ASSESSMENT AND DETERMINATION OF SPATIAL DISTRIBUTION PATTERN OF FILLING STATIONS IN AKURE METROPOLIS, ONDO STATE NIGERIA

Tukka, Apollos .A. and Odunaiya, Adedayo. K
Department of Surveying and Geoinformatics,
Federal University of Technology Akure, Ondo State Nigeria
aatukka@futa.edu.ng, 08064046472
akodunaiya@futa.edu.ng, 08029277977

Abstract

This study aimed at Assessing and Determination of Spatial Distribution pattern of Filling Stations in Akure Metropolis, Ondo State Nigeria. Department of Petroleum Resources (DPR) stipulated that 'distance from the edge of the road to any nearest pump should not be less than 15m and less than 400 meters to the next petrol filling station and not be located less than 100 meters from school, hospital, theatres, clinics and other public and semi-public buildings. Meanwhile, in line with the objectives of this study, the Global Positioning System (GPS) instrument was used to acquire spatial and attribute data where queries employing proximity and buffering analysis was performed using ArcGIS 10.3 software respectively. The Z ratio analytical technique was used to examine the conformity of petrol filling stations to the required distance of 400m and 15m from each other and from the road respectively as stipulated by DPR amendment decree 37 of 1997. Findings from the Z ratio analysis at 66 degree of freedom and 95% confidence level reveals that 32(57%) conform to the required distance of 400m apart, 25(40%) conformed to the required distance of 15m from the existing road, 95.5% conformed to the required distance of 100m from existing school and 100% conformed to the required distance of 100m from the existing healthcare facility. there is a general an indication that the distribution of Filling stations in Akure metropolis is tending towards a clustered pattern which automatically translates into high level vulnerability to potential hazards associated with each utility. Thus, recommended is hereby made for adoption of this work by the regulatory agency DPR, as an A-prior data to improve their capacity in enforcing the compliance of petrol filling stations with laid down regulations.

Keywords: Spatial, Pattern, Assessment, Conformity, Standards

1 Introduction

Nigeria is blessed with abundant natural resources and at present, she is the ninth world producer and sixth world exporter of crude oil (CBN, 2010). Despite this, population growth rate has continued to outpaced the ability of Government to build essential infrastructures, enact and enforce legislation needed to make life in safe, rewarding and healthy (W.H.O, 2010). This rapid growth rate of most urban centres has increased the use of automobiles, generators and other petroleum demanding plants. The pathetic power situation in Nigeria has exacerbated the increasing demand for petroleum products, leading to the proliferation of petrol filling stations and consequently, with less consideration of the minimum environmental safety requirements for their operations (Afolabi, Olajide & Omotayo, 2011).

Safety practices in locating petrol filling stations are of utmost importance in preventing hazards and reducing potential risks that could affect humans and their environment (Samuel et, al,, 2015) . In most large urban areas of Nigeria, there is high demand for land for socio-economic services that are in high demand. This high land demand often results to land scramble and illegal conversion of land uses, leading to haphazard development and the deliberate location of petrol filling stations in unsuitable areas that are highly vulnerable to hazard (KASUPDA, 2009). Several problems have come to be associated with these poorly located filling stations. Today, this has become an important social issue requiring the attention of social critiques and researchers alike. For example, Samuel (2011) acknowledged the significant contributions of petrol filling stations' location to traffic congestion, pollution, and fire. The dimension and extent of the problems depend on the criteria or variable such as location, size and set back from the road. Ehinomen and Adeleke (2012)" the onus of selecting an optimal site for business enterprise such as a petrol filling station depends on factors such as proximity to population centres, distance from neighbouring stations, the easements of using existing utility, and the magnitudes of environmental pollution parameters. Similarly, Oetomo and Sesulihatien (2012) observed other factors to take into account when making a decision about the location of business this includes: customers, transport, the neighbourhood, finances and the longer term future as part of the variables that should not be wished away in the location of investments such as filling stations. In view of how important the sittings of facilities like petrol filling stations are to environmental safety and sustainability of a burgeoning settlement like Akure metropolis, it is imperative to assess the spatial location and distribution pattern of petrol filling stations within the metropolis in order to ascertain the extent to which they conform to the planning standards.

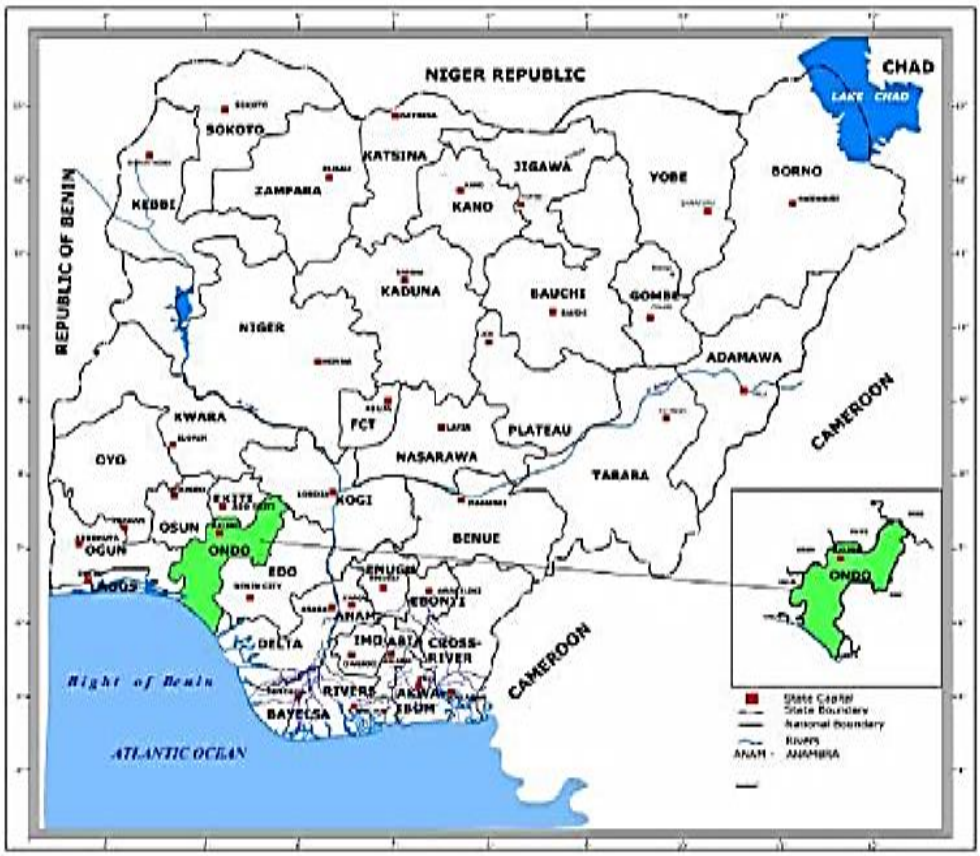
Statement of Problem

From the review of related literature, there is corollary of the lack of developmental control and non-conformity with planning standards in semi–urban and fully urbanized settlements. The problem of indiscriminate location of petrol stations is taking place at alarming rate in most Nigerian cities and Akure metropolis inclusive. The planning methods are expressed in poor sitting, inadequate size, limited set back from road, poor radius allowance from major facilities like schools, hospitals, military and Para military facilities which are against the planning standard. This culminates in traffic congestion, pollution, fire and many unforeseen problems resulting from un-coordinated development. The study area is a developing urban centre, which on account of its expansion had also witnessed the proliferation of petrol filling stations, most of which are poorly sited, with disregards to planning standards. The imperativeness of this study is borne out of the non-existence of spatial database of petrol filling station in the area as no study has been done in this regard. The study also aims at assessing the location and spatial distribution of petrol filling stations in Akure metropolis through the following objectives: To identify and map all the petrol filling stations in the study area; To determine and assess the

distribution pattern of the petrol filling station with respect to their conformity or otherwise with planning standards; To examine the implication of the spatial distribution of petrol filling station within Akure metropolis.

II. Material and Method

Study Area: The Akure metropolis in Ondo state lies between latitude 7° 5'23.62''N. to 7º21'12.972''N. and longitude 5°20'46.975E to 5°10'9.953 E with an altitude of 353 metres above the Mean sea level. It has an area of 331sq.km and a population of 353,211 at the 2006 census, which is projected to 618,570 at 2016.



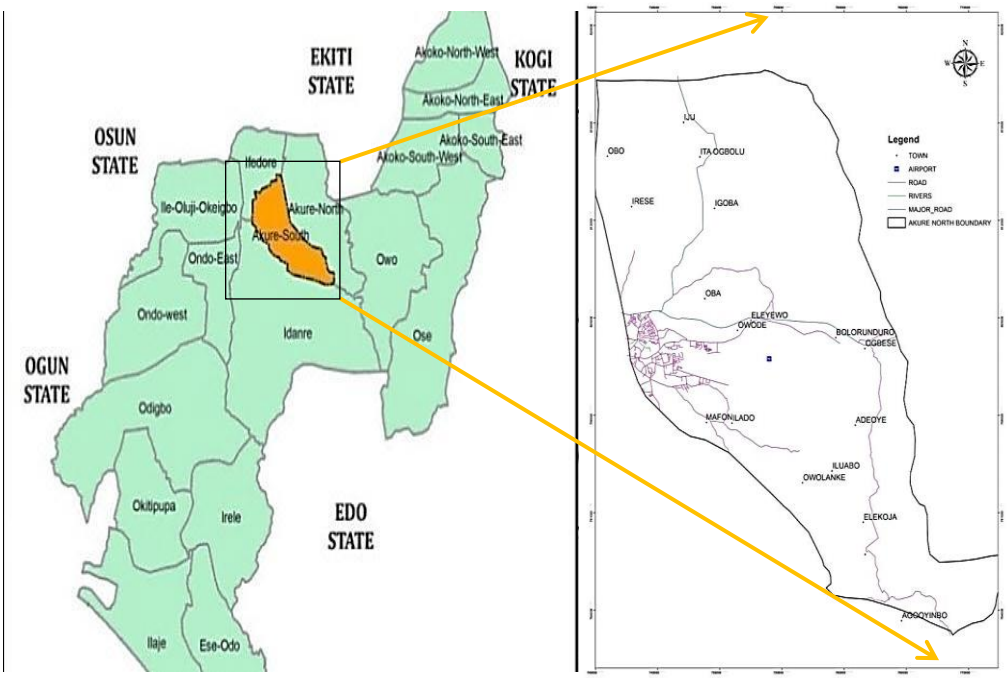


Figure 1: Map of Nigeria showing Ondo State and Map of Ondo state showing Akure-metropolist other L.G.As. **Source:** https://www.researchgate.net, http://article.sapub.org

For this study, a preliminary field survey was first conducted to identify the spatial location of existing petrol filling stations. A 2016 Google-earth imagery of Akure metropolis of 2.5-meter resolution was sourced from the Department of Surveying, Federal University of Technology Akure Ondo State Nigeria. The primary Data was acquired from the field using Handheld GPS. Data obtained from the field observation were first entered in Excel Microsoft (2007) applications to create a simple database. Columns were used as field to store information on filling station. The data were saved in the project folder (created in C drive) and exported to Arc Map environment of ArcGIS 10.3 The data were then converted to shape file to be used in performing the analysis. Although, the image used for the project was in .TIFF format (tagged image file format). It is also accompanied by a world file in TIFF format. The world file contains the information about the map coordinate system. ARC GIS 10.3 software was used for the geo-referencing and digitizing exercise. Layer was created for each theme using ARC GIS 10.3. Each theme in the layer was assigned colours. Each theme was then digitized using polyline tool for linear objects and tracing them out electronically and appropriate tool for other non-linear objects. The major error like undershoot, overshoot, dang lines were taken care of. The data of the filling stations and other major point of interest i.e. hospital, police station, Schools stored in the excel sheet was converted to shape file with the aid of ARC GIS 10.3 A standard symbolization was used to map out the filling stations.

III. Results and Discussion

Inventory of Filling Stations by Road

There exist sixty seven (67) filling stations at the time of study. These filling stations are located along the major and minor roads in the Akure metropolis. Meanwhile, Table 3.1 below shows filling stations in Akure Metropolis with their coordinate, However Measured Distances of Petrol Filling Station from another using their Coordinates in ArcGIS10.3 are contained in Table 3.2 to 3.9 respectively.

