



ANALYSIS OF DISAGREGATE TRIP GENERATION AND TRIP ATTRACTIONS OF CRIPPLES IN YOLA NORTH LOCAL GOVERNMENT AREA, ADAMAWA STATE, NIGERIA

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ABSTRACT

The study analysed disaggregate trip generation and trip attraction of cripples in Yola North Local Government Area, Adamