

Analysis of Intra-Urban Freight Traffic Pattern in Lagos State, Nigeria

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This study examined the intra-urban freight trips pattern in Lagos State, Nigeria. Major traffic bottlenecks along selected roads served as data collection stations for this study. At each station, data were collected on type of vehicle, origin of trip, destination of trip, land use at origin and land use at destination by trained field assistants. A combination of observatory survey and questionnaire administration to freight vehicle drivers was used for the data collection. A total of 12,533 drivers of freight vehicles who at the time of the survey were conveying goods in their vehicles for delivery were randomly sampled. Both descriptive and inferential statistical techniques were employed for data analysis. Simple percentages, averages, tabulation and charts are some of the descriptive statistical techniques employed to measure the spread of observations. Two-Way Analysis of Variance (ANOVA) was used to test the hypothesis that “freight vehicle’s trips do not vary by land use types in the study area”. Urban land use was found to significantly influence freight trips. The study revealed that commercial, industrial, residential and circulatory land uses are the pivots upon which urban freight movement revolves in the study area. Commercial land use is the largest generator (42%) and attractor (34%) of urban freight trips. Industrial land use generates 28% and attracts 20% of the urban freight trips, while residential land use generates 4% and attracts 26%. Also, circulatory land use generates 17% and attracts 8% of the urban freight trips. The analysis also revealed that small trucks are the commonly used vehicles for intra-urban freight movement in the study area accounting for about 47% of the freight trips. Also, freight vehicles’ trips significantly varied by land use types, $F(4, 1) = 3097.39$, $P = 0.13$. This study concludes that land use types played a significant role in the pattern of freight traffic distribution in the study area. It was therefore recommended that efforts should be directed towards effective freight transport planning and management in the study area.

Keywords: Freight vehicles, land use, urban freight traffic, trip destination, and trip origin

Introduction

The movement of people and goods in a city, referred to as traffic flow, is the joint consequence of land activity and the capability of the transportation system to handle this traffic flow exactly like that of the principle of demand and supply. There is a direct interaction between the type and intensity of land use and transportation facilities provided. Ensuring an efficient balance between land use activity and transportation capability is the primary concern of urban planning. Land use is one of the prime determinants of movement and activity, that is, trip generation which needs streets and transport systems for movement. This will lead to increased accessibility which further enhances value of land and land use.

Most of the studies on transport land use modelling have not so far taken into account trips made by goods vehicles. Comparing the result of a modelling exercise with the actual traffic flow on the transportation system network may not match because there will be additional flow of traffic in terms of goods vehicles. Unless the goods traffic is also accounted for, comparing the theoretically estimated traffic flow with the actual observed traffic flow in the field will be difficult. This shows the importance of analysing urban goods movement (Arasan, 2014).

Urban land use plays a significant role in the pattern of traffic in urban areas. Land use and transport planning are closely connected because the demand for travel facilities is a function of

human activity and conversely the provision of transport facilities has often stimulated land use activity (Fajugbagbe, Aderinwole and Croope, 2012). The understanding of the relationship between land use characteristics and urban movement pattern is very essential in fashioning appropriate land use policies for sustainable transport development. According to Oduwaye, Alade and Adekunle (2011), different land use types are found in metropolitan cities and each of them is unique and has its own propensity to generate not only trips but also dictate the pattern of development. The different land use types include residential, commercial, industrial, recreational, institutional, and circulatory, amongst others (Ogunsanya, 2002).

The need for the various land use types to interact with one another is what necessitated traffic in urban areas. In other words, urban land use constitutes the origin and destination of different types of movement. These origins and destinations define the exact pattern of different types of movement, as well as the volume and spatial dimension of traffic (Ogunsanya, 2002). Edward Ullman, in his explanation on the bases of interaction between places, approached the subject from a geographic perspective of uneven distribution of markets and raw materials. It is certainly true that in the absence of geographical variation, there would be no need for transport. It means that if all areas were the same in terms of economic activities and resources, there would be no need to interact or trade with other areas. So, it is essentially the variation of resources that gives rise to interaction.

