RESEARCH ARTICLE OPEN ACCESS

Geospatial Analysis and Assessment of Traffic Congestion on Major Road in Ibadan North Local Government Area, Oyo State, Nigeria.

Adewuyi, Gbola K.[1*], Ajani, Ayodeji O.[2], Oyekunle, Abraham O.[3]
[1]*Department of Surveying and Geoinformatics, The Polytechnic Ibadan, Oyo State, Nigeria.*
[2]*Department of Geographical Information System, Federal School of Surveying Oyo, Oyo State, Nigeria.*
[3]*Bureau of Lands and Survey, Oke-Ilewo Abeokuta, Ogun State, Nigeria.*
Corresponding Author : Adewuyi, Gbola K.

ABSTRACT
This study examines traffic congestion on major roads in Ibadan North Local Government Area, Oyo State, Nigeria using geospatial approach, and also assesses its causes and effects. Field observation was done using surveying method while other data were collected through questionnaires and oral interview. Hi-Target Differential Global Positioning System (DGPS) was used to acquire spatial data i.e. (X, Y, Z) coordinates of major points prone to congestion. Four hundred (400) structured questionnaires was administered and distributed among the road users comprising drivers (Private and Commercial), passengers, pedestrians, traffic officers, community leaders, residents, and other road users. A total number of three hundred and fifteen (315) questionnaires were completed and returned. Also, interviews were conducted with roadside hawker, motorcycle and tricycle drivers, passengers, Oyo State Road Traffic Management Authority (OYRTMA), Traffic Warden and Nigeria Police Officer on Special Duty. Further analysis was carried out using Hi-target Geomatics Office (HGO), Global Navigation Satellite System (GNSS) Solution and IBM SPSS 20 Statistical Package for the Social Sciences for data processing, and ArcGIS 10.2.1 for graphic design. The result of the study were presented inform of plans/maps, map queries, charts, pictures and frequency tables. Generally from the study, it showed that traffic congestion were caused by traffic warden, accident, roadside-hawking, vehicle-breakdown, double packing, roadside-packing, inadequate road capacity, absence of walkways, traffic light malfunctioning and pot holes while the effects of the traffic congestion are extra fuel consumption, reduction in working hour, less productivity, stress/anger, late/missed appointment, inability to forecast travel time, extra time consumption. It is hoped that this study will become the foundation of further study in the area to improve road traffic management on our major road in Ibadan North Local Government Area as well as Oyo State as a whole.
Keywords: Traffic Congestion, Geospatial approach, structured questionnaire, Statistical package, traffic management

---

Date Of Submission: 22-06-2019 Date Of Acceptance: 08-07-2019

I. INTRODUCTION

Road networks are defined as an open, General Public Way for the passage of Vehicle, people and Animals. [1]. Transport is the means by which people are able to engage in activities that require people themselves and material goods to be in different places at a different time. [2]. Transportation and property are important in physical and economic development of towns and cities all over the world. Property and land values tend to increase in areas with expanding transportation networks, and increase less rapidly in areas without such improvements. Rapid and continued rise in housing and land prices are expected in cities with transportation improvements and rapid economic and population growth [3]. According to [4], [5] urban road transportation system is one of the important factors responsible for shaping the urban centers, based on the assumption that consumers rationally choose a form of transportation, according to their social and spatial position within the urban market. They opined that the urban road transportation system acts as basic component of urban areas' social, economic and physical structure it plays an essential role in the determination of the scale, nature and form of urban areas. Accessibility must be taken into consideration in all human life journey. Accessibility refers to ease of reaching destinations with people in places that are highly accessible reaching many other activities or destinations quickly, while people in inaccessible places can reach fewer places in the same amount of time [6]. Illegal roadside parking and lack of geospatial information necessary to tackle the spatial problem as other causes of traffic congestion as highlighted by [7]. The study further suggested the

use of a Dynamic Traffic Information System (DTIS) structure to monitor congestions in Ibadan north for easy accessibility.

Traffic congestion occurs when a city's road network is unable to accommodate the volume of traffic that uses it. This situation is caused by rapid growth in motorization and with less than corresponding improvement in the road network facilities and traffic management techniques. The problem of traffic congestion has reached an alarming rate in Nigeria especially in many cities. According to [8]; Defined Traffic Congestion as an essentially a relative phenomenon that is linked with the different road way system performance that road users expect and how the system actually performs. Furthermore, European conference of ministers of transport [9] Defined congestion as long queues of vehicles which are constantly stopping and starting passengers cannot move in a desirable manner under the serious conditions [10]. This is a condition of traffic delays whereby traffic flow is slowed below reasonable speeds because the number of vehicles to use exceeds the design capacity of the traffic to handle it [11].

Congestion results when traffic demand approaches or exceeds the available capacity of the road system. While this is a simple concept, it is not constant because traffic demand may vary significantly depending on the season of the year, the day of the week and even time of the day. Nevertheless, the overall effect of congestion on Nigeria Highway in which Ibadan North Local Government is part of, cannot be accurately quantify due to uncounted and diversified effects it has on the national capacity but its significant effect can be seen on service delivery, good delivery, pollution, discomfort, excessive fuel consumption, excessive vehicle maintenance all these accounted for economic loss. On the issue of poor road network, developing countries have witnessed an explosive growth in their vehicular population resulting into failure of conventional traffic management strategies [12]. The recent research by Centre for Economics and Business Research (CEBR), quantifies the cost of traffic congestion on individual households and national economies in the U.S., U.K., France and Germany indicates that traffic congestion instead does much more than test our patience, it drains people's wallets as well our economies [13].

The traffic speeds are slower where densities are higher and the reverse is true. In the United States, average roadway speeds in urban areas are around 32 miles per hour; the European speeds are less than 20 miles per hour, while Canadian speeds are less than 25 miles per hour [14]. The inability to forecast travel time and delay movements [15], research has proved that travel behaviors of customer choice models to drive the valve of time spent in travel for both work and other activities. However, research studies again have demonstrated the importance of considering time variability in the deviation of traveler cost function [16], [17], [18], the studies show that the right circumstances during congested peak period travel, reduces the variability hence uncertainty associated with trip times can offer a significant traveler benefits. This empirical evidence examined that a major cause of day to day variability in trip times is the occurrence of traffic incidents, including major accidents that block traffic lanes for prolonged periods and many minor incidents, such as vehicle breakdowns and other factors [19], [20].

Geographic Information System (GIS), over the years, has emerged as one of the efficient technological tools in the field of transportation engineering. It has shown great applications in a number of fields including transportation. According to [21] emphasized the advantage of Global Positioning System (GPS) to map the relevant traffic parameters. This can easily be done in a GIS environment. This makes possible to make a pre-evaluation of various measures related to the local targets and which usually proves to be conclusive. Spatial analysis allows the tool to start responding to various events, evaluates impact and answers the best route for the road users [22]. The problems related to the transportation aspect of a Guangzhou city in China as studied by [23]. The use of GIS to create an extensive database containing all the traffic information such as speed data, road geometry, traffic flow etc as highlighted by [24]. The data obtained is then processed and mapped. The information obtained can subsequently be used to create a database in GIS to help in decision making for any planning process including a speed management programme. The application of GPS for traffic data such as travel time and traffic speed and they validated the GPS data by conventional methods and statistically validated the results of these parameters and found that the GPS data can be used for traffic studies without compromising the accuracy of the data as studied by [25]. There has been every day delay due to traffic on major roads in Ibadan North Local Government Area of Oyo State, Nigeria and the causes, effects is yet determined. Therefore, this study used geospatial approach to analyze traffic information and also assesses the causes and effects of such traffic congestion on the affected major roads of the study Area.

II. THE STUDY AREA

Ibadan North Local Government is located within geographic Latitude 7^0 38'00"mN to $7^0$44'00"mN and geographic Longitude 3^0 88'00"mE and 3^0 95'00"mE. It covers a total land area of about 26,332msq with a population of about 306.795 as at

the 2006 census [26]. It is a home for small, medium and large scale commercial activities as well as center for most commercial organization headquarters. The Local Government area is a host to two major higher institutions in Ibadan which includes the University of Ibadan, The Polytechnic Ibadan and the Nigeria Institute of Social and Economic Research (NISER). The major mode of transport in the study area is by road.

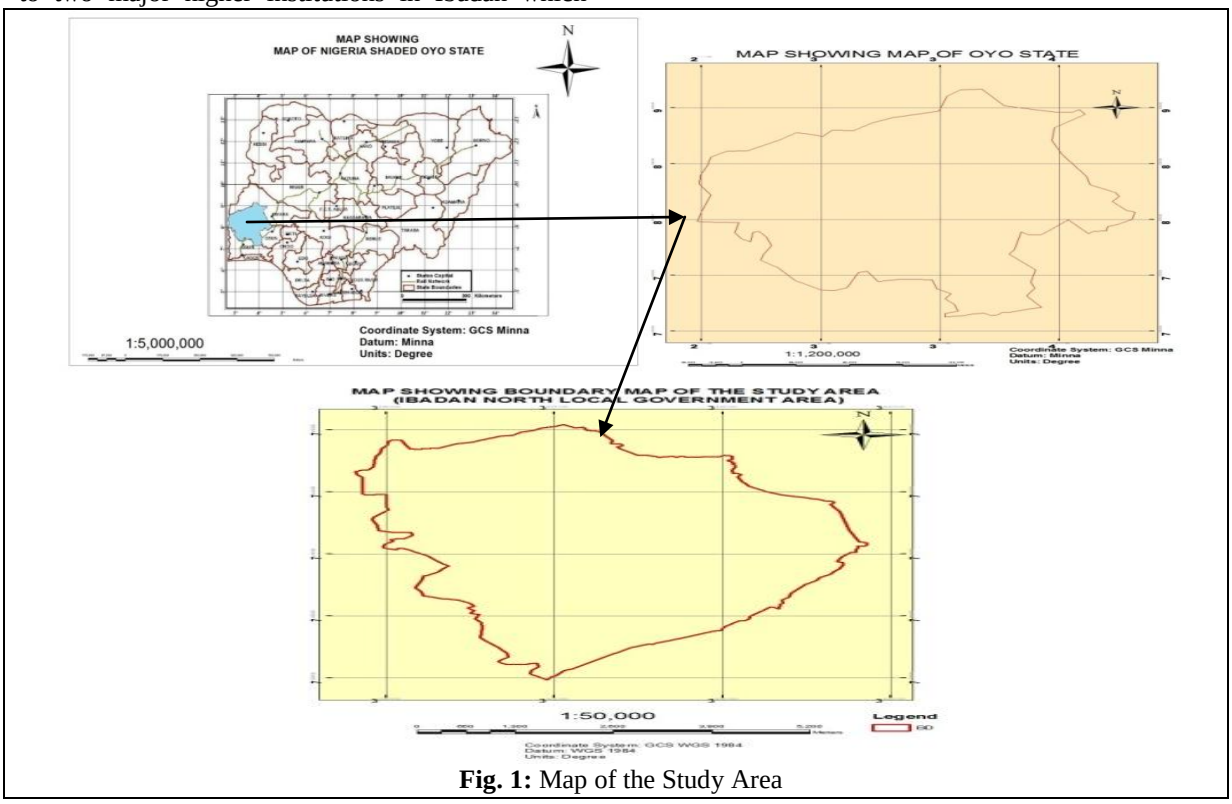


Fig. 1: Map of the Study Area

III. MATERIALS AND METHODS

3.1 Material used

The following equipment were used during the course of the study

3.1.2 Surveying instrument and equipment

i. Hi-Target Differential Global Positioning System and it accessories used to acquired X,Y,Z coordinate

ii. Measuring tape used to measure the height of the instrument

3.1.3 Hardware

i. Elite Book (HP)

ii. Model: HP 2540p

iii. Rating: 1.0 window experience index

iv. Memory RAM: 4.00GB

v. Processor: Inter(R) CORE^{TM} i5, CPU 2.53GHz, M540@ 2.53GHz

vi. System type: 64 bit operating system

vii. Printer: Kyocera FS-2020D and Kyocera FS-4020DN

3.1.4 Software

1. Arc GI S 10.2
2. Notepad for running scrip
3. Microsoft offices (Microsoft word and excel for report writing and for editing respectively)
4. Hi-Target Geometric Office (HGO)
5. GNSS Solution

3.2 Data Acquisition

This involved the field procedure required in carrying out the field observation for the study. Data were source from both the Primary source and Secondary source. Also, during the field observations, the causes, effects attributed to economic and social impact were taken into consideration.

3.2.1 Primary Source

i. Direct observation for geospatial data (using Hi-Target DGPS to acquire Northing, Easting and Height coordinate value of interested points).

ii. Questionnaire survey and personal interview.

iii. Traffic and delay survey and counting.

3.2.2 Secondary Source

i. These involved related journals, conference proceedings, books etc. (downloaded online),

ii. Quickbird satellite imagery (Resolution 0.6) collected from Federal Research Institute of Nigeria (FRIN)

iii. The coordinate information of the control beacon point at Sango junction was use and its information was obtained from the ministry of survey Oyo state and tabulated in TABLE 1 below:

Table 1: show the coordinate value of the Control Beacon at Sango junction

Station Prefix	Easting (m)	Northing (m)	Height (m)	Remark
YZN 364	599236.455mE	820553.304Mn	234.144m	In-situ

Source: Office of the Surveyor General, Oyo State

3.3 Procedures/Methods of data acquisition

3.3.1. Data acquisition by Surveying Method

This is the data acquired by ourselves in other to achieve the aim of the study. This involved the use of Hi-target Differential Global Positioning System to determine the spatial position/locations of traffic point, traffic flow observation to know days and time traffic are occurred at each location, determination of road locations prone to traffic congestion. One of the two GPS was set on a known point called the base station at Sango. The base GPS point is a static point. The other GPS was taken to all traffic points called the Rover point/station to captured data for 20mins before taken to another point. The data captured by the DGPS was then processed to get the final coordinate of the rover station for all traffic points.

3.3.2 Traffic observation

This involves physical observation of the flow vehicles at days of the week and at different time interval. Also, during the traffic observation the causes and the effect of traffic congestion were also observed.

3.3.2.1 Traffic Counting and Observation

There are various technique and methods used in traffic survey (traffic counting) but for the purpose of this study, manual counting was adopted. Preliminary investigation has incited and thus carried out on traffic counting at selected location.

3.3.2.2 Manual counting

Manual counting is usually carried out between hours for a day because it is impossible to manually carry out the counting for a longer period. The counting (number of vehicles) was based assessed per hour, all private car, commercial cab and buses, motorcycle, tricycle and heavy duty vehicles were counted. For the purpose of this study, counting was carried out for two weeks between hours of 7am to 9:00am, 2:00pm to 4:00pm and 4:00pm to 6:00pm for morning, afternoon and evening observation respectively from Monday to Saturday. TABLE 2-5 described the manual counting for the study in four of the major traffic locations.

Table 2: Manual Counting of Vehicles (Bodija Market/Ojurin)

Day	Duration and Time	Car 1 (Private)	Car 2 (Commercial)	Bus	Tricycle	Motor cycle	Truck	Total
Monday	Morning (7-9am)	105	181	207	88	94	23	698
	Afternoon (2-4pm)	86	127	194	87	62	16	572
	Evening (4-6pm)	161	211	271	92	136	13	884
Tuesday	Morning (7-9am)	97	109	197	78	41	12	644
	Afternoon (2-4pm)	85	129	168	57	129	18	586
	Evening (4-6pm)	188	203	203	93	116	26	829
Wednesday	Morning (7-9am)	102	110	196	84	123	28	643
	Afternoon (2-4pm)	52	117	139	59	103	17	487
	Evening (4-6pm)	167	103	224	112	162	24	792
Thursday	Morning (7-9am)	127	79	136	76	100	19	537
	Afternoon (2-4pm)	92	119	152	70	80	8	521
	Evening (4-6pm)	127	137	214	96	113	23	711
Friday	Morning (7-9am)	100	113	197	83	124	16	633
	Afternoon (2-4pm)	97	156	206	98	118	19	694
	Evening (4-6pm)	178	106	201	168	70	25	748
Saturday	Morning (7-9am)	84	109	174	36	43	16	462
	Afternoon (2-4pm)	115	86	192	52	100	13	558
	Evening (4-6pm)	120	120	183	50	123	19	615

Table 3: Manual Counting of Vehicles (Sango)

Day	Duration and Time	Car 1 (Private)	Car 2 (Commercial)	Bus	Tricycle	Motorcycle	Truck	Total
Monday	Morning (7-9am)	253	318	212	102	118	56	1059
	Afternoon (2-4pm)	98	113	124	82	74	22	513
	Evening (4-6pm)	110	196	202	98	141	18	765
Tuesday	Morning (7-9am)	199	218	184	88	103	48	840

	Afternoon (2-4pm)	82	92	105	65	69	14	427
	Evening (4-6pm)	120	221	199	103	127	23	793
Wednesday	Morning (7-9am)	213	202	176	68	116	37	812
	Afternoon (2-4pm)	78	101	87	66	109	22	463
	Evening (4-6pm)	132	118	110	85	112	18	575
Thursday	Morning (7-9am)	117	103	115	97	104	21	557
	Afternoon (2-4pm)	82	88	96	75	90	12	443
	Evening (4-6pm)	106	122	113	81	99	25	546
Friday	Morning (7-9am)	112	120	132	92	122	15	593
	Afternoon (2-4pm)	88	134	128	77	103	16	546
	Evening (4-6pm)	122	142	133	101	112	11	621
Saturday	Morning (7-9am)	114	117	132	45	56	9	473
	Afternoon (2-4pm)	94	104	108	58	82	17	463
	Evening (4-6pm)	132	142	173	88	156	32	723