Table 3.1: Showing filling stations in Akure Metropolis with their coordinate

NAME OF PETROL STATION	EASTING	NORTHING
FIRST DEEP WATER NIG LTD	736272	808124
FORTE OIL	737163	807808
DIVINE FRUIT	736547	808063
BAYDUK	737652	807480
ZION PETROLEUM	736852	807925
OMEGA PETROLEUM	737988	807123
SB FAGBOTE & CO PETROLEUM	738278	806789
AKINGBOLA ADEGBAMIGBE	738147	806977
L. OMATADOWA	737522	807579
SCAB	738601	806503
IBI BABATUNDE PETROLEUM	738668	806359
JJNPC	738839	806195
MOBIL	738935	806098
AYUS OIL &GAS LIMITED	739715	805798
BOVAS	738493	807086
TOTYM	738488	807300
GIANT IBK	737988	806382
LNPC	737754	806529
BOWET PERTOLEUM	738774	805920
CONOIL	738970	805312
FIRST DEEP WATER NIG LTD	739031	805016
FORTE OIL	739038	804845
ADEEMAN NIG LTD	739277	804270
MOBIL	739360	804127
TOTAL	739361	804050
BAYDUK	739744	803322
REMA PETROLEUM	740684	802740
FREEMAN	741127	802509
HS OIL &GAS	741241	802479
OANDO	741636	802409
MOBIL	742158	802014
FEWA	741848	802072
LAO OIL	742930	801035
TOTAL	742810	800307
SATA BEST	742909	799742
ENERGY	742921	799293
TOTAL	742565	802197
MRS	742823	802109

NAME OF PETROL STATION	EASTING	NORTHING
OANDO	743192	80209
NNPC	740099	805967
MANIA FILLING STATION	740413	805838
ARCON FILLING STATION	740637	805830
NNPC MEGA STATION	742999	797747
CASHOLD	742212	802110
BOLA FASTO NIG LTD	742764	798508
AP	742848	799407
SAMDEK FILLING STATION	741637	800988
OANDO	742366	801971
DAMILAK FILLING STATION	740068	802134
OYECTIN OIL AND GAS	738975	806134
STALLION PETROLEUM	738934	804338
KUTEYI GAS STATION	738784	806332
LIBRA PETOLEUM	738766	806279

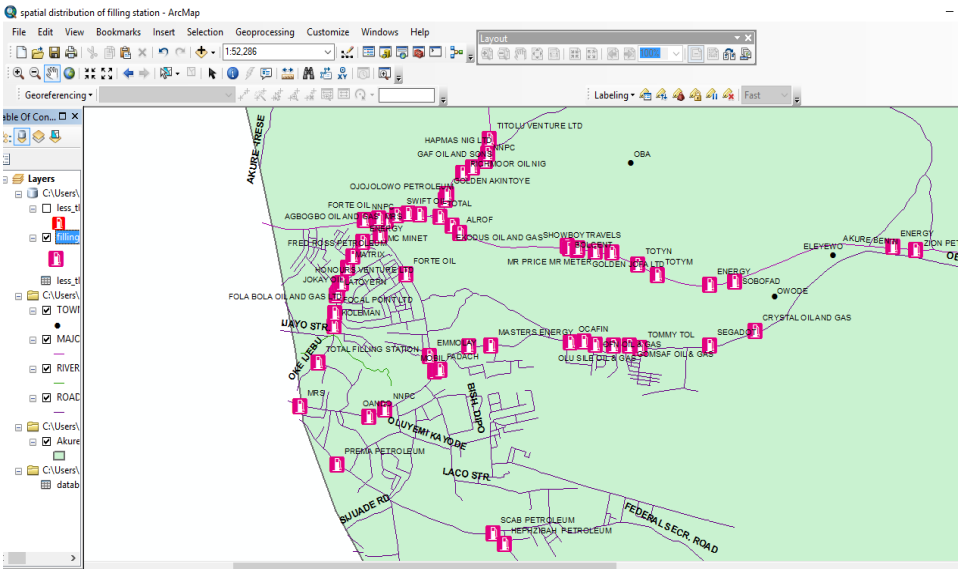


Figure 3.1: showing the spatial distribution of Filling stations in the study area.

Table 3.2: showing the distances between the Filling stations situated along Oba Adesida.

ROAD NAME	OBA-ADESIDA ROAD/ BISH FAGUN			MEASURED DISTANCE WITH RESPECT TO THE ROUTE
	FROM	TO	CAL DIST.	
1	MRS	OANDO	1278.601	1270.211
2	OANDO	NNPC	322.0947	330.336
3	NNPC	MOBIL	1114.826	1151.803

Table 3.3: showing the distances between the Filling stations situated along Oba Ile road.

ROAD NAME	**OBA ILE ROAD**			**MEASURED DISTANCE WITH RESPECT TO THE ROUTE**
	FROM	TO	CAL DIST.	
1	MOBIL	FADACH	93.00538	75.777
2	FADACH	FREEMAN	668.012	692.927
3	FREEMAN	MASTERS ENERGY	398.1017	390.797
4	MASTERS ENERGY	OCAFIN	1462.273	1548.697
5	OCAFIN	HOLAR	246.3433	259.724
6	HOLAR	OFN OIL & GAS	212.4924	205.256
7	OFN OIL & GAS	OLU SILE OIL & GAS	334.9343	338.628
8	OLU SILE OIL & GAS	GOMSAF OIL & GAS	284.0634	295.641
9	GOMSAF OIL & GAS	TOMMY TOL	199.2636	194.745
10	TOMMY TOL	SEGADOT	1270.568	1293.532
11	SEGADOT	CRYSTAL OIL AND GAS	874.6028	881.433

Table 3.4: showing the distances between the Filling stations situated along Akure-Ilesha.

ROAD NAME	**AKURE-ILESHA ROAD**			**MEASURED DISTANCE WITH RESPECT TO THE ROUTE**
	FROM	TO	CAL. DIST.	
1	NNPC	MRS	232.1745	263.446
2	MRS	FORTE OIL	47.50789	44.832
3	MRS	AGBOGBO		138.952
4	FORTE OIL	HEROES CHOICE LTD	347.2247	352.83
5	HEROES CHOICE LTD	FUNKY MASS NIG LTD	205.7037	202.367
6	FUNKY MASS NIG LTD	SWIFT OIL	204.1984	202.985

Table 3.5: showing the distances between the Filling stations situated along Akure Owo road

ROAD NAME	AKURE-OWO ROAD			MEASURED DISTANCE WITH RESPECT TO THE ROUTE
	FROM	TO	CAL DIST.	
1	SWIFT OIL	TOTAL	374.7119	377.867
2	TOTAL	EXODUS OIL AND GAS	270.1129	279.576
3	EXODUS OIL AND GAS	ALROF	179.6051	189.144
4	ALROF	BOLCENT	1986.245	2204.304
5	BOLCENT	SHOWBOY	60.82763	44.954
6	SHOWBOY	MR PRICE MR METER	129.2594	125.114
7	MR PRICE MR METER	TRAVELS	30.61046	20.186
8	TRAVELS	GOLDEN JOFA LTD	323.6109	322.507
9	GOLDEN JOFA LTD	PHEMOCHY OIL AND GAS	306.4719	314.335
10	PHEMOCHY OIL AND GAS	TOTYN	506.4632	531.41
11	TOTYN	TOTYM	405.2172	405.217
12	TOTYM	ENERGY	973.318	983.523
13	ENERGY	SOBOFAD	456.3266	460.624
14	SOBOFAD	ENERGY	2954.361	3070.829
15	ZION PETROLEUM	MRS	421.2944	422.055

Table 3.6: showing the distances between the Filling stations situated along Akure –Ado road.

ROAD NAME	AKURE-ADO ROAD			MEASURED DISTANCE WITH RESPECT TO THE ROUTE
	FROM	TO	CAL DIST.	
1	TITOLU VENTURE LTD	OLU SILE OIL & GAS	846.4195	849.81
2	OLU SILE OIL & GAS	BCAL JAY	350.464	364.997
3	BCAL JAY	LOLY JAY GLOBAL OIL	204.0882	215.362
4	LOLY JAY GLOBAL OIL	PROPOSED FILLING STATION SITE	139.0863	138.548
5	PROPOSED FILLING STATION SITE	AM JOE OIL AND GAS	1329.676	1319.875
6	AM JOE OIL AND GAS	OLA OLUYI J NIG LTD	6771.9	7564.897

7	OLA OLUYI J NIG LTD	PROPOSED FILLING STATION SITE	498.5258	528.527
8	OJOJOLOWO PETROLEUM	GOLDEN AKINTOYE	98.37174	103.762
9	GOLDEN AKINTOYE	RICHMOOR OIL NIG	462.905	484.395
10	RICHMOOR OIL NIG	GAF OIL AND SONS	205.1536	208.59
11	GAF OIL AND SONS	NNPC	258.0891	255.544
12	NNPC	HAPMAS NIG LTD	123.4828	128.564
13	HAPMAS	TITOLU	0	275.176

Table 3.7: showing the distances between the Filling stations situated along Ijapo Estate road

ROAD NAME	**IJAPO-ESTATE ROAD**			**MEASURED DISTANCE WITH RESPECT TO THE ROUTE**
	FROM	TO	CAL. DIST	
1	MOBILL	EMMOLAY	288.4042	298.865
2	EMMOLAY	FORTE OIL	1455.808	1544.197
3	FORTE OIL	MC MINET	817.3451	831.346

Table 3.8: showing the distances between the Filling stations situated along Oke Ijebu road.

ROAD NAME	**OKE IJEBU ROAD**			**MEASURED DISTANCE WITH RESPECT TO THE ROUTE**
	FROM	TO	CAL. DIST.	
1	TOTAL FILLING STATION	KOLEMAN	689.3657	739.073
2	KOLEMAN	FOCAL POINT LTD	216.5918	202.46
3	FOCAL POINT LTD	LATOYERN	307.2784	296.357
4	LATOYERN	JOKAY OIL	48.02083	42.332
5	JOKAY OIL	FOLA BOLA OIL AND GAS LTD	161.8054	168.22
6	FOLA BOLA OIL AND GAS LTD	HONOURS VENTURE LTD	39.45884	16.655
7	HONOURS VENTURE LTD	MATRIX	282.5774	284.258
8	MATRIX	FRED ROSS PETROLEUM	221.1425	225.591
9	FRED ROSS PETROLEUM	ENERGY	300.6293	303.789
10	ENERGY	AGBOGBO	0	603.789

Table 3.9: showing the distances between the Filling stations situated along Arakale road

ROAD NAME	ARAKALE ROAD			MEASURED DISTANCE WITH RESPECT TO THE ROUTE
	FROM	TO	CAL. DISTANC	
1	PREMA PETROLEUM	SCAB PETROLEUM	3086.631	3213.146
2	SCAB PETROLEUM	HEPHZIBAH PETROLEUM	270.9465	248.452

Table 3.10: PERCENTAGE Distribution of Filling Stations along Major and Minor roads within Akure Metropolis.

S/N	ROAD	TYPE OF ROAD	NOS OF FILLING STATIONS	PERCENTAGE %
1	OBA ADESIDA /BISHOP FAGUN	MINOR	5	7.4626866
2	OBA ILE	MINOR	10	14.925373
3	AKURE ILESHA	MAJOR	6	8.9552239
4	AKURE OWO /AKURE –BENIN	MAJOR	15	22.38806
5	AKURE ADO	MAJOR	14	20.895522
6	IJAPO ESTATE	MINOR	4	5.9701493
7	OKE IJEBU	MINOR	10	14.925373
8	ARAKALE ROAD	MINOR	3	4.4
	TOTAL		67	100

3.2 Analysis of Results: Considering the standard siting criteria, standards were defined to guild the establishment of Filling station in any locality in Nigeria. In this study the analysis were restricted to the following standards.

1. That the distance from the edge of the road to the nearest pump will not be less than 15meters.
2. A petrol Filling Station should be sited 400 meters away from the next petrol Station.
3. Filling Station should not be located less than 100 meters from school, hospital, theatres, clinics and other public and semi-public buildings.

Proximity analysis: (Distance from Road): Offset from the road was determined from the coordinate of the road and the coordinate of the first pump at each Filling stations, following the completion of the study it was discovered that 42 stations (62.7%) did not meet the criteria of 15m minimum distance from road, while 25 stations (37.3 %) conform to the 15 distance from the road This result confirms that majority of the Filling stations did not meet the standard criteria of locating 15m distance from road.

Table

FILLING_STATION

OBJECTID *	NO_	NAME_OF_FILLING_STATION	OFFSET_FROM_ROAD	NUMBER_OF_PUMPS	E	N	HEIGHTINGS	VILLAGE_TOWN	
1	1	MOBIL	19	6	74521	80281	332.4	ALAGBAKA	BIS
2	2	FADACH	23	6	74530	80284	335.9	ALAGBAKA	BIS
3	3	FREEMAN	26	6	74583	80324	343.4	OBA ILE	KM
4	4	MASTERS ENERGY	16	5	74623	80325	341.2	OBA ILE	KM
5	5	OCAFIN	10	4	74769	80331	334.6	OBA ILE	KM
6	6	HOLAR & HOLAR PETROLEUM	11.2	7	74794	80333	334.2	OBA ILE	OB
7	7	OFN OIL & GAS	5.3	4	74815	80328	338.3	OBA ILE	OB
8	8	OLU SILE OIL & GAS	7.5	6	74848	80325	333.6	OBA ILE	OB
9	9	GOMSAF OIL & GAS	14.2	6	74876	80326	331.7	OBA ILE	OB
10	10	TOMMY TOL	13.2	6	74896	80322	330.7	OBA ILE	OB
11	11	SEGADOT	11.2	6	75023	80326	321.2	OBA ILE	OB
12	12	CRYSTAL OIL AND GAS	4.8	8	75107	80350	327.5	OBA ILE	OB
13	13	NNPC	23	6	74430	80217	346.2	ALAGBAKA	AL
14	14	OANDO	33.2	2	74401	80204	357.2	ALAGBAKA	AL
15	15	EMMOLAY	15	5	74511	80308	346.4	ALAGBAKA	FA
16	16	FORTE OIL	34.3	5	74469	80448	357.6	IJAPO ESTATE, ALAGBAKA	FA
17	17	MC MINET	29.4	5	74421	80514	364.2	IJAPO ESTATE, ALAGBAKA	FA
18	18	AGBOGBO OIL AND GAS	28	4	74433	80539	371.4	IJAPO ESTATE, ALAGBAKA	FA
19	19	MRS	20	5	74416	80540	364.5	SHASHA, ALAGBAKA	KM
20	20	FORTE OIL	28	6	74418	80544	363.3	SHASHA, ALAGBAKA	KM
21	21	NNPC	3.2	6	74392	80540	364	SHASHA, ALAGBAKA	KM
22	22	HEROES CHOICE LTD	12.3	6	74452	80549	375	SHASHA, ALAGBAKA	KM
23	23	FUNKY MASS NIG LTD	7.4	6	74473	80551	383.1	SHASHA, ALAGBAKA	KM
24	24	SWIFT OIL	14.6	8	74493	80550	360	SHASHA, ALAGBAKA	KM
25	25	TOTAL	33	6	74530	80545	378	SHASHA, ALAGBAKA	KM
26	26	EXODUS OIL AND GAS	3.2	5	74554	80531	373.5	SHASHA, ALAGBAKA	KM
27	27	ALROF	23	7	74566	80519	350	SHASHA, ALAGBAKA	KM
28	28	BOLCENT	21	6	74764	80496	353.4	SHASHA, ALAGBAKA	AK
29	29	SHOWBOY	7.4	8	74768	80492	356.6	SHASHA, ALAGBAKA	KM
30	30	MR PRICE MR METER	13	12	74781	80490	351	SHASHA, ALAGBAKA	KM
31	31	TRAVELS	4.3	9	74783	80492	352	SHASHA, ALAGBAKA	KM
32	32	GOLDEN JOFA LTD	29.2	6	74814	80486	344.4	OBA ILE	KM
33	33	PHEMOCHY OIL AND GAS	30.8	6	74845	80484	337.2	OBA ILE	KM
34	34	TOTYN	16.2	5	74891	80464	337.7	OBA ILE	KM
35	35	TOTYM	11.2	6	74928	80447	337.7	OBA ILE	KM
36	36	ENERGY	33.2	4	75024	80429	329.9	OBA ILE	KM
37	37	SOBOFAD	30.3	6	75069	80435	337.1	OBA ILE AKURE	KM
38	38	ENERGY	8.8	6	75358	80495	347	ELEYOWO,AKURE	K

1 (25 out of 67 Selected)

Figure 3.2: Spatial query for more than 15m **Source:** field survey

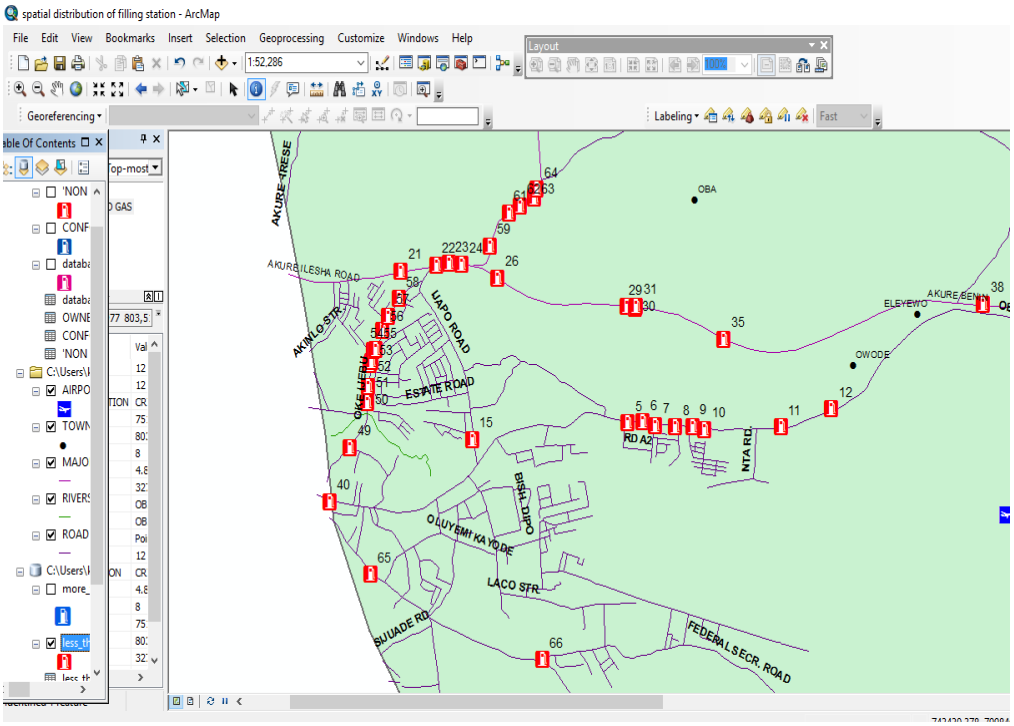


Figure 3.3: Filling stations that conforms to the 15m offset

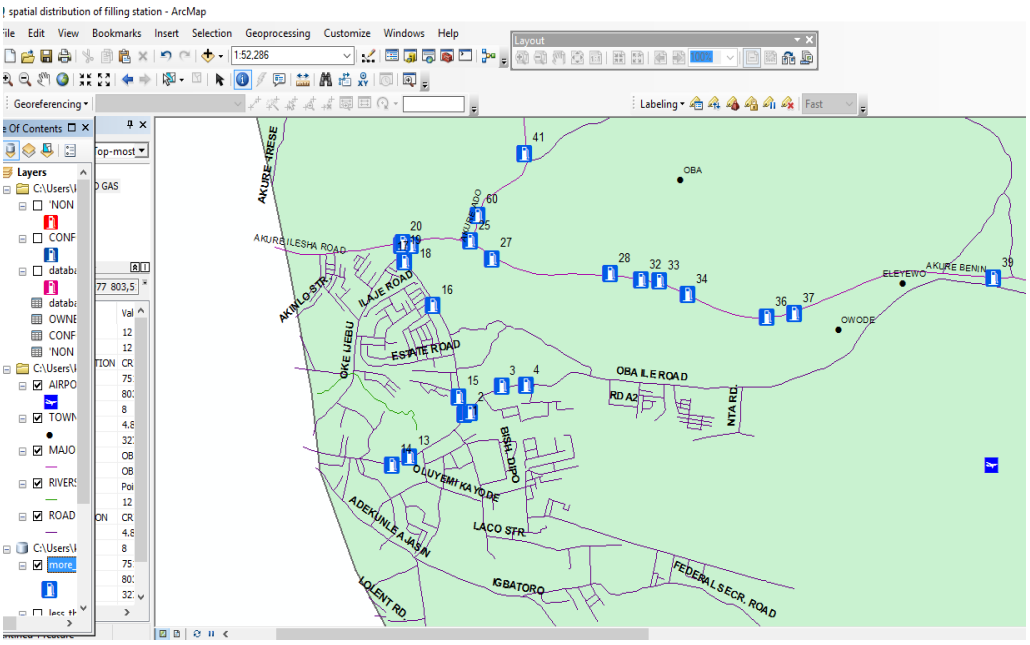


Figure 3.4: Filling stations that contravene the 15m offset

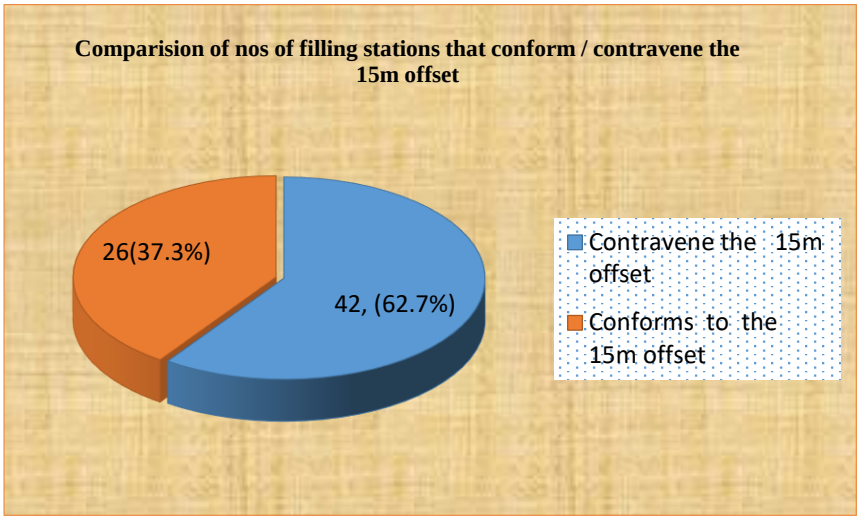


Figure 3.5: pie chart showing Comparison of no: of filling stations that conform / contravene the 15m offset. **Source**: Field Survey (2017).

3.2.1.2 Distance between the Locations of Filling Stations The finding revealed that longest distance between neighboring Filling stations was 6771.9, which exist between AM JOE OIL and GASOLA OLUYI J NIG LTD along Akure Ado; The result also shows that 46% of the Filling stations conform to the 400 meters distance to their neighbours by road. However, about only 54% of the Filling stations could not meet the minimum distance of 400 meters road separation to their neighbours. The highest number of those that did not meet the minimum standard of 400m distance to their neighbours' locations by road was of Filling observed in Akure Owo road and Oke Ijebu road.

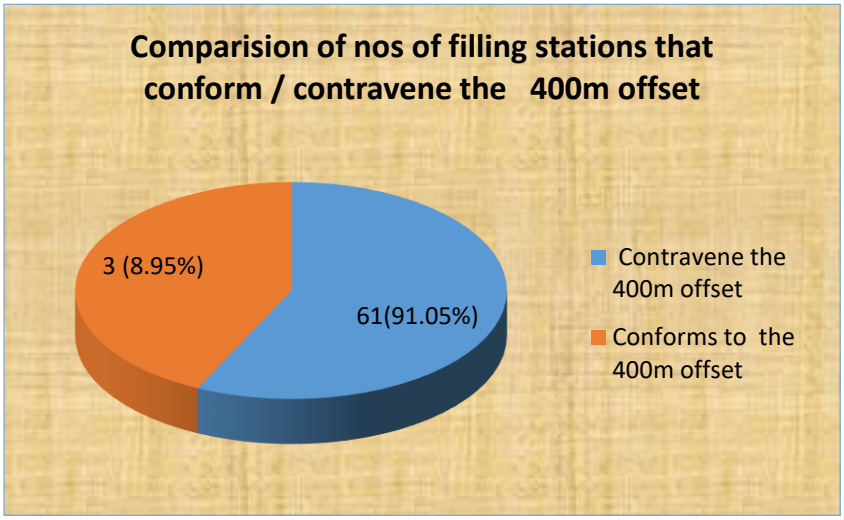


Figure 3.6: pie chart showing Filling Stations in Relation to 400 meter road separation to Nearest Filling Station. **Source:** Field Survey (2017).

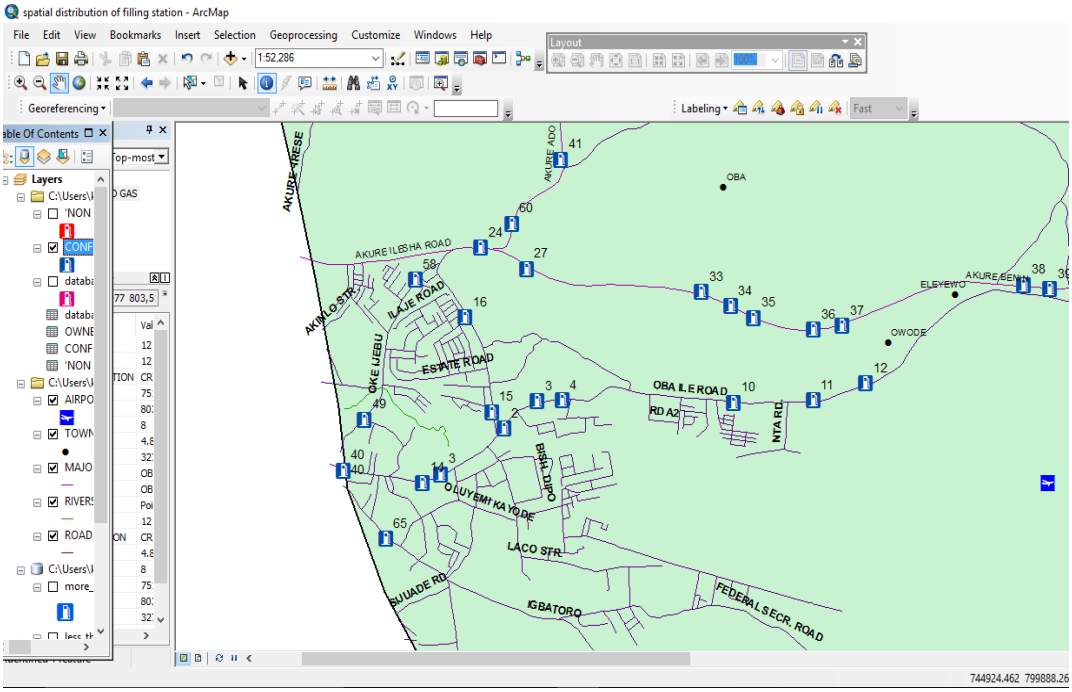


Figure 3.7: Filling station conforming to the 400m.

3.2.2. Buffer analysis (Considering the 400m buffer query on Filling stations)

The result of the 400m buffer analysis revealed that only 6 Filling stations did not contravene the 400 m standard, this implies that 61 other Filling station contravenes the 400m standard defined by the DPR

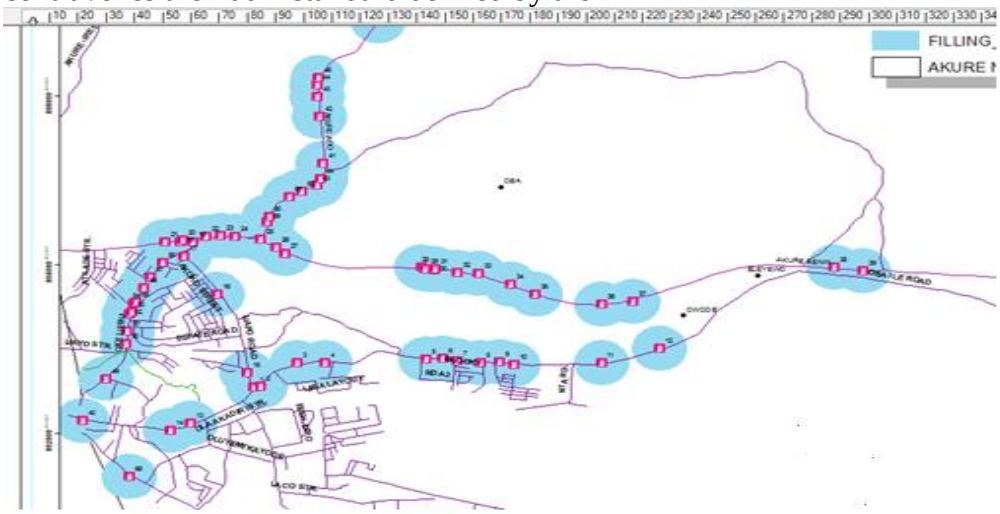


Figure 3.8: 400m buffer on Filling station.

3.2.2.2 Distance of Filling Stations to Health Facilities According the criteria set by the DPR, Filling stations are not allow to operate adjacent to public institution like hospitals. The coordinates of healthcare facilities was plotted and a buffer of 100 m was done in the Arc GIS environment. The result obtained

thus showed that all the Filling station situated within the study area complied to the 100m distance away from the location of health facilities as shown in Figure 3.9 below.

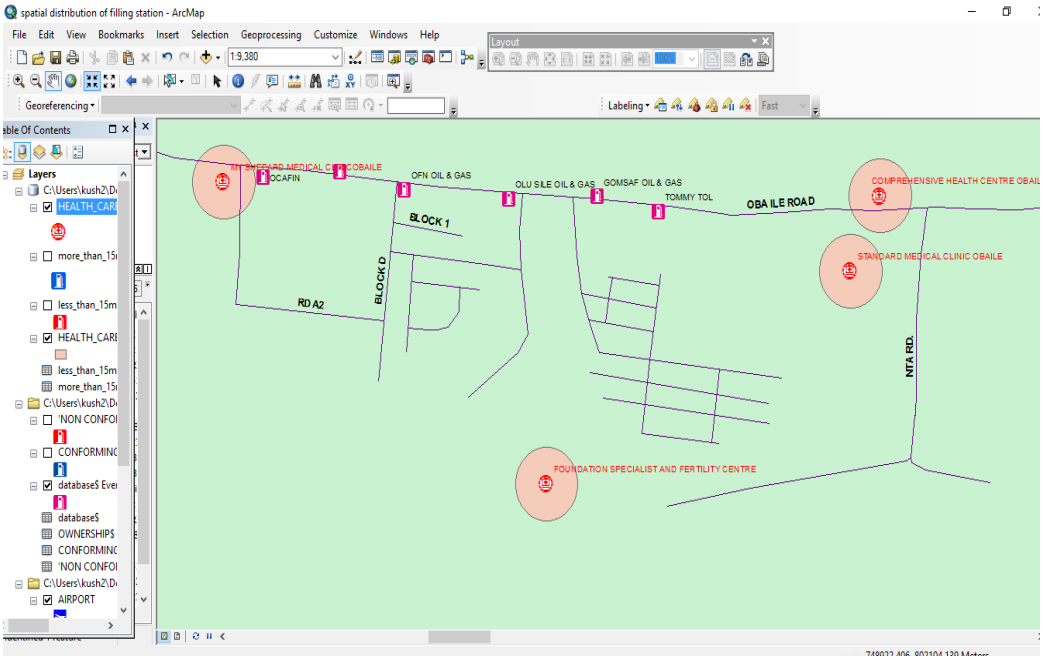


Figure 3.9: 100m buffer analysis of Filling Stations in Relation to some Health Care Facilities in Akure Metropolis **Source:** Field Survey (2017)

3.2.2.3 Distance of Filling stations to schools: Similarly buffer analysis was performed on the schools layer, representing the distribution of schools in the project area, a query by location was performed to display Filling stations that contravenes the 100m distance from schools. Query result shows that only 3 Filling stations did not conform to the specified distance from schools in the project area.

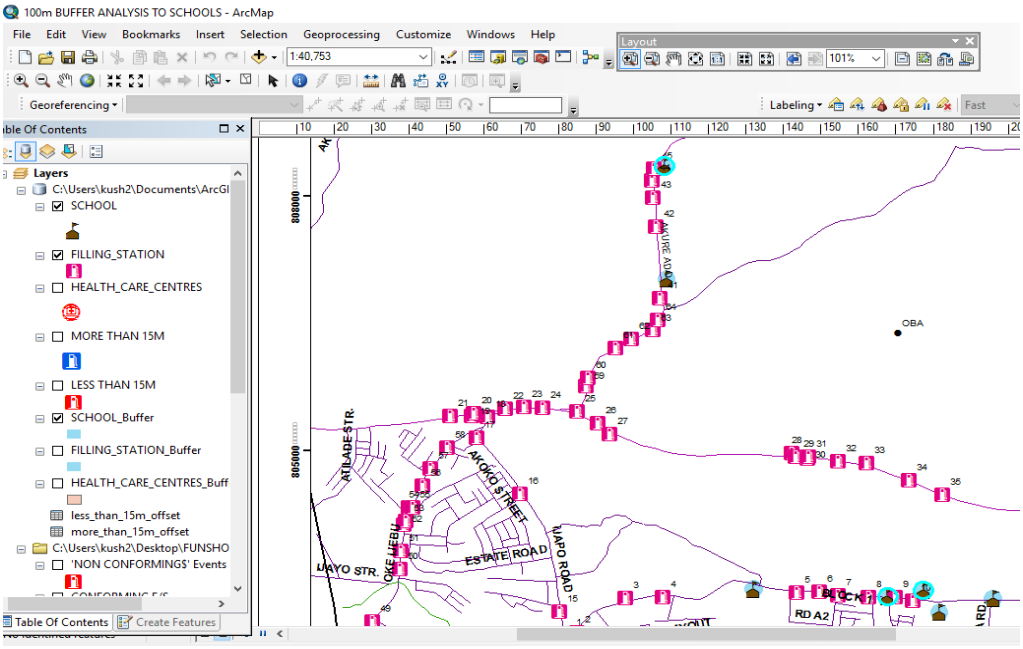


Figure 3.10: 100m buffer analysis of Filling Stations in Relation to schools in Akure Metropolis, **Source**: Field Survey