According to Filani (2000), the environment consists of different land uses which creates spatial imbalance between areas of desires and fulfilments thus generating interactions/movements. The land use activities within the city create room for demand and supply or desires and fulfilments and thus create spatial imbalance. The objective of transportation is therefore to eliminate this spatial imbalance. Transport is how products are brought from supply areas to areas where they are needed. These points of desires and fulfilments are designed by land use. Certain issues arise from these interactions of desires and fulfilments which include activity coordination, distance to be covered, the need for transport, and economy of

scale. A major consequence of land use activities and patterns in urban centres is that there is a creation of areal specialisation and spatial interdependence. People move from one land use to the other creating a complex pattern of movements. The land use of urban areas thus constitutes the origin and destination of movements. This complex pattern of inter-land use movements is impossible without transport (Filani, 2000).

Several studies have been conducted on the relationship between land use and trip pattern in Nigeria and other countries of the world. For instance, Adetunji and Aloba (2013) examined the spatial structure and patterns of work trips in Ilesa, Nigeria. The study revealed that high rate of urbanization trends over the past three decades coupled with poor planning of urban environment and political fortunes of the city have led to land-use differentiations which have directly influenced the pattern and structure of urban work trips in the city. It was observed that the pattern of work trips is strongly influenced by residential as well as the spatial location of work places. The findings also revealed that the areas of the city with more mixed land-uses attract a considerable volume of work trips than areas of the city with less mixed land use which are mostly used for residential purposes. The findings are similar to a study by Owolabi (2010) on land-use analytical approach to trip patterns in Akure, Nigeria. It was observed from the study that the distance of each land use area from the Central Business District (CBD) was found to have played a dominant role in trip attraction to it. The commercial zone attracted the highest volume of daily work and recreational trips and also serves as the place where most trips in the Metropolis terminate for various business transactions, and commuters change or access modes of transport to other parts of the Metropolis (Owolabi, 2010).

Likewise, De Vos (2015) analysed the influence of regional land use on travel behaviour by comparing two regions (Flanders (Belgium) and the Netherlands) with varying land-use patterns. The study showed that the different land-use patterns influenced travel behaviour in both regions. An active spatial planning policy (i.e. clustering of activities in urban surroundings) in the Netherlands was found to realize sustainable travel behaviour, as a substantial share of the residents frequently walk, cycle or use public transportation.

On the other hand, the rather passive spatial planning (resulting in urban sprawl) in Flanders stimulated car use. In addition, the study revealed that the applied mobility policy also has an impact on the travel behaviour and land use of the Flemings and the Dutch. Infrastructure is concentrated in Dutch urban environments, whereas Flanders has a more widespread network of infrastructure and cheap public transportation, resulting in a further increase in suburbanization (De Vos, 2015).

Urban land use has also been found to have significant influence on volume and pattern of freight flows in urban areas. For example, Ogunsanya (1982, 1984a, b) observed that intra-urban freight flow provides a useful basis for identifying the structure and pattern of traffic flow in cities. Lagos Metropolis was divided into fourteen traffic zones and data was collected on the volume of freight shipped into and out of the zones to prepare a 14 x 14 matrix of inter-zone freight flow. The matrix was subjected to the R-mode and Q-mode factor analytic techniques to obtain major spatially interrelated freight producing and consuming zones. Within the Metropolitan Lagos, four major producing and three major consuming regions were identified. A graph-theoretic analysis of the flow matrix further indicates an intra – metropolitan hierarchy of freight zones with Apapa as the first order; Lagos and Ikeja as the second order while Palmgrove, Yaba, Agege, Ijora, Ajegunle, Ikoyi, Maroko, Mushin, Kirikiri and Oshodi are in the third order (Ogunsanya, 2002).

In a similar vein, Okoko (2008) examined the spatial pattern of urban goods movement in Akure, Nigeria. A sample of empirical pattern of urban goods movement in various land use typologies in Akure was examined. The empirical pattern of interaction was subjected to gravity modelling and linear programming modelling to obtain predictions on the spatial pattern of urban goods movement, using the travel time impedance factor. The study identified, through the modelling exercise, the major land use typologies that are the main generators of urban goods movement and the land uses that are major attractors of urban goods trips in the city. The study revealed that residential land use and commercial areas are the major pivots upon which urban goods movement rotates in Akure. The empirical pattern of goods movement depicted commercial land use as the largest generator and

attractor of urban goods trips. After the empirical pattern of distribution was subjected to gravity modelling analysis, the major urban goods attraction zones in the town as predicted by the model were commercial, industrial/institutional and residential zones.

