranged from 0.1 – 2.15.
Where: 0.1 – 1.0 =

Thus, with the nearest neighbour index of 0.74, it is evident that filling stations are clustered within the central area of Ede town. To have a visual knowledge of the exact locations of the filling

stations in space, geospatial data ((latitude, longitude) were analysed with the aid of Archview GIS software. The result of the analysis is presented in the map below.

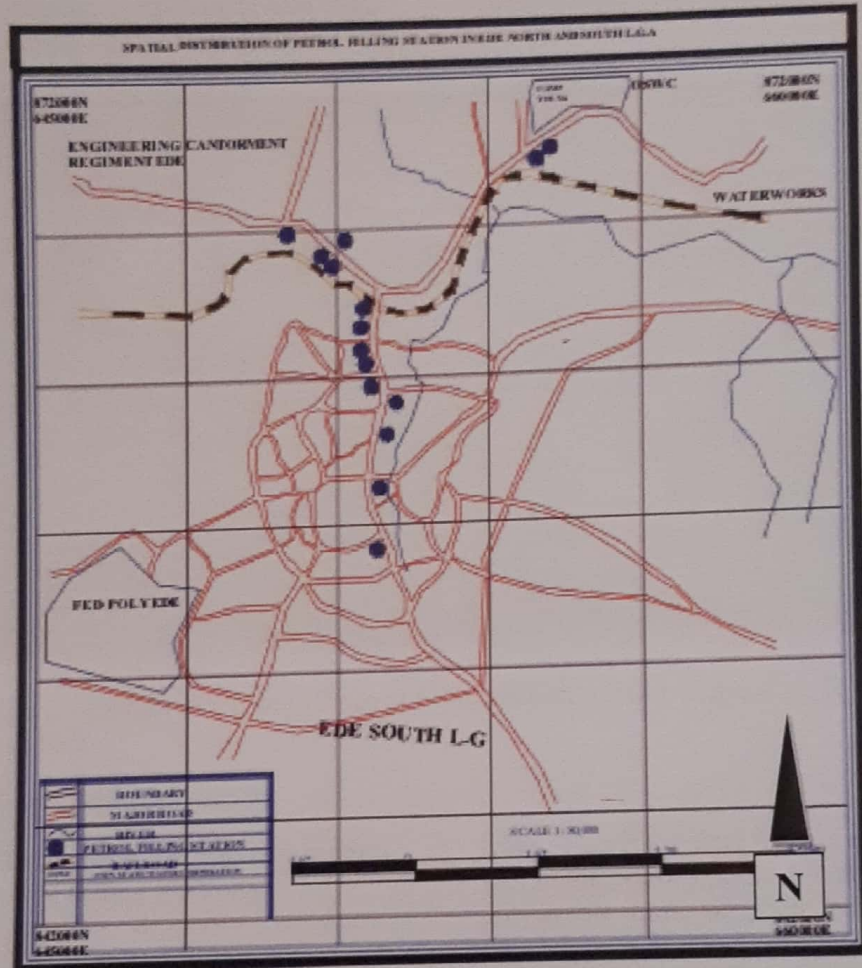


Figure 1: Spatial Distribution of Petrol Filling Stations in Ede
SOURCE: Authors' Fieldwork, 2019

However, as evident in Figure 4, petrol filling stations are located in linear form along the major roads that delineate the town. Attempt by the petrol filling stations' owners to enjoy maximum sales and accessibility appears to have influenced this location pattern of the filling stations. Moreover, as observed during the field survey, the proximity of the petrol filling stations to each other influenced high

traffic volume on the roads. This may create debilitating effects on the roads and the neighbourhoods such as traffic congestion (Plate 1), automobile accident, crime, noise etc. For instance, traffic congestion leads to man-hour loss and a potent source of automobile accidents if not well managed. Such heavy traffic equally exerts pressure on the roads infrastructure and roads' pavements thereby reducing the durability of the roads.

There is also the possibility of criminal activities such as theft and dispossession of valuables belonging to motorists and other commuters during traffic congestions. A

number of scholars have partly linked transport crime to traffic congestion and poor road infrastructure (Odufuwa, 2015).

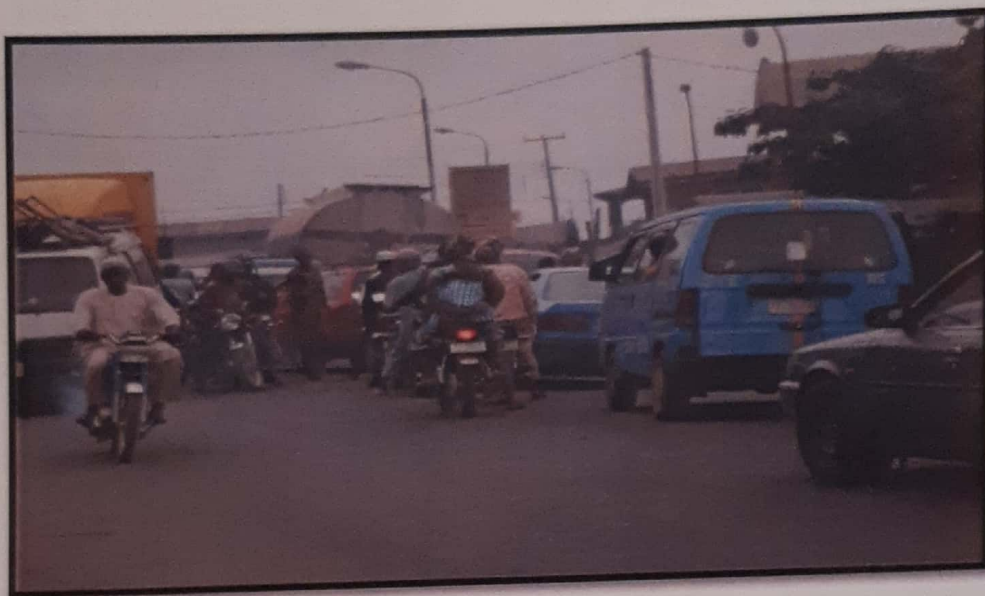


Plate 1: Traffic congestion as a result of petrol filling station's trailer dispensing fuel on road setback

Source: Authors' fieldwork, 2019

Residents' Perception of Environmental Effects of Petrol Filling Stations

This section discusses residents' perceived effects of petrol filling stations on the environment. The parameters considered are noise, fire outbreak, road accidents, traffic congestion, water contamination and fuel odour irritation. Analysis of the respondents' responses on this indicates that 93 % of the respondents considered noise pollution as the major problem associated with petrol filling stations in their neighbourhoods (Table 9). The noise was reported to have emanated from horns and engines of different automobiles that patronise the petrol stations in the area. The intensity of noise pollution from automobiles is particularly high and disturbing during fuel

crisis. This is the time intense struggle to buy fuel in the petrol stations by motorists lead to unbearable noise in their neighbourhoods. Other source of noise pollution by the filling stations as indicated by the residents include electric generators being used as alternative source of power by the petrol stations during public power outage as well as noise associated with petty trading in the filling stations. However, only a very few percentage of the respondents considered the existence of petrol stations as having any significant association with fire outbreak, road accidents, traffic congestion and contamination of surrounding water. For instance, just 8.7% of the respondents reported the fire outbreak effects of filling stations, about 22.7% related occurrence of

road accidents to filling stations, 32.7% linked traffic congestion to the existence of filling stations, only 24.7% believed petrol stations in their neighbourhoods contribute to ground water contamination while only 18.0% of the respondents indicated fuel odour irritation as the effect of petrol stations in their neighbourhoods (Table 9).

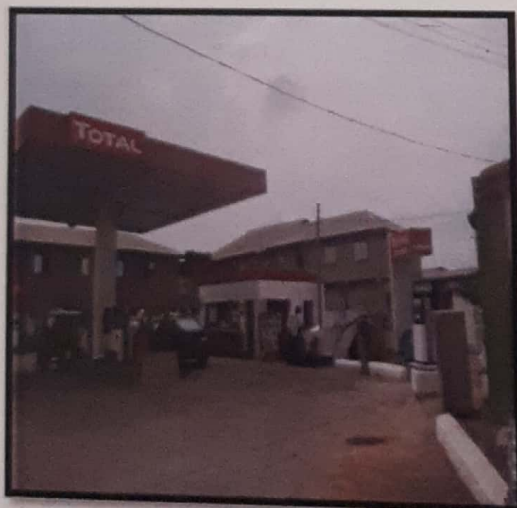
Meanwhile, juxtaposing the responses of the residents on the effects of petrol stations on their environment and health with findings of scholars who have

objectively determined the effects as highlighted earlier, one will conclude that the residents have little understanding of these effects and may not be able to effectively link certain illnesses to the proximity of their residences to petrol stations. Low literacy level among the residents appears to be responsible for the lack of awareness of the environmental and health implications of petrol stations in their neighbourhoods.

Table 9: Perceived Environmental Impacts of Petrol Filling Stations

Perceived Impact	Yes		No		Total	
	Freq.	%	Freq.	%	Freq.	%
Noise	140	93.3	10	6.7	150	100.0
Fire outbreak	13	8.7	137	91.3	150	100.0
Road accident	34	22.7	116	77.3	150	100.0
Traffic congestion	49	32.7	101	67.3	150	100.0
Water contamination	37	24.7	113	75.3	150	100.0
Fuel odour	27	18.0	123	82.0	150	100.0

Source: Authors' survey, 2019



Plates 2 and 3: Petrol filling stations without setback to residential building

Source: Author's fieldwork, 2019

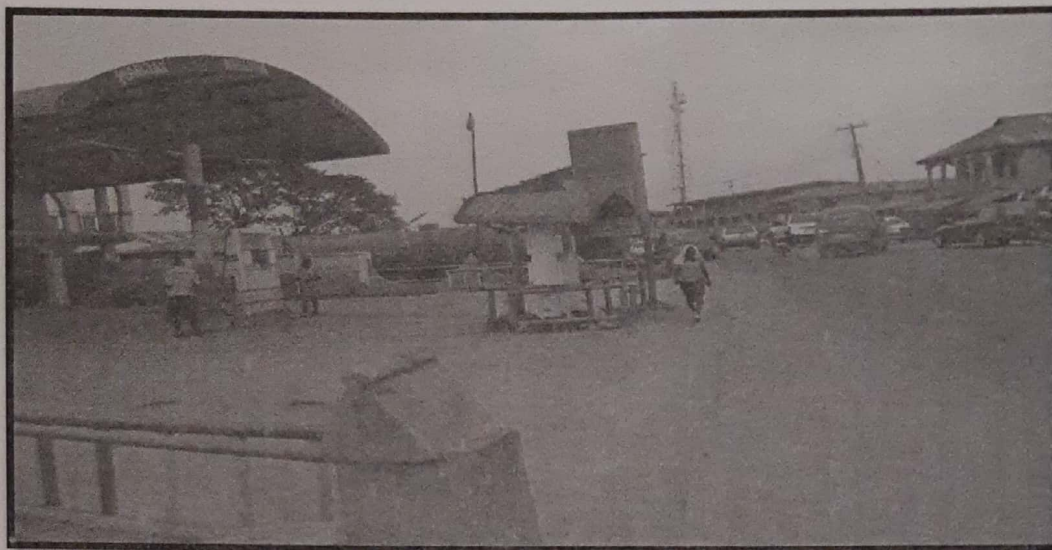


Plate 4: Petrol filling station without setback to road

CONCLUSION

From the foregoing, it has been established that petrol filling stations are springing up in the study area with little compliance with the existing physical planning standards, hence, posing threat to the environment and public health. Unfortunately, majority of the residents were not aware of the health implications of the non-compliance of the petrol stations with the planning standards. To safeguard public health and ensure health urban development in the study area, it is imperative for the Osun State Ministry of Physical Planning and Ede

North and South Local Planning Authorities to ensure strict enforcement of planning standards and regulations in petrol stations development as well as any other physical developments in the area. There is also the need for public sensitisation programmes by the relevant authorities on the environmental and health problems associated with such physical developments. Such sensitisation programmes can be achieved through mass media and partnership with the traditional rulers and home town associations.

REFERENCES

- Adeyeye, L.A (2010) Understanding Urban and Regional Planning Law and Administration in Nigeria. Ile Ife: Timade publication ventures.
- Alam, R., Zafar, A., Ghafoor, A., Naseem, A., Ali, Q., and Imtiaz, F. (2014). Lung function abnormalities among fuel filling workers in Karachi, Pakistan.
- Pinnacle Environmental and Earth Sciences*, 1(1): 183-187
- Australian Transport Safety Bureau (2005). An examination of the myths and facts about fire cause by electricity and exploding mobile phones. Static fire at retail petrol filling stations, Australia.
- Ayodele S. J (2011). Spatial Distribution of Petroleum Filling Station in Kaduna

- North Retrieved on 5th March, 2013
from www.srib.com/samuel_ayodele1.
- Blamah, N. V., Vivan, E. L., Tagwi, M. V. and Ezemokwe, I. U. (2012). Locational impact assessment of Service stations along Abuja-Keffi Road and Environs in Karu, Abuja, Nigeria. *Journal of Environmental Management and Safety*. 3(5): 106 -126.
- Colin McIntosh and Joanna Turnbull (Ed)
Oxford Advanced Learner's Dictionary (7th Edition).
- DPR (2010). Guidelines for liquefied petroleum gas: The Procedures and Conditions to be fulfilled before the grant of Approval and License for the Construction, Modification, and Relocation of LPG filling stations. Department of Petroleum Resources. Available at <http://www.nigerianoil-gas.com>. Retrieved May 27, 2016.
- El Faleet, O. J. (2017) Spatial analysis of the petrol stations in khan-Younis City using geographic information system (GIS) techniques. *Journal of Geography and Regional Planning*, 10(6): 133-147.
- European Fuel Oxygenates Association (EFOA) (2002), Methyl Tertiary Butyl Ether Resource Guide. Brussels. Belgium. Energy Regulation Act (Cap 436), Laws of Zambia
- Fatdeo&Associate Ltd (2012): Feasibility study of establishing fuel filling station in Nigeria 2012-01-01publisher
- Gbadamosi, H. (2014). Dangers of petrol stations in residential areas of Ondo State. *The National Mirror* 16 January, p.17. Available at www.nationalmirroronline.net/lomming-danger-stakeholders-express-concern-over-petrol-stations-sited-in-residential-areas Retrieved April 30, 2018.
- Grin environment Consultants (2012)
Environmental impact assessment study report for the proposed petrol service station cum commercial building, Nairobi on plot no:26
- Hamid, A. B., Iman, M. H., Suriatini, B. I. and Martin, R. B. T. (2009), Site Potentiality of petrol Stations Based on Traffic Counts. *Malaysia Journal of Real Estate*, 4(1): 216
- Hove, T., & Paek, H.-J.(2015). Effects of risk presentation format and fear message on laypeople's risk perceptions. *Journal of Public Relations*, 19(1), 162-182.
- Iman et. al., (2008) Traffic jams to queue to access petrol filling stations
- Isabel, M., Minarro, M., Ferradas, E., Caracena, A, and Rico, J. (2010). Assessing the impact of petrol stations on their immediate surroundings: *Journal of Environmental Management*.
- Keeble L. (1969) Principles and Practice of Town and country Planning (4th Edition) London; Gazette Limited
- Kwoles and Wearing (1980): Economics and Social Geography made simple.
- London WH alien. Lagos; Omega Hi-tech information and planning System Ltd and Leod Associated, Nigeria.

- Marta, D. M., Isabel M. Morales Terrés, Enrique González Ferradas, Antonia Baeza Caracena, Jonathan Barberá Rico (2010): Assessing the impact of petrol stations on their immediate surroundings. *Journal of Environmental Management*, 2010; 91 (12): 2754 DOI:
- Maurice (2010): Environmental impact assessment study report for proposed Simwata filling station on plot no. asembo/ramba/4700, at Ndori market centre, siaya county
- Mbhele, P.P. 2007. The Remediation of Soil and Water Contaminated by Heavy Metals and Hydrocarbons Using Silica Encapsulation. Unpublished Master's Thesis University of Witwatersrand, South Africa.
- Miñarro, M. D., Morales Terrés, M. I., Ferradas, E. G., Caracena, A. B., Rico, J. B. (2010). Assessing the impact of petrol stations on their immediate surroundings. *Journal of Environmental Management*, 91 (12): 2754.
- MirzaMunir Ahmed, S.R.M. Kutty, Moh'd Faris Khamidi, Idris Othman, and Azmi Mohd Shariff (2012): Hazard Contributing Factors Classification for Petrol Fuel Station.
- Mohammed, M. U., Musa, I. J., and Jeb, D. N., (2014). GIS-Based analysis of the location of filling stations in metropolitan Kano against the physical planning standards. *American Journal of Engineering Research*, 3(9): 147-158.
- Mudambi, S. M. (1994). A topology of strategic choice in retailing. *International Journal of Retail & Distribution Management*, 22 (4): 32-40.
- National Mirror 16 January, p.17. Available at www.nationalmirroronline.net/lomming-danger-stakeholders-express-concern-over-petrol-stations-sited-in-residential-areas Retrieved April 30, 2018.
- NBS (2018). Unemployment rate. National Bureau of Statistics. Available at: www.nigerianstat.gov.ng
- Neuman, W. L. (1994). *Social research methods: Qualitative and quantitative approaches*. Second Edition. Boston: Adyn and Bacon.
- Nieminen, P. M. (2005). Environmental Protection Standards at Petrol Stations: A Comparative Study of Technology Between Finland and Selected European Countries. Thesis for the Degree of Doctor of Technology, Tampere University, Finland.
- Nwanjo H.U. and Ojiako O.A. (2007). Investigating the potential health hazards of the petrol station attendants in Owerri Nigeria. *Journal of applied science and environmental Management*, 11(2).
- Obateru, I.O (2003): "Land subdivision Basics", penthouse publications Ibadan Nigeria
- Oh, S. H., Paek, H.-J., & Hove, T. (2015). Cognitive and emotional dimensions of perceived risk characteristics, genre-specific media effects, and risk perceptions: The case of H1N1

- influenza in South Korea. *Asian Journal of Communication*, 25, 14–32.
- Oladejo E.O (2010) The Assessment of Impact of Fuel Station on the Resident Liveability of Ogbomoso township, Oyo State. An unpublished Degree dissertation of URP dept.LAUTECH, Nigeria.
- Oyesiku (1998): Modern Urban and Regional Planning Law and administration in Nigeria Published by Kaoft Books Limited
- PlataformaSINC(2013). "Gas stations pollute their immediate surroundings, Spanish study finds." *Science Daily*, 5 Feb. 2011. Web. 13 Jun. 2013.
- Raleru, S. (2005): Geohydrological Remediation of Hydrocarbon Contaminated Soil at Johannesburg International Airport. Unpublished Master's Thesis University of Johannesburg, South Africa
- ShaliniSareen (2005): Urban pollution and Environmental management. Published by IVY publishing House Delhi-110095
- Sidaway, R. (1998). Study of Petrol Stations in Rural Scotland. *General Agricultural Policy and Rural Development*, (16), 455-98.
- Sule, J. O., Shebe, M. W., Bichi, M. A. and Atiyong, P. B. (2006). Distribution of filling stations in Kaduna Metropolis. *International Journal of Advanced Engineering Sciences and Technologies*, 7(1): 110 – 121.
- Tripathy, D.P. and Dhar, B.B; (2002) Browning & Shafer, 2002; Edgar, 2009).: "Environmental Pollution Research", A.P.H Publishing Cooperation, New Delhi, India.
- Uba, M. M. (2015) Location analysis of filling stations in Kano metropolis, Nigeria. M.Sc. Dissertation, Department of Geography, Faculty of Science, Ahmadu Bello University, Zaria Nigeria.
- Vaneshrie Govender (2009): Filling Stations and Associated Contamination: Remediation and Proposed Mitigation Measures. Published MSc dissertation submitted to the University of Witwatersrand.