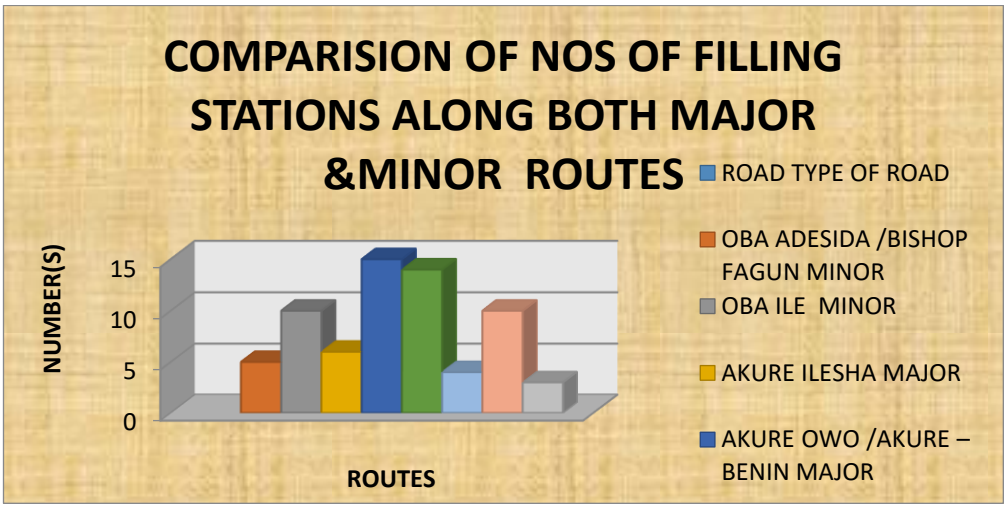


Figure 3.11: Comparison of number Of Filling Stations Along Both Major &Minor Routes in Akure Metropolis, **Source**: Field Survey

3.2.3 Nearest Neighbour Analysis In order to determine the location pattern of the fuel stations, the nearest neighbour statistics (R) formulated by Clark and Evans was applied. The statistics is defined as n

$$R_n = 2\bar{d}\sqrt{\frac{n}{A}}$$

Where R =nearest neighbour index n
A = land area of the study area
d = total mean distance between the fuel stations

n = number of fuel stations

The following conditions are applied to determine if location pattern of the distribution of Filling stations Akure Metropolis are :

`R = 0: the distribution is clustered n

- R = 1: the distribution is random n
- R = 2.15: the distribution is regular n

Using the ArcGIS, the nearest neighbour distance computed result is 0.19, which thus indicate that the general distribution of Filling stations in Akure metropolis is tending towards clustered pattern. Nearest neighbour index (Rn) value is less than 1 and Z-value is -12.744 less than -1.96. Also there is significant difference between the distributions of Filling stations in the area.

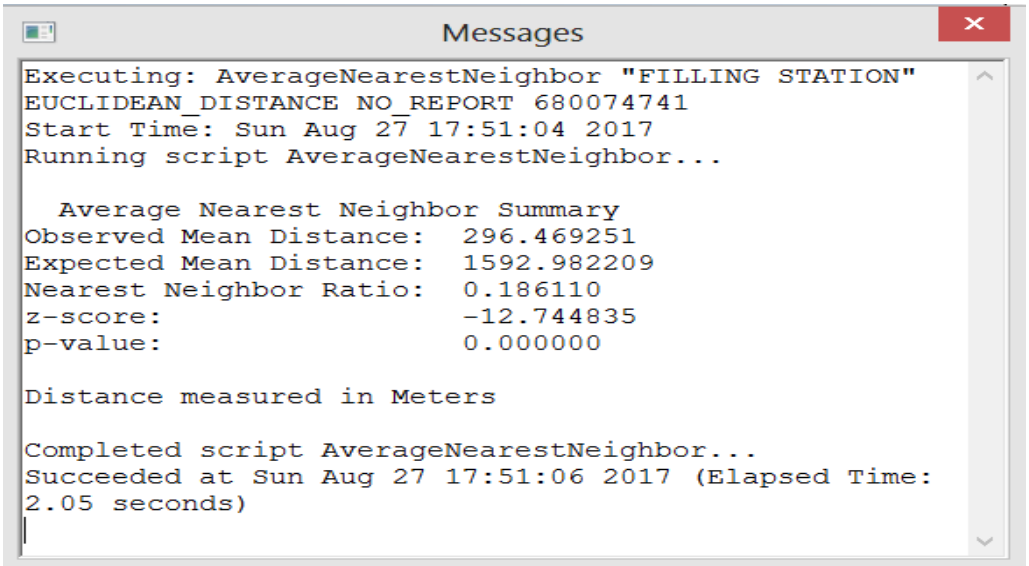


Figure 3.11: Result of the nearest neighbour analysis.

IV. Conclusion and Recommendations

4.1 Conclusion

The analysis of the spatial distribution of filling stations in the study area reveals that conformity to 400m required distance from one another was met by only 37 (54%) out of the 67 petrol filling stations in the region, while the remaining 30 (46%) did not conform. Also, the analysis of petrol filling stations' conformity to the required 15m distance from the road shows that only 25 (40%) petrol filling stations conformed while 42 (60%) petrol filling stations did not. Similar, the Buffering results revealed that, 95.5% conformed to the required distance of 100m from existing school and 100% conformed to the required distance of 100m from the existing healthcare facility. Thus, there is an indication that, the general distribution of Filling stations in Akure metropolis is tending towards a clustered pattern which automatically translates into high level vulnerability to potential hazards associated with each utility.

4.2 Recommendations

This study is hereby recommended for adoption by the regulatory agency, DPR, as an A-prior data to improve their capacity for future work that requires enforcing the compliance of petrol filling stations with laid down regulations.

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