Table 4: Manual Counting of Vehicles (University of Ibadan Main gate/Agbowo)

Day	Duration	Car 1 (Private)	Car 2 (Commercial)	Bus	Tricycle	Motorcycle	Truck	Total
Monday	Morning (7-9am)	156	221	185	78	84	28	752
	Afternoon (2-4pm)	95	147	186	67	74	21	590
	Evening (4-6pm)	192	222	189	59	96	28	786
Tuesday	Morning (7-9am)	127	201	158	66	51	16	619
	Afternoon (2-4pm)	94	149	108	47	110	14	522
	Evening (4-6pm)	206	213	175	86	103	21	804
Wednesday	Morning (7-9am)	121	126	156	64	106	24	597
	Afternoon (2-4pm)	66	107	101	69	93	19	455
	Evening (4-6pm)	182	222	104	88	133	22	751
Thursday	Morning (7-9am)	147	99	116	62	101	17	542
	Afternoon (2-4pm)	77	109	99	72	87	11	455
	Evening (4-6pm)	138	129	114	86	93	26	586
Friday	Morning (7-9am)	121	123	107	75	114	29	569
	Afternoon (2-4pm)	89	136	148	78	98	25	574
	Evening (4-6pm)	167	184	195	96	84	27	753
Saturday	Morning (7-9am)	119	129	117	85	63	18	531
	Afternoon (2-4pm)	105	144	131	44	97	23	544
	Evening (4-6pm)	126	145	143	57	116	28	615

Table 5: Manual Counting of Vehicles (Mokola Roundabout)

Day	Duration	Car 1 (Private)	Car 2 (Commercial)	Bus	Tricycle	Motorcycle	Truck	Total
Monday	Morning (7-9am)	148	197	155	86	91	23	700
	Afternoon (2-4pm)	98	127	113	53	68	18	477
	Evening (4-6pm)	174	212	169	69	88	24	736
Tuesday	Morning (7-9am)	121	189	122	58	62	25	577
	Afternoon (2-4pm)	101	125	102	57	108	22	515
	Evening (4-6pm)	197	162	125	84	113	28	709
Wednesday	Morning (7-9am)	111	123	106	67	96	21	524
	Afternoon (2-4pm)	84	118	107	56	84	14	463
	Evening (4-6pm)	172	202	94	78	119	26	691
Thursday	Morning (7-9am)	132	120	106	66	93	27	544
	Afternoon (2-4pm)	97	119	98	62	99	12	487
	Evening (4-6pm)	138	129	114	86	93	29	589
Friday	Morning (7-9am)	139	133	99	85	124	29	609
	Afternoon (2-4pm)	81	128	114	58	86	17	484
	Evening (4-6pm)	155	197	178	98	91	28	747
Saturday	Morning (7-9am)	138	149	127	95	93	26	628
	Afternoon (2-4pm)	115	114	101	51	62	19	462
	Evening (4-6pm)	136	151	133	88	121	26	655

Source: Field Survey, 2018/2019

3.4 Data acquisition using oral interviews and questionnaires.

Data was collected between the months of November, 2018 to January 2019. Eight field personnel's were involved in data collection from traders, drivers and passersby. Four hundred (400) questionnaires were administered and were distributed within Ibadan North Local Government Area. The study area was divided into four axis which are; Mokola/Sango/University of Ibadan Axis

route, Bodija/Secretariat Axis route, Ashi/Ore-meji Axis route and Agodi Gate/University College Hospital route. A total of 100 questionnaires were distributed to each axes route (TABLE 4). Two in one questionnaires were prepared. One type was for shop occupiers and available drivers at garages, while the other was administered for the passersby, commercial and private vehicle drivers and passengers delayed in the traffic. The questionnaires addressed to traders consisted of questions that covered the location and background of respondents, time at which road is congested with traffic and the length of time it takes, what are the major causes of traffic congestion. Other questions cover the rate of speed during traffic congestion, causes, and effects in terms of economic and social impact of traffic congestion. By virtue of the busy nature of hawkers/traders, passerby's drivers, movements of private and commercial vehicles there was considerable reluctance on their parts to volunteer information. Some of the respondents, especially drivers and traders, delayed in completing the questionnaires and it took perseverance as some of them couldn't read and write, the researcher had to treat it inform of question and answer for the uneducated ones. Out of the four hundred (400) questionnaires distributed, three hundred and fifteen (315) were returned (representing 78.75%). In-depth personal interviews were conducted during the course of questionnaire distribution for this study.

3.5 Data Processing

Fig. 2 and 3 below is the processing procedures of the data acquired from the field through surveying method with the H-target differential GPS. Data pre Processing was done using Hi-Target Geometric Office (HGO) and store in Rinex for post processing using the GNSS Solution application software. Fig. 4 is the database creation for the questionnaire administered. TABLE 6 is the processed traffic point/location data from the differential Global positioning System DGPS equipment for the study. IBM SPSS 20 (statistical package for the social sciences) was used to create database for study based on the questionnaire administered. Each question was coded, store and save.

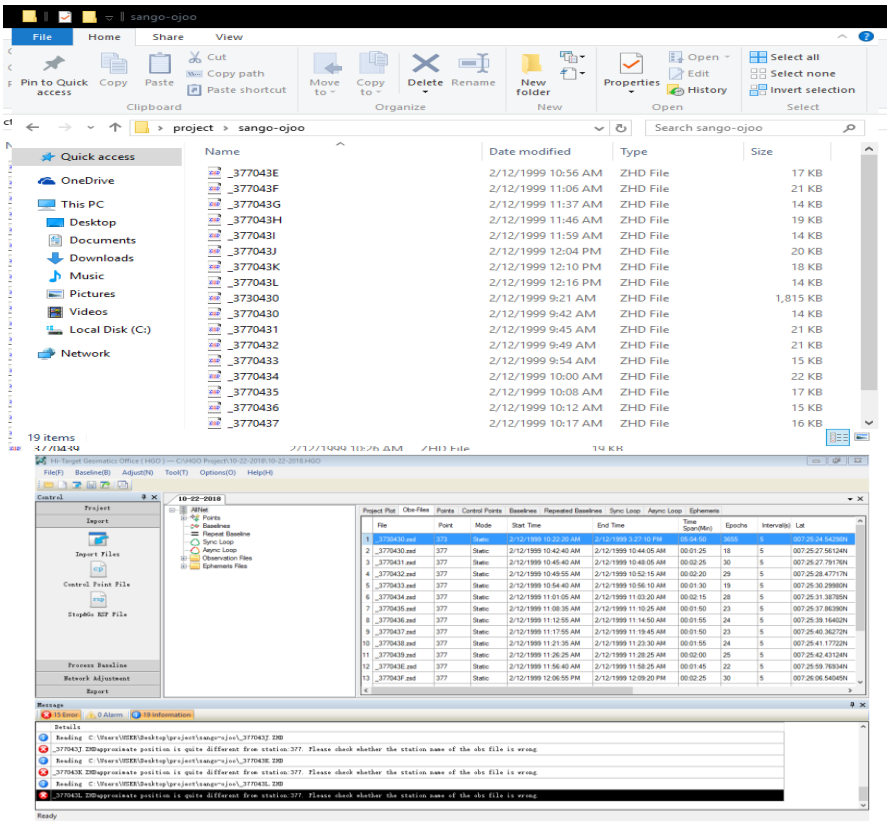


Fig 2: showed the raw downloaded data from DGPS to computer system. The figure showed the HGO for Post Data Processing

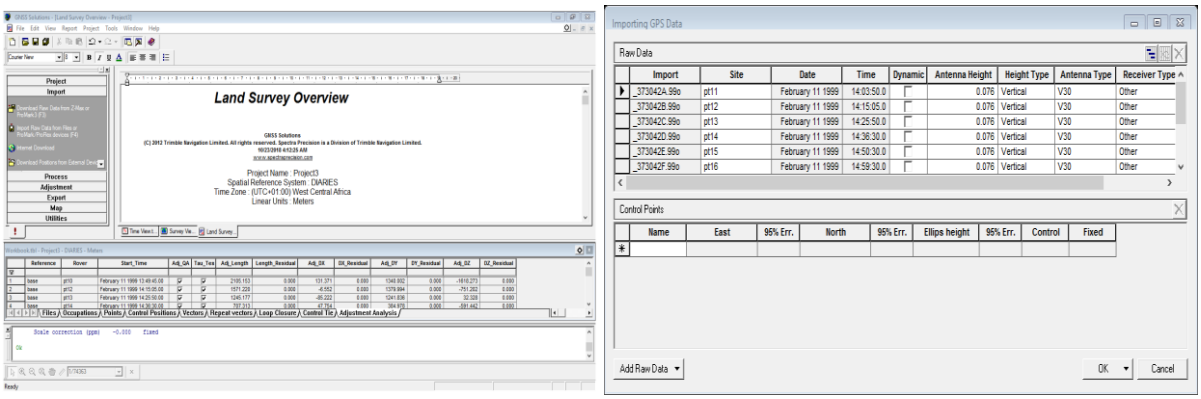
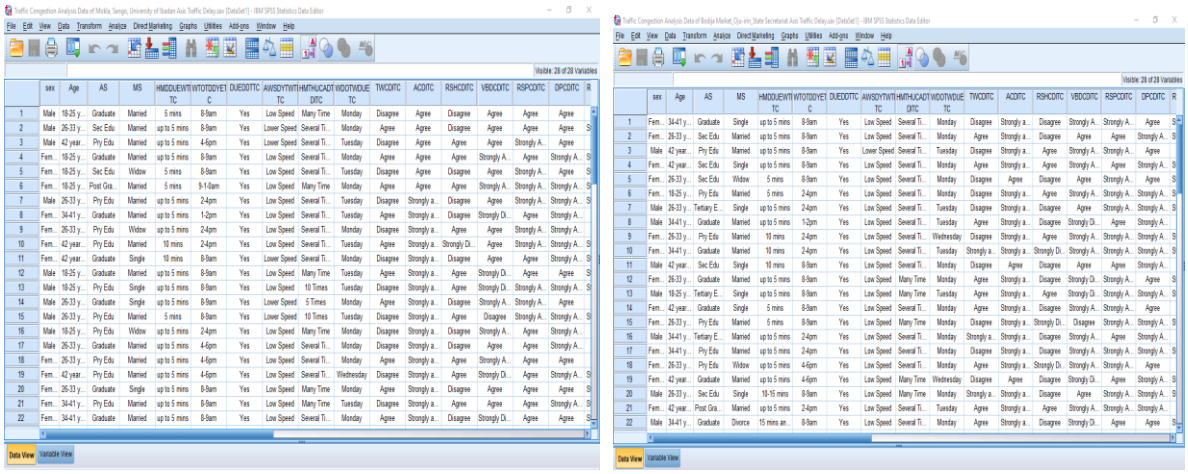


Fig 3: The figure shows the processed adjusted and real coordinate. The figure shows the Processed Data in Rinex Format

Table 6: Processed data from DGPS of points across the study area

S/N	Location	Easting (m)	Northing (m)
1	Mokola	598246.988	818167.649
2	Ojuirin Sango	599047.089	820398.629
3	Awolowo	598966.656	820182.720
4	Housing Awolowo	599527.572	820040.903
5	Uncle Joo	598244.871	818485.150
6	Dandaru	598996.289	818212.100
7	UCH	599533.924	817991.966
8	Total Garden	600325.559	817890.366
9	Sectariat	600499.863	819047.724
10	Ojuirin Bodija	600756.301	821477.594
11	Custom	600629.301	819490.569
12	Awolowo/ Sectariat	600531.405	819921.840
13	Awolowo UBA	600391.175	820702.363
14	Bodija Market	600489.071	821985.595
15	Agbowo	600200.675	822657.638
16	University of Ibadan	600064.364	822576.173
17	Ashi	603213.265	820384.481
18	Oluwo Nla	602978.742	819684.154
19	Idi Ape	602214.778	818479.654
20	Arisekola Junction	602813.738	818499.274
21	Jamb Junction	601918.132	818113.546
22	New Gbagi	601649.039	817715.426
23	Agodi	601402.615	817581.091
24	NTA Junction	601241.26	817765.954
25	Sango	599151.608	820665.868



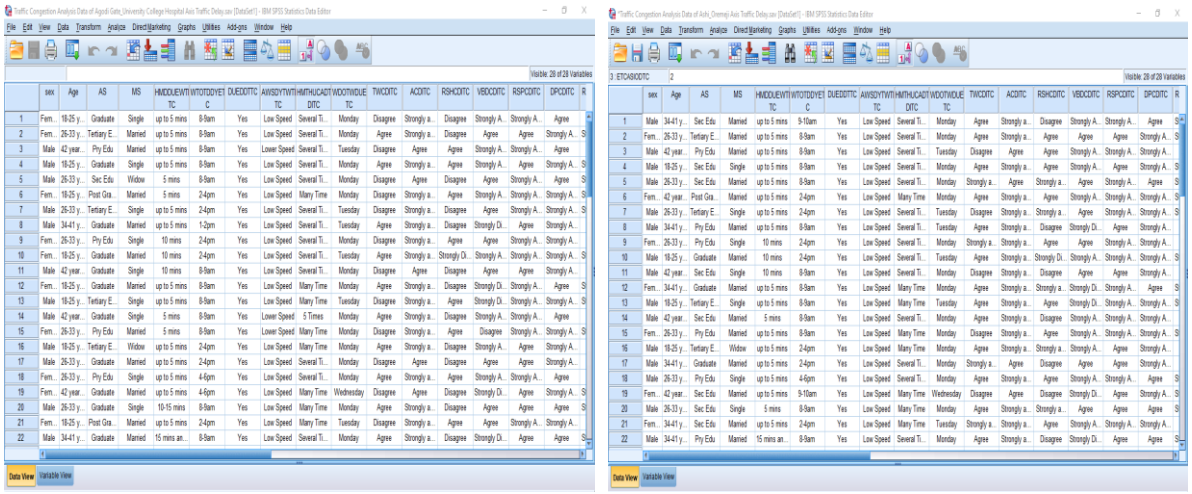


Fig 4: Database creation using IBM SPSS 20 for the questionnaires

IV. RESULTS

Fig. 5 described the road network within the study area and the traffic delay junctions/hotspots on major roads in Ibadan north local government. TABLE 4 described the analysis of the questionnaire distributed and returned. TABLE 7 presents the analysis of the data collected from questionnaires administered to respondents and Occupiers of commercial properties in Ibadan North Local Government. Fig. 6 described traffic flow of Bodija, Awolowo and their intersections. Fig. 7 described the traffic point of Ashi, University of Ibadan and their intersections. Fig. 8 showed the traffic point of Mokola, Sango and their intersections. Fig. 9 described traffic point of Total garden, Agodi and their intersections. Fig. 10 described Query of the areas that are heavy and fair in congestion.

Table 7: Analysis of questionnaire distributed and returned

S/N	Location Name	Distributed Questionnaires	Returned Questionnaires
ASHI/OREMEJI AXIS ROAD			
1	Ashi	20	15
2	Idi-Ape	30	20
3	NECO/Skye Bank Junction	20	14
4	Ore-Meji Junction	30	19
	Total	**100**	**68**
BODIJA/SECRETARIAT AXIS ROAD			
5	Bodija Market/Bodija Oju-Irin	35	34
6	Oshuntokun Junction	10	8
7	Awolowo Junction	15	10
8	Ikolaba/Custom Junction	10	8
9	Oyo State Secretariat	10	9
10	Oluwo Nla Junction	20	15
	Total	**100**	**84**
MOKOLA/SANGO/UNIVERSITY OF IBADAN AXIS ROAD			
11	Mokola	20	16
	Leventes Junction	10	9
12	Idi-Ape	10	7
13	Sango	25	21
14	University of Ibadan/ Agbowo	35	32
	Total	**100**	**92**
AGODI GATE/UNIVERSITY COLLEGE HOSPITAL AXIS ROAD			
	Gate	20	14
15	Agodi rounabout	15	10
16	NTA Junction	15	8
	Total Garden	20	16
	University Teaching Hospital	30	23
	Total	**100**	**71**
	Grand Total	**400**	**315**

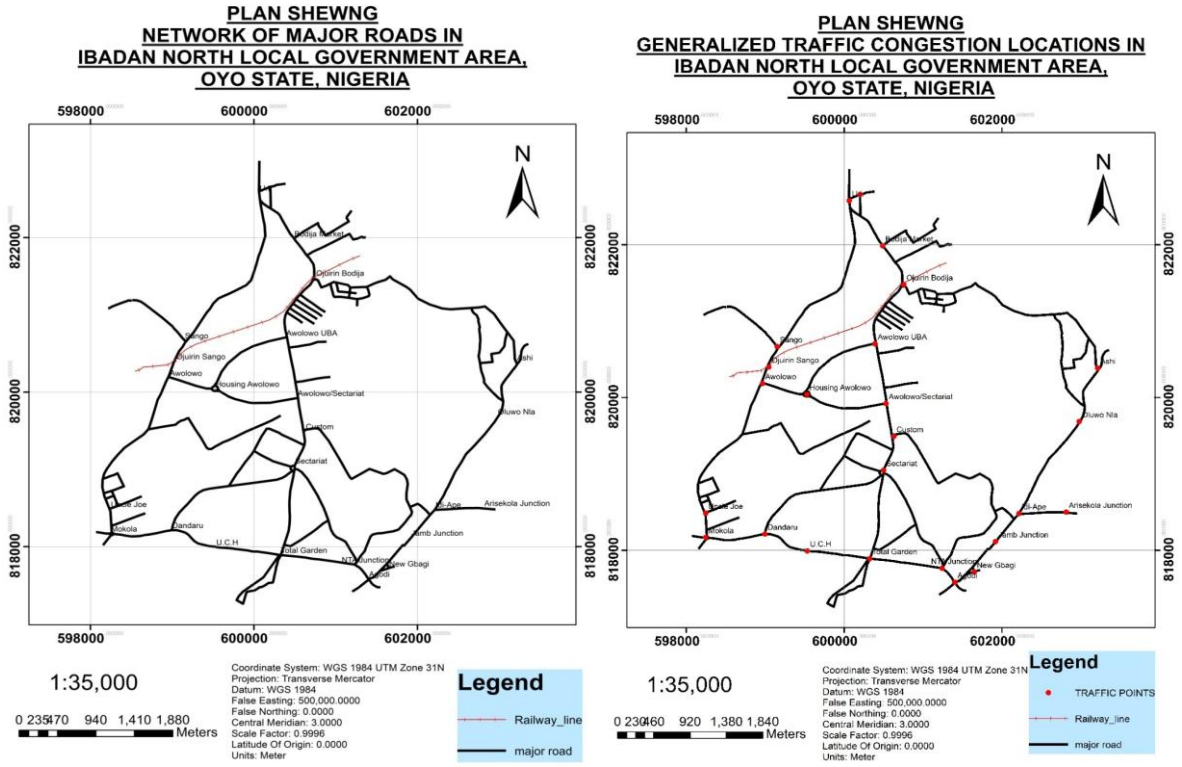


Fig 5: Map showing Network of major in the Study Area Map of the Arterial Roads with Traffic Congestion Hotspot in the Study Area

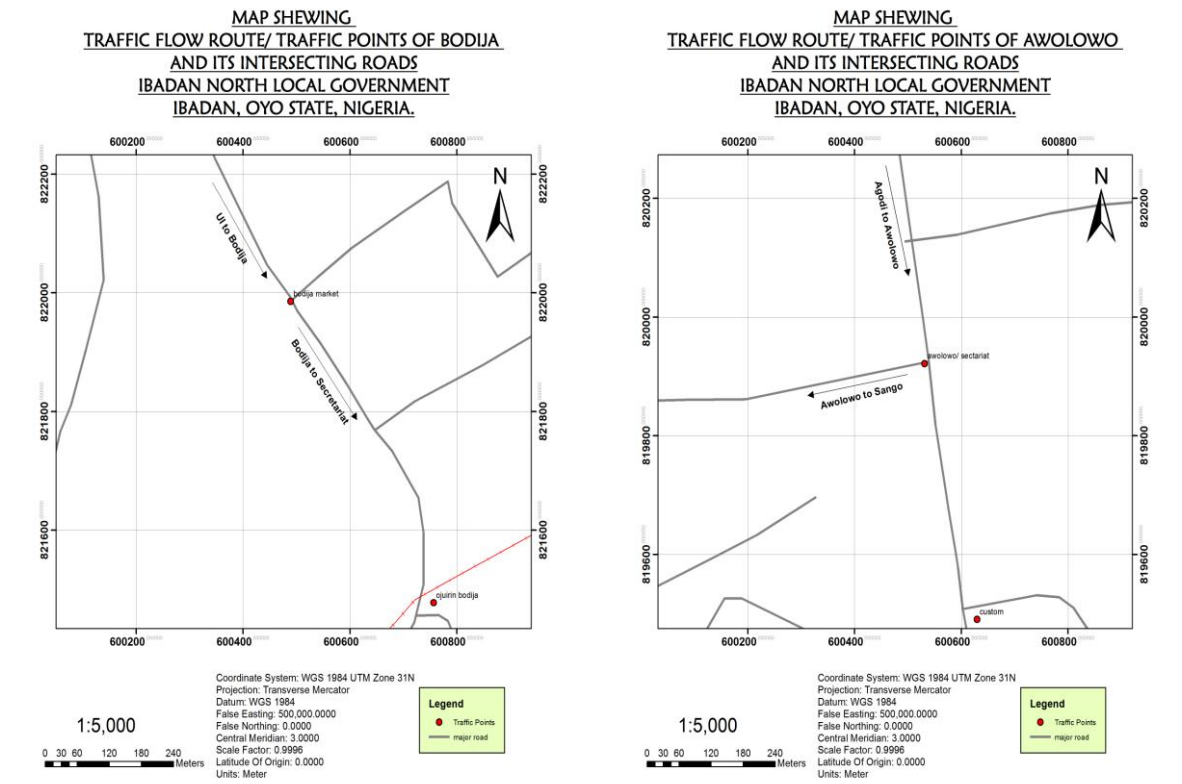
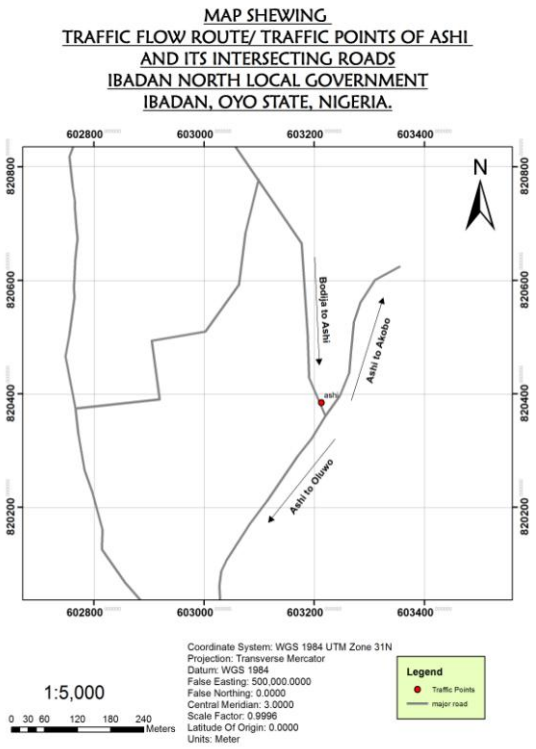


Fig 6: Traffic Flow/Point of Bodija and Its Intersecting Road Traffic Flow/Point of Awolowo and Its Intersecting Road in the Study Area



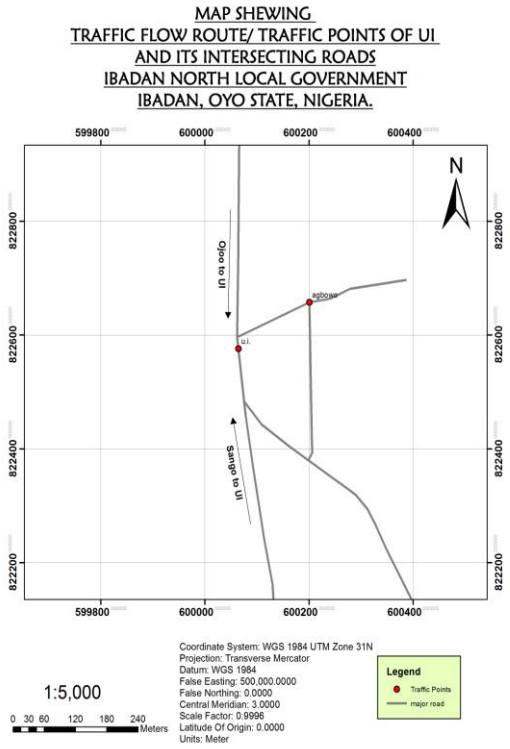
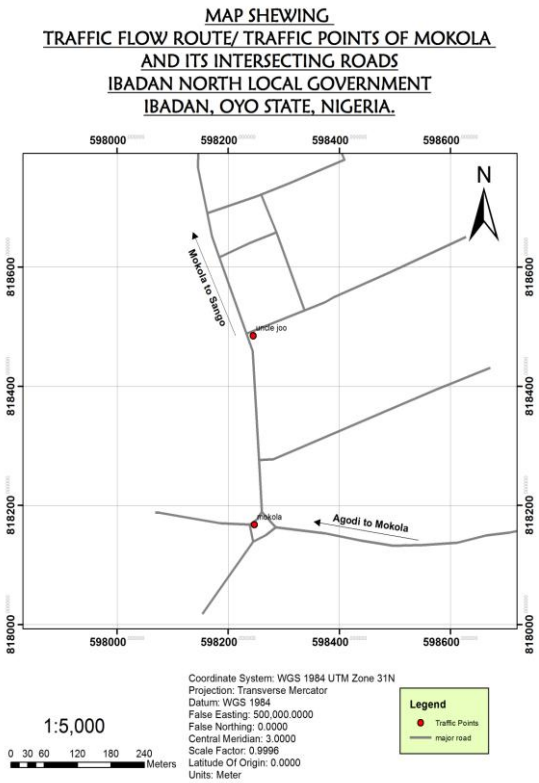


Fig 7: Traffic Flow/Point of Ashi and Its Intersecting Road Traffic Flow/Point of U.I. and Its Intersecting Road in the Study Area



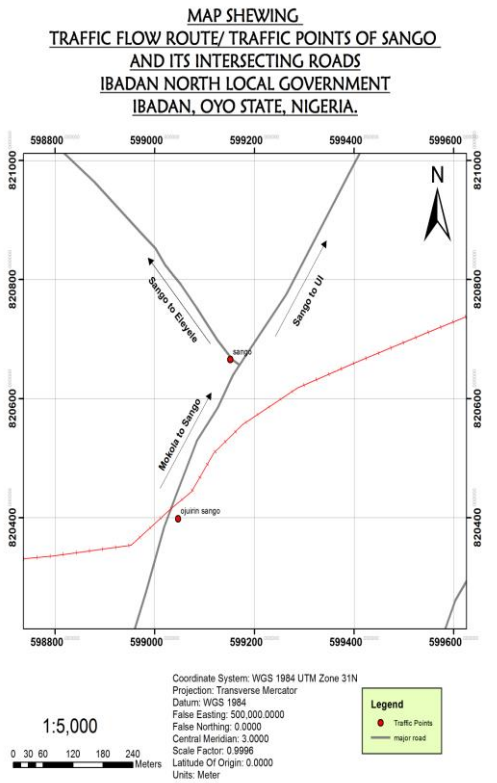


Fig 8: Traffic Flow/Point of Mokola and Its Intersecting Road Traffic Flow/Point of Sango and Its Intersecting Road in the Study Area

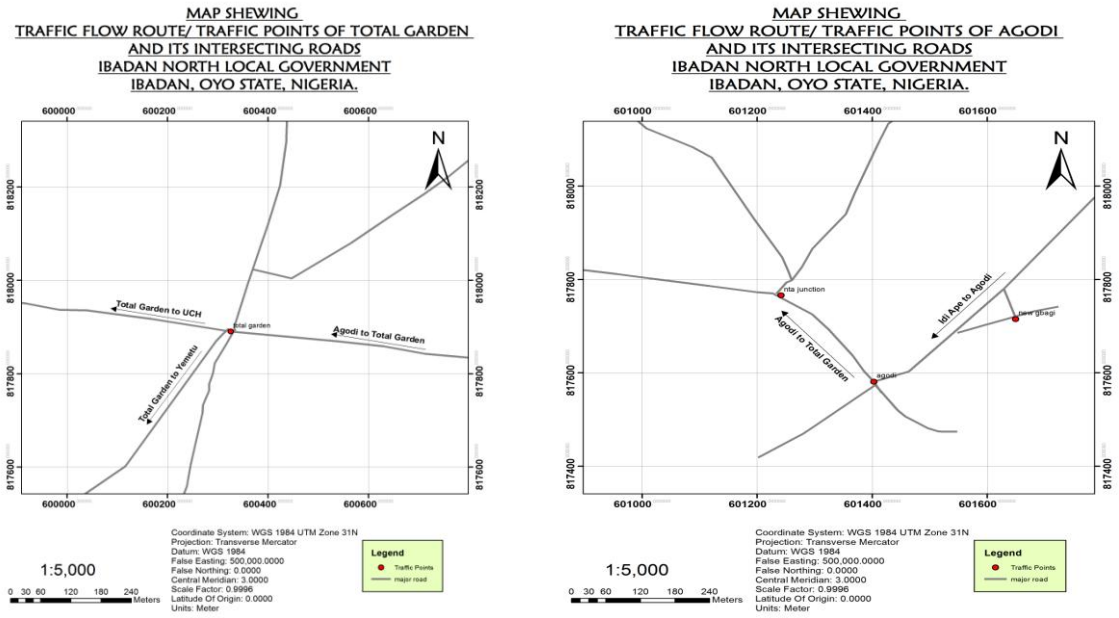


Fig 9: Traffic Flow/Point of Total Garden and Its Intersecting Road Traffic Flow/Point of Agodi and Its Intersecting Road in the Study Area

Query Analysis and Assessment

Both the attribute and spatial data were used for assessing, querying and to ascertain the level of each factors causing congestion and its effect.

Query 1:- This is to show the situation of traffic of study area either it is heavy, fair and free

Syntax for heavy congestion:-[TRAFFIC _SITUATION] =”HEAVY”

Syntax for fair congestion:-[TRAFFIC _SITUATION] =”FAIR”

Syntax for free congestion:-[TRAFFIC _SITUATION] =”FREE”

Analysis:- the analysis of this query show those area that area heavy, fair and free from congestion which area causes by types of vehicles passing.

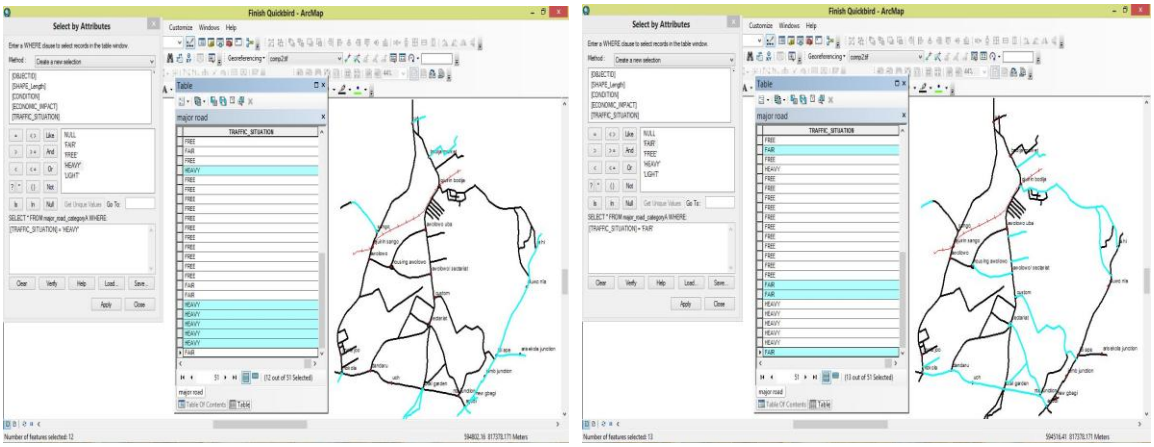


Fig 10: Query syntax show the areas that are heavy in congestion Query syntax show the areas that are fair in congestion

Query 2:- This is to show the conditions of the road either good or bad which is one of the factors causing congestion.

Syntax for roads in good condition:-[CONDITION]=”GOOD”

Syntax for roads in bad condition:-[CONDITION]=”BAD”

Analysis:-The analysis of this query show that the street hawkers are benefiting from the traffic congestion by selling goods in the holdup e.g. those that are selling cold drinks

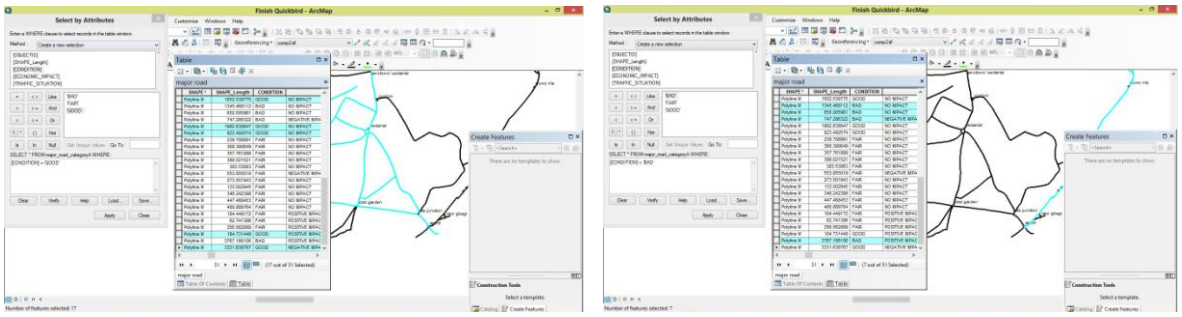


Fig 12: Query showing the roads that are in good condition Query showing the roads that are in bad condition

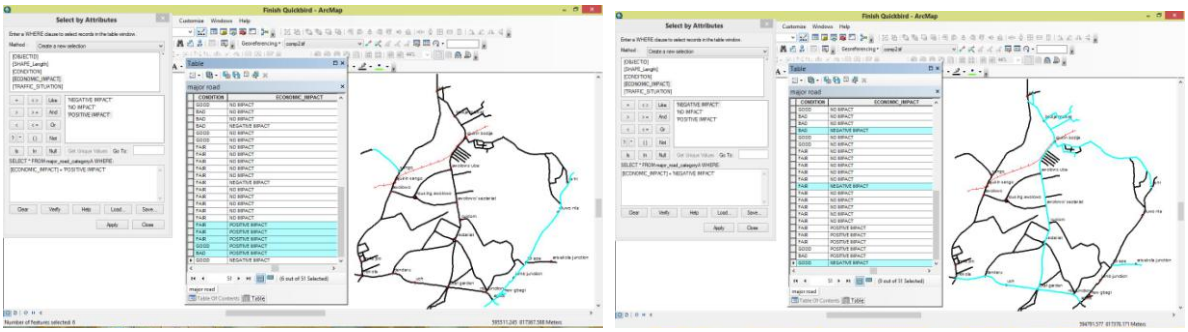


Fig 13: Query syntax show the area that has economic positive impact Query syntax show the area that has economic negetive impact

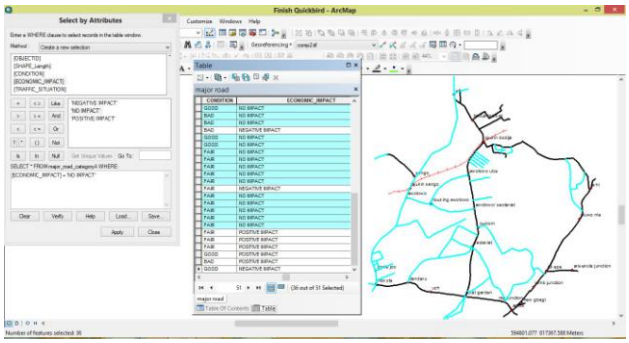


Fig 14: Query syntax show the area that has neighter the positive non negetive economic impact

Table 8: Summary of Analysis of questionnaire using IBM SPSS 20 for the study

Sex			Which days of the week do you experience traffic congestion along this corridor		
	Frequency	**Percent (%)**	Monday	208	66.1
Male	169	53.6	Tuesday	90	28.6
Female	146	46.4	Wednesday	17	5.4
Total	315	100.0	Total	315	100.0
Age			Traffic Wardens causes of delay and traffic along the corridor		
18-25 years	79	25.0	Agree	152	48.2
26-33 years	118	37.5	Disagree	163	51.8
34-41 years	79	25.0	Total	315	100.0
42 years and above	39	12.5			
Total	315	100.0			
Academic Status			Accident causes of delay and traffic along the corridor?		
Pry. Edu	62	19.6	Agree	129	41.1
Sec. Edu	34	10.7	Strongly agree	175	55.4
Tertiary Edu	51	16.1	Disagree	11	3.6
Graduate	129	41.1	Total	315	100.0
Post Graduate	39	12.5			
Total	315	100.0			

Marital Status			Road-side hawking causes of delay and traffic along the corridor?		
Single	146	46.4	Agree	129	41.1
Married	141	44.6	Strongly agree	6	1.8
Widow	28	8.9	Disagree	158	50.0
Total	315	100.0	Strongly Disagree	22	7.1
			Total	315	100.0
How much delay do you experience when there is congestion / traffic?			Vehicle breakdown causes of delay and traffic along the corridor		
up to 5 mins	191	60.7	Agree	124	39.3
5 mins	57	17.9	Strongly Agree	113	35.7
10 mins	39	12.5	Disagree	22	7.1
10-15 mins	22	7.1	Strongly Disagree	56	17.9
15 mins and above	6	1.8	Total	315	100.0
Total	315	100.0			
What time of the day do you experience traffic congestion along this corridor?			Road side Parking causes of delay and traffic along the corridor		
8-9am	168	53.6	Agree	152	48.2
9-10am	7	1.8	Strongly Agree	146	46.4
1-2pm	11	3.6	Disagree	17	5.4
2-4pm	67	21.4	Total	315	100.0
4-6pm	62	19.6			
Total	315	100.0			
Do you experience delay due to traffic congestion along this corridor?			Double Parking causes of delay and traffic along the corridor		
Yes	56	100.0	Agree	146	46.4
			Strongly Agree	169	53.6
			Total	315	100.0
At what speed do you travel when there is congestion?			Road Capacity causes of delay and traffic along the corridor		
Low Speed	253	80.4	Agree	152	48.2
Lower Speed	62	19.6	Strongly Agree	163	51.8
Total	315	100.0	Total	315	100.0
Have you and how many times you have cancelled appointment due to delay?			Absence of Walkway causes of delay and traffic along the corridor		
5 Times	17	5.4	Agree	163	51.8
10 Times	11	3.6	Strongly Agree	62	19.6
Many Time	101	32.1	Disagree	90	28.6
Several Times	186	58.9	Total	315	100.0
Total	315	100.0			
Traffic Light Malfunctioning causes of delay and traffic along the corridor			Potholes causes of delay and traffic along the corridor		
Agree	124	39.3	Yes	259	82.1
Strongly Agree	191	60.7	No	56	17.9
Total	315	100.0	Total	315	100.0
Extra fuel consumption is one of the economic impact of the delay and traffic			Reduction in Working Hour is one of the economic impact of the delay and traffic		
Yes	270	85.7	Yes	248	78.6
No	45	14.3	No	67	21.4
Total	315	100.0	Total	315	100.0
Less in Productivity is one of the economic impact of the delay and traffic			Stress / Anger is one of the social impact of delay and traffic		
Yes	236	75.0	Agree	135	42.9
No	79	25.0	Strongly Agree	180	57.1
Total	315	100.0	Total	315	100.0
Late/missed Appointment is one of the social impact of delay and traffic			Unpredictable time travel is one of the social impact of delay and traffic		
Agree	118	37.5	Agree	157.5	50.0
Strongly Agree	197	62.5	Strongly Agree	157.5	50.0

Total	315	100.0	Total	315	100.0
Inability to forecast Travel time is one of the social impact of delay and traffic			Extra time Consumption is one of the social impact of delay and traffic		
Agree	129	41.1	Agree	175	55.4
Strongly Agree	107	33.9	Strongly Agree	140	44.6
Disagree	79	25.0	Total	315	100.0
Total	315	100.0			

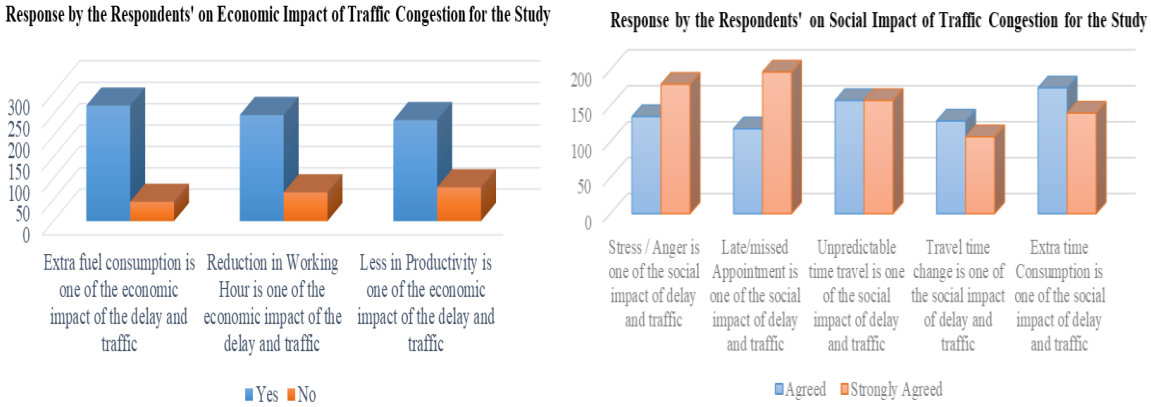


Fig 15: Response based on Economic and Social impact of Traffic Congestion

General from TABLE 8, the results showed the entire analysis based on questionnaire distributed for the study and it showed that the 191 out of 315 respondents concluded that the delay during traffic was not up to 5minutes neither above 5minutes before the flow of vehicles. 168 out of 315 experienced traffic delay between 8am-9am and this is due to the early morning to work, also 67 respondents believe traffic occurred between 2-4pm due to pupil/student school closing hour and as well 62 respondents between 4-6pm which was as a result of worker and traders returning home from their working place. It was agreed by all respondents that they all experienced traffic along the corridor. 253 out of 315 respondents' consisting of both the private and commercial car agreed that they move at low speed while 62 respondents believe at lower speed. Monday is the major day that the respondents believe the most delay/traffic day of the week with 208 responses which can be attributed to being the first working day of the week.

It also showed from the questionnaire analysis that the causes of traffic congestion for this study include traffic warden with 163 respondents disagree and 152 agreed, accident with 129 respondents agreed, 175 disagree, roadside-hawking with 129 respondents agreed and 158 disagreed, vehicle-breakdown with 124 respondents agreed and 113 disagreed, double packing with 146 respondents agreed and 169 agreed strongly, roadside-packing with 152 respondents agreed and 146 agreed strongly, inadequate road capacity with 152 respondent agreed and 163 agreed strongly, absence of walkways with 163 respondents agreed, 62 agreed strongly and 90 disagree, traffic light malfunctioning with 124 respondents agreed 191 agreed strongly and pot holes with 259 respondents say Yes and 56 say No. Other causes of traffic congestion as inadequate road capacity, poor road pavement, poor traffic management, poor drainage system, poor driving habit, poor packing habit, poor design junctions/round-about, presence of heavy trucks, lack of pedestrian facilities, lack of road furniture, lack of packing facilities, road trading and others.

The effects of the traffic congestion on major road of the study was attributed to the economic and social impacts of traffic delay on people and the economic impacts are extra fuel consumption with 270 respondents say Yes and 45 say No, reduction in working hour with 248 respondents say Yes, and 67 say No, less productivity with 236 respondents say Yes and 79 say No. The social impact are stress/anger with 135 respondents agreed and 180 agreed strongly, late/missed appointment with 118 respondents agreed and 197 agreed strongly, inability to forecast travel time with 129 respondents agreed, 107 agreed strongly and 79 disagree, extra time consumption with 175 respondents agreed and 140 agreed strongly. To drastically reduce these effects; there must be provision for adequate parking space, construction of proper drainage, enlarging the width of the road, rehabilitate all roads needing attention, public enlightment, traffic education, hack down all illegal buildings/shops built on the right of way (ROW), create a separate/alternative root for trucks and heavy vehicle provisions of pedestrian facilities, in depth training transport/traffic personnel, ban all form of road trading/hawking, and reduce the number of bus stop where necessary. It is hoped that this study will become the foundation of further research in the area to improve road traffic management on our major highway.

Fig 15: Traffic Congestion at Mokola Roundabout, Vehicle break down and Traffic warden at mokola caused traffic Congestion

Traffic is always congested from 8am-10am, 4pm-7pm after closing hour and 8pm-10pm at night as seen above. Road side hawking, street parking are the causes of traffic congestion in this area. The intersection of roads is also one of the causes according to fig. 15 above, each road leading to each other, there by vehicle branching from one road to another leads to congestion. Traffic warden also adds to the cause of traffic congestion most times as seen in the above figure due to tiredness or lack of good orientation on the control of traffic. Vehicle breakdown is one of the effect of traffic congestion in mokola which arises from the commercial driver seen changing tire at then centre of the road instead of moving it out of the road.

Fig 16: Shows traffic congestion at Sango, Traffic Congestion at UI road, Road Side Hawking at Agodi

Fig. 16 above showed the busy nature of Sango roads and UI road at night. Traffic are congested and heavy due to incessant/double parking by the commercial vehicle, intersection of roads, road side hawking etc The two road is always busy road during the days as well as in the night but only free on environmental days.

V. CONCLUSION

Traffic congestion on major roads in Ibadan North Local Government Area has been examined using geospatial approach and assessment based on the causes and effects on daily life. From the finding of the result, it revealed that traffic on major road in the study was as a result of traffic warden, accident, roadside-hawking, vehicle-breakdown, double packing, roadside-packing, inadequate road capacity, absence of walkways, traffic light malfunctioning and pot holes while the effects of the traffic congestion are extra fuel consumption, reduction in working hour, less productivity, stress/anger, late/missed appointment, inability to forecast travel time, extra time consumption. The result of this study will go a long way in improving road traffic management in the study area as well as all our major roads in Oyo State as a whole.

Recommendations for the study

The following are recommended by the authors:

1. Buildings to be newly constructed should comply with minimum setbacks as set by the ministry and other planning standards, also existing building which do not comply with standards be served with the necessary notices and then finally enforcement of such standards through demolition exercise where necessary.
2. Parking standards should be enforced especially on public and commercial developments so as to reduce the pressure of parking problems on existing transportation facilities and consequently encourage off-street parking.
3. The relocation of the major motor parks in the study area to a suitable outskirt site is imperative in order to ensure better traffic flow.
4. The existing motor parks along the major roads in the study area should be well located and maintained for effective use to eradicate loading of vehicles within the city.
5. However, there is the need to dualize all major roads in order to eradicate the use of one-way strategy employed in these roads and in turn reduce congestion and increase traffic flow.
6. The government should be more committed for maintenance of roads within the city as most of the roads are in a poor state and need urgent attention.

Such maintenance of roads should include filling up pot-holes, complete scraping off and replacement.

7 .The public needs to be enlightened on road use and road safety measures such as zebra crossings, traffic light and so on to avoid accidents on these major roads in the study area.

8. Appropriate training needs to be organized for traffic wardens in other to know the reason why they are there.

REFERENCES

[1]. American Heritage Dictionary 2011. American Heritage Dictionary of the English Language, 5th edition. Chicago: Houghton Mifflin.

[2]. M.G.H Bell and R.E. Allsop, Introduction. In M G H Bell (ed) Transportation Networks: Recent Methodological Advances. Oxford: Elsevier, 1998

[3]. M.A. Goldberg, Transportation, Urban Land Values, and Rents: A Synthesis Land Economics, 46, 2 (May), 1970, 153-162.

[4]. J.W. Dickey, Metropolitan Transportation Planning. (Washinton D.C: Scripta books, 1975).

[5]. P.N. Balchin, J.L. Kieve, and G.H. Bull, Urban Land Economics and Public Policy (Fourth Ed.) (Hampshire: Macmillan Educational Limited, 1991).

[6]. Wikipedia contributors, Arterial Roads in Wikipedia, The Free Encyclopedia, 2008.

[7]. M.O. Popoola, W.A. Adeniji, and S.O. Abiola, Traffic Congestion on Highways in Nigeria Causes, Effect and Remedies. International Journal of Civil, Architectural Science and Engineering 7(11), 2013, pp, 528. Retrieved from waste.org/publications/17391.

[8]. The department of transportation, U.S, Traffic congestion and reliability: Trends and advanced strategies for congestion mitigation, Office of Operations, (Texas Transportation Institute, Federal Highway Administration, 2005)

[9]. European Conference of Ministers of Transport, (ECMT), Report of the Hundred and Tenth Round Table on Transport Economics held in Paris on 12 -13" March 1998 on The following topic: Traffic Congestion in Europe, Paris: (Economic Research Centre, European Conference of Ministers of Transport, 1999)

[10]. D. Levinson, J.M. Mathieu, Gillen D., K. Adib, The full cost of high speed rail: an engineering approach, Volume 31, Issue 2, 1997, pp189-215.

[11]. G. Weisbrod, D. Vary and G. Treyz, Economic implication of congestion, National Cooperative Highway Research Program (NCHRP) Report 463, (Transportation Research Board, National Research Council, Washington D.C, 2001).

[12]. B.C. Kwikiriza, causes and effects of traffic congestion in kamoala city, (December, 2016).

[13]. S. Das, and P. Roychowdhury, Smart Urban Traffic Management System. Goh, 2013.

[14]. L. Chakravarthy, and A. Dash, Quality of Life in Urban India: A State Level Analysis of Socioeconomic Indicators. ICFAI Journal of Urban Policy, 3(1), 2008.

[15]. D.A. Hensher, Behavioral Value of Time Savings in Personal and Commercial Automobile Travel. The Full Costs and Benefits of Transportation. Berlin, Germany: Springer-Verlag, 245–280, 1997.

[16]. W.B. Jackson, and J.V. Jucker, An Empirical Study of Travel Time Variability and Travel Choice Behavior. Transportation Science 16.4:460–475, 1982.

[17]. J. Polak, Travel Time Variability and Travel Departure Time Choice: A Utility Theoretic Approach, discussion paper no. 15. (Polytechnic of Central London, 1987).

[18]. I.G. Black, and J.G. Towriss, Demand Effects of Travel Time Reliability. (London, England: United Kingdom Department of Transport, 1993.

[19]. J.A. Lindley, Urban Freeway Congestion: Quantification of the Problem and Effectiveness of Potential Solutions. Journal of the Institute of Traffic Engineers 57.1: 1987, 27–32.

[20]. G. Giuliano, Incident Characteristics, Frequency, and Duration on a High Volume Urban Freeway. (Transportation Research 23A: 1989, 387–396)

[21]. P. Greibe, P. Kristine Nilsson and L. Herrstedt, Speed Management in Urban Areas, A framework for the planning and evaluation process, Ministry of transport, Denmark, Report no. 168, 1999, pg 9,13.

[22]. Akshay Upadhyay, early, Traffic Congestion modeling using GIS, 2018

[23]. Shaopei Chen, Cyril Ray, Jianjun Tan, and Christophe Claramunt, Analysis of an integrated Transportation GIS for the City of Guangzhou, China, 2006.

[24]. J. Owusu, F. Afukaar and B.E.K Prah, Urban Traffic Speed Management: the uses of GPS/GIS. Conference proceeding, Shaping the Change XXIII FIG congress Munich, Germany, October 8-13, 2006).

[25]. R. Kalaga Rao, and Mohan Rao, "Application of GPS for Traffic studies" in Journal of Urban Transport Volume-8 No.1, 2009.

[26]. NIPOST. Post offices-with map of LGA. NIPOST. Retrieved 2009-10-20

Adewuyi, Gbola K." Geospatial Analysis and Assessment of Traffic Congestion on Major Road in Ibadan North Local Government Area, Oyo State, Nigeria" International Journal of Engineering Research and Applications (IJERA), Vol. 09, No.06, 2019, pp. 56-71