Furthermore, Jaller, Wang, and Holguín-Veras (2015) studied large urban freight traffic generators: opportunities for city logistics initiatives. The study developed procedures to identify and quantify the role played by large urban freight traffic generators as contributors to truck traffic in metropolitan areas. It was discovered that, although ports, container terminals, and other industrial sites are usually associated with large generations of truck trips, they only represent a small proportion of the total trips produced and attracted in large metropolitan areas. The study analysed the importance of other facilities such as ordinary businesses or buildings that individually or collectively (clusters) generate a large proportion of truck traffic. The study also discussed the opportunities of these large traffic generators for city logistics initiatives. In addition, the study introduced two effective and complementary procedures to identify large urban freight traffic generators (LTGs): large buildings or landmarks and large establishments. Moreover, freight trip generation (FTG) models estimated by the authors were used to quantify the freight traffic generated by these LTGs. The FTG models were estimated using a trip generation dataset of about 400 receiver and 400 carrier companies in the New York City area. Ordinary least squares were used to estimate the disaggregate models at the establishment level based on employment. Large urban freight traffic generators were identified based on three main criteria: first, large buildings and landmarks, second, large establishments defined by employment size, and third, large establishments based on commercial area.

Studies so far have established that there exist significant relationships between land use and traffic pattern in urban areas. Nevertheless, in developing countries, significant attention have so far not been given to how these relationships translate to the efficient management and planning of freight traffic in urban areas. In this study, therefore, attention was focused on the effects of land-use characteristics on freight traffic as well as suggesting ways for better freight traffic

management and planning in the study area. The specific objective of the study is to assess the influence of land use on urban freight traffic pattern in the study area. In addition, effort will be made to ascertain the variation of freight vehicle trips by land use types in the study area.

The study area

Lagos State is located in the South-Western part of Nigeria. It is situated within Latitudes 6° 22'N and 6°45'N and Longitudes 2° 42'E and 4°22'E (Figure 1). It is the smallest State in the Federation and it occupies an area of 3,577 square kilometre; 22% or 787 square kilometre of which consists of Lagoons and Creeks (Bashiru and Waziri, 2008; Akanni, 2010; Lagos State Government, 2015; Osoba, 2012). The study focused on the urban areas across the 20 Local Government Areas (LGAs) of the State.

The Land Use pattern in Lagos and its environs is made up of residential, commercial, industrial, transportation (circulatory) institutional and

recreational land uses. Others are water bodies such as Creeks and Lagoons, dry and wetlands (Osoba, 2012). The land use map of Lagos State is shown in Figure 2. The Metropolitan Lagos obviously dominates the settlement system in Lagos State.

The geographical terrain consists of the mainland and island. Most of the population lives on the mainland, and most industries are located there too. Lagos Island contains a Central Business District (CBD) which is characterized by high-rise buildings. The two major urban islands of Lagos are Lagos Island and Victoria Island. These islands are separated from the mainland by the main channel draining the Lagos Lagoon into the Atlantic Ocean which forms Lagos harbour. The islands are separated from each other by creeks of varying sizes and are connected to Lagos Island by road bridges (Lagos State Government, 2015). The land use and settlement patterns create spatial imbalances that require the services of freight vehicles for the movement of goods from one location to another in the study area.

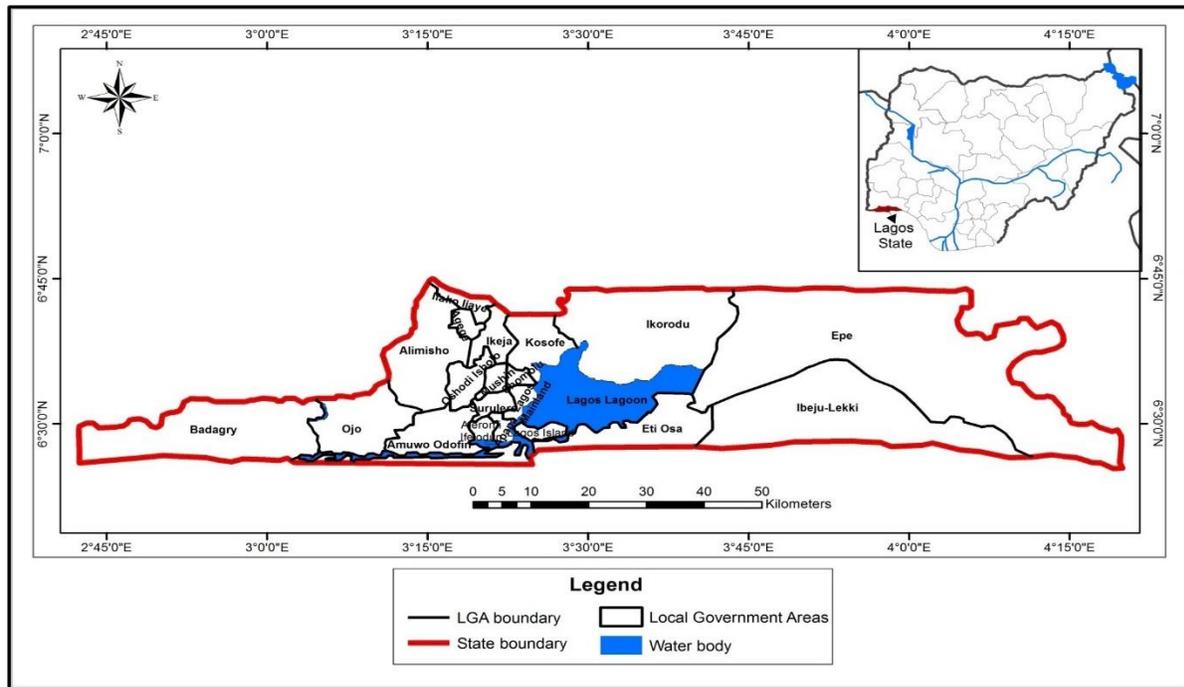


Figure 1: The Administrative Map of Lagos State
Source: Adapted and Modified from LAMATA, 2015

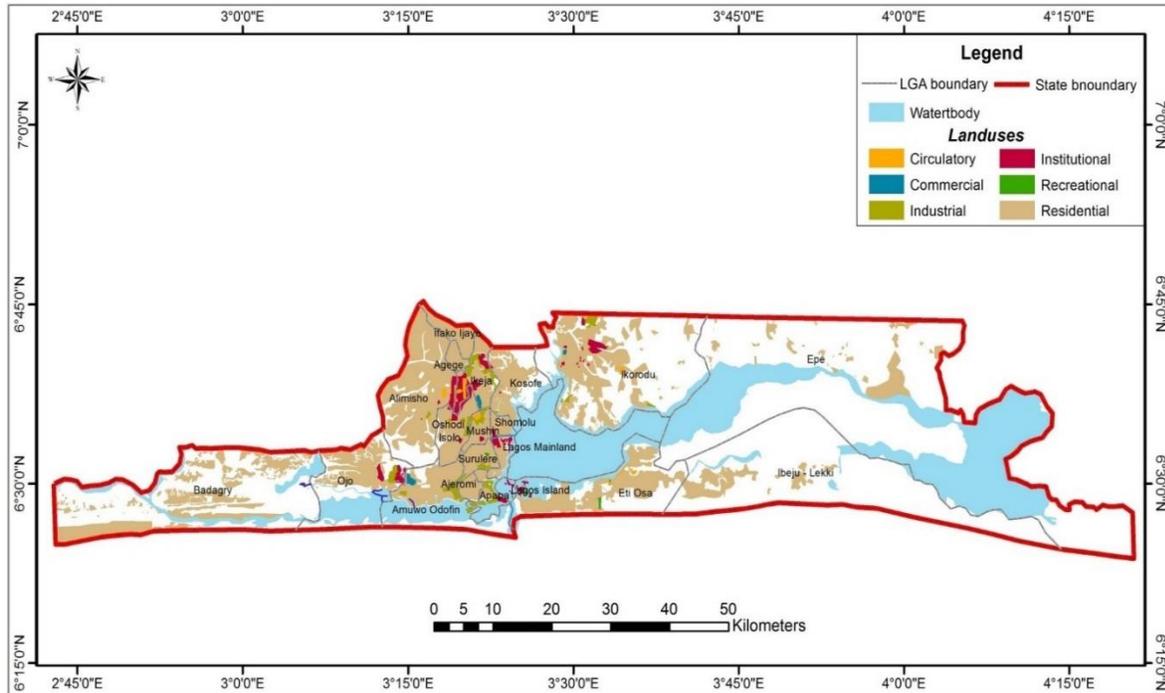


Figure 2: Land Use Map of Lagos State
Source: Adapted and Modified from LAMATA, 2015

Methods

Intra-urban freight trips and land use types are the major data used for this study. The data was collected from selected major roads in the study area, one from each Local Government Area (LGA) of Lagos State. One major traffic bottleneck, on each of the selected roads, was used as survey/data collection station (Table 1). The requirements for choosing the major routes are:

- i. The peculiarities of the roads with the four patterns of urban freight movements, namely; urban-originating traffic, urban-terminating traffic, intra-urban traffic and urban-through traffic (Ojekunle, 2004).
- ii. The dominant utilisation of these routes by freight vehicles.
- iii. The linkage of the roads to major freight generating (origin of freight trips) and terminating or attracting (destination of freight trips) zones within and outside the study area.

Table 1: Selected major roads and traffic stations in Lagos State

S/N	LGAs	Road Name and Traffic Bottlenecks/Stations
1	Agege	Agege Motor Road - At Oba Ogunji Road
2	Ajeromi Ifelodun	Lagos Badagry Expressway - By Ojo Road
3	Alimosho	Ipaja Rd/Idimu Road/Ikotun Road Roundabout - On Ipaja Road
4	Amuwo Odofin	Lagos badagry Expressway, Apapa Oshodi expressway and Apapa Oworonshoki Express Way Interchange – Before Bridge Towards Apapa
5	Apapa	Creek Road - After Burma Road Junction
6	Badagry	Lagos Badagry Express Way –By Agbara Junction
7	Epe	Ikorodu Road-Before Iki Junction
8	Eti Osa	Ahmadu Bello Way - Silverbird Galleria
9	Ibeju Lekki	Lekki-Epe Expressway - Eleko Beach/Sangotedo Area
10	Ifako Ijaye	Lagos Abeokuta Expressway - Abule Egba Bus-Stop
11	Ikeja	Mobolaji Bank Anthony way- After Eko Hospital
12	Ikorodu	Ayangbunren Road, Ikorodu - Before Obafemi Awolowo Junction
13	Kosofe	Apapa Oworonshoki Express Way and Lagos Ibadan Interchange (LGA Boundary) - Gbagada Under Bridge Before Access to Bariga and Third Mainland Bridge
14	Lagos Island	Eko Bridge (Towards Lagos Island) - Apongbon Bridge
15	Lagos Mainland	Third Axial Road (Lagos Mainland) - Ebute Meta Axis
16	Mushin	Agege Motor way (Mushin LGA) - Mosalasi Bus-Stop Mushin
17	Ojo	Isheri-LASU Expressway - (The Bend After Oduduwa Street)
18	Oshodi Isolo	Agege Motor way (LGA Boundary) - Bolade Bus-Stop
19	Shomolu	Ikorodu Road - Onipanu Bus-Stop
20	Surulere	Western Avenue - Stadium Bus-stop

Source: Author’s Field Survey

A detailed land use survey was also carried out to outline the various land use types in the study area based on dominant socio-economic activities. With the aid of trained field assistants, a combination of observatory survey and questionnaire administration to freight vehicle drivers was used for the data collection. At each of the survey stations, the field assistants were instructed to interact with drivers of freight vehicles who at the time of the survey were conveying goods in their vehicles for delivery. The sample was restricted to only delivery within the town (i.e. intra-urban goods delivery). In other words, only intra-urban movements were considered which implied that urban originating, urban terminating and urban through freight movements were not included in the sample.

The field assistants were sensitized on the need to keep the interview as brief as possible to minimize delay to traffic at the stations. As a result, information were only collected on; freight vehicle type, origin of trip, destination of trip, land use type at trip origin and land use type at trip destination. The survey was conducted between 6:00 am to 7:00 pm daily for a period of five days (Monday to Friday). Throughout this period, the field assistants sampled a total of 12,533 freight vehicle drivers that were willing to supply the required information. Registration numbers of the vehicles were noted and later cross checked at the end of each day to guard against double sampling of the drivers (Okoko, 2008).

Both descriptive and inferential statistical techniques were employed for data analysis in this study. Simple percentages, frequency distribution

tables and charts are some of the descriptive statistical techniques employed to summarise the data and measure the spread of observations. Two-way Analysis of Variance (ANOVA) was used to test the hypothesis that “freight vehicle’s trips do not vary by land use types in the study area”. The Two-Way ANOVA compares the mean differences between groups that have been split on two independent variables (called factors). The primary purpose of a two-way ANOVA is to understand if there is an interaction between the two independent variables on the dependent variable. The interaction term in a Two-Way ANOVA informs researchers whether the effect of one of the independent variables on the dependent variable is the same for all values of other independent variables and vice versa (Laerd Statistics, 2018). In this study therefore, the freight traffic pattern (origin and destination) and the land use types (residential, industrial, commercial, recreational/institutional, circulatory, and other land uses) represent the independent variables, while the volume of freight vehicles’ trips is the dependent variable.

Analysis and discussion

Pattern Intra-Urban Goods Movement in Lagos State

Table 2 shows the pattern of urban goods trips distribution in Lagos State. Analysis reveals that commercial land use generates 42% of the freight trips in the study area. About 28% of the freight trips also originate from industrial land use, while 17% were initiated from circulatory land use. Residential and recreational/institutional land uses

generate 4% and 3% of freight trips respectively, while other land use types generate the remaining 6%. It can be seen from the analysis that commercial land use generates the highest volume of freight trips in Lagos State. This is understandable due to the fact that Lagos State has many local and international markets which serve as distribution centres for urban goods.

It is also vital to note that 1,706 (32%) out of the 5,289 trips that originate from commercial land use terminates at residential land use, while 1,432 (27%) revolve around commercial land use in the study area. This implies that commercial land use serves as distribution and re-distribution centres for urban goods. Again, majority (1,507) of the trips (3,518) from industrial land use terminates in commercial land use, while 852 revolve around industrial centres in the study area. About 926 (43%) of the trips from circulatory land use also terminate in the various markets across the State, while 27% and 19% is attracted by residential land use and industrial land use respectively. Furthermore, 37% of the trips from other land use types terminate in residential land use, while 21% and 19% make industrial and commercial land uses their destination respectively.

The result obtained is in agreement with that of Okoko (2008) on the spatial pattern of urban goods movement in Akure, Nigeria. In the study, commercial land use was depicted as the largest attractor and generator of freight traffic. This could be explained by the fact that the various markets in urban areas serve as distribution and re-distribution centres for goods.

Table 2: Pattern of freight trip distribution in Lagos State

Origin (O)	Destination (D)						ΣO
	Residential	Industrial	Commercial	Recreational/Institutional	Circulatory	Others	
Residential	72	57	133	36	88	149	535
Industrial	596	832	1,507	187	281	115	3,518
Commercial	1,706	964	1,432	389	505	293	5,289
Recreational/Institutional	33	57	99	64	27	51	331
Circulatory	573	407	926	109	54	65	2,134
Others	268	151	137	96	51	23	726
ΣD	3,248	2,468	4,234	881	1,006	696	12,533

Source: Author’s Field Work Analysis

It can be observed from the analysis in Figure 3 that commercial, industrial, residential and circulatory land uses are the pivots upon which urban freight movement revolves in the study area. Commercial land use is the largest generator (42%) and attractor

(34%) of urban freight trips. Industrial land use generates 28% and attracts 20% of the urban freight trips, while residential land use generates 4% and attracts 26%. Also, circulatory land use generates 17% and attracts 8% of the urban freight trips.

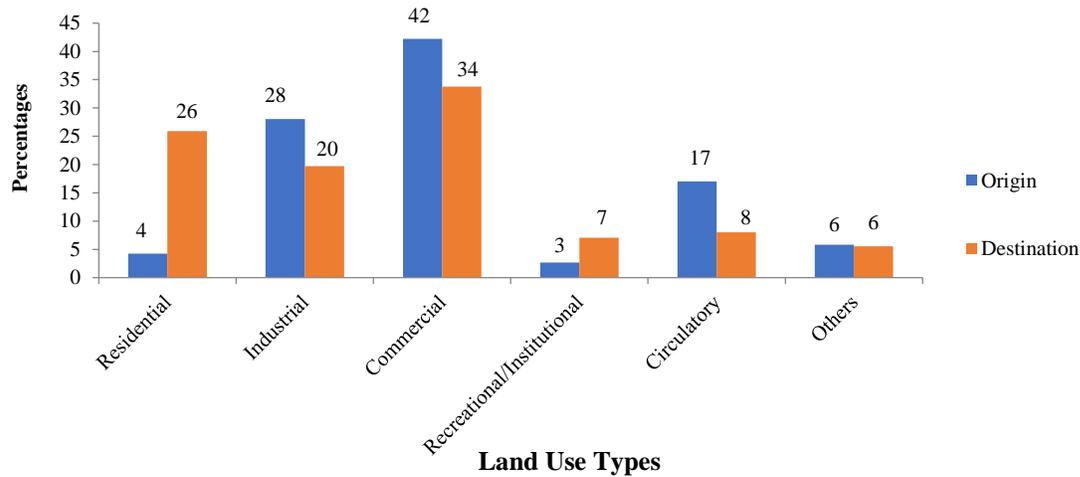


Figure 3: Distribution of Freight Vehicles' Trips in Lagos State

Source: Author's Field Work Analysis

Composition of freight vehicles in urban freight trips

The movement of freight from one point to the other in Lagos State is essentially carried out by different types of freight vehicles. The different freight vehicles are generally categorised into three, namely; small trucks, medium trucks and heavy trucks. The small trucks include; pickups canter trucks, delivery vans and three wheeled trucks, while the medium trucks include; tippers and

lorries. The heavy trucks on the other hand include; trailers, tankers, and containers.

The origin and destination of freight trips by freight vehicle types is presented in Table 3 and Table 4. Analysis reveals that small trucks are the commonly used vehicles for intra-urban freight movement in the study area accounting for about 47% of the freight trips. Medium trucks accounts for 30% while heavy trucks account for 23% of the intra-urban freight trips in Lagos State.

Table 3: Trips origin by freight vehicle types

Land Use	Vehicle Types			Total
	Small Vans	Medium Trucks	Heavy Trucks	
Residential	258	194	83	535
Industrial	1263	1204	1051	3,518
Commercial	2869	1513	907	5,289
Recreational/Institutional	184	78	69	331
Circulatory	991	516	627	2,134
Others	369	226	131	726
Total	5,934	3,731	2,868	12,533

Source: Author's Field Work Analysis

Table 4: Trips destination by freight vehicle types

Land Use	Small Vans	Medium Trucks	Heavy Trucks	Total
Residential	1,877	1,273	98	3,248
Industrial	663	743	1062	2,468
Commercial	1,989	1,228	1,017	4,234
Recreational/Institutional	472	216	193	881
Circulatory	434	167	405	1,006
Others	499	104	93	696
TOTAL	5,934	3,731	2,868	12,533

Source: Author’s Field Work Analysis

Analysis further reveals that commercial land use and industrial land use are the major generators of trips made by small trucks, medium trucks and heavy trucks in the study area (Table 4). About 48% (2,869) and 21% (1,263) out of the 5,934 of the small trucks start their trip from commercial land use and industrial land use respectively. Again, about 41% and 32% of the medium trucks start their journey from commercial land use and industrial land use respectively. Majority (37) of the heavy trucks on the other hand start their journey from industrial land use, while 32% take off from commercial land use.

Analysis of the trip destination by vehicle types in Table 4 shows that 34% of the small truck trips terminate in the commercial land use, while 32% and 11% terminate in the residential land use and industrial land use respectively. Similarly, about 34% of the trips made by medium trucks terminate in the residential land use, while 33% and 20% terminate in the commercial and industrial land use respectively. Industrial land use attracts about 37% of the heavy trucks trips, while commercial and residential land uses attract 35% and 14% respectively.

Similar results were obtained from a study on freight movement in Ibadan Metropolis, Nigeria, by Adetunji and Atomode (2014). The study revealed that light duty vehicles constitute the largest proportion (45.7%) of freight vehicles in the city. This was followed by medium trucks with an average of 32.3%, while heavy duty had the least proportion of 21%.

Variation of freight Traffic by land use types in the study area

A Two-Way ANOVA statistical technique was conducted to examine the variation in freight vehicles’ trips within different land use types in the

study area. There was a significant interaction between the effects of land use and trip pattern (origin and destination) on the volume of freight traffic, $F(4, 1) = 3097.39, P = .013$ - at 0.05 alpha level. Also, there was a significant main effect of the land use on the volume of freight trips, $F(5, 1) = 10696.43, P = .007$. There was a non-significant main effect of the trip pattern on the volume of freight trips, $F(1, 1) = .20, P = .732$ (Table 5). This effect means that when we ignore the land use types, the volume of freight vehicles is not influenced by the trip pattern. In other words, the volume of freight vehicles is the same for both origin and destination. Therefore, the null hypothesis that “freight vehicle’s trips do not vary by land use types in the study area” is hereby rejected. This means that the variation in the volume of freight vehicles as well as the variation in the origins and destinations of freight vehicles’ trips are explained by land use differentiation in the study area.

Table 5: Two-way analysis of variance result for variation in the urban freight trips and land use types

Tests of Between-Subjects Effects					
Dependent Variable: Freight Traffic Volume					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	30307413.667 ^a	10	3030741.367	6734.981	.009
Intercept	54439749.541	1	54439749.541	120977.221	.002
Land Use	24066977.057	5	4813395.411	10696.434	.007
Trip Pattern	90.000	1	90.000	.200	.732
Land Use * Trip Pattern	5575299.000	4	1393824.750	3097.388	.013
Error	450.000	1	450.000		
Total	82666560.000	12			
Corrected Total	30307863.667	11			

Source: SPSS Output of Author’s Analysis

Conclusion and recommendations

The study area was categorised into different land use types to establish the influence of land use on urban freight traffic pattern of the study area. Urban land use was also found to significantly influence freight trips. The study found that the land use differentiation in the study area was responsible for the variation in freight traffic volume and composition.

The study revealed that commercial, industrial, residential and circulatory land uses are the pivots upon which urban freight movement revolves in the study area. Commercial land use is the largest generator (42%) and attractor (34%) of urban freight trips. Industrial land use generates 28% and attracts 20% of the urban freight trips, while residential land use generates 4% and attracts 26%. Also, circulatory land use generates 17% and attracts 8% of the urban freight trips. Analysis also revealed that small trucks are the commonly used vehicles for intra-urban freight movement in the study area accounting for about 47% of the freight trips. Medium trucks accounts for 30% while heavy trucks account for 23% of the intra-urban freight trips in Lagos State.

The findings of this research provide the basic understanding of the influence of land use on urban freight traffic pattern in the study area. This understanding will serve as a basis for the improvement in urban freight traffic management and planning. Efforts are required to provide substantial transport infrastructure and access facilities for freight vehicles, especially in the major

freight generating and terminating zones. There is the need for provision of parking spaces, loading and offloading facilities in such zones. Besides, the routes to such zones should be redesigned to accommodate increasing freight traffic. This is important because, freight vehicles possess certain detrimental characteristics (such as their sizes, in terms of weight, length and height and the driving behaviour of their drivers) which differ from those of the passenger vehicles. These characteristics are believed to be predisposing the vehicles to urban traffic problems than the passenger vehicles. Therefore, the provision of special facilities for freight vehicles will to a large extent reduce traffic problems in the study area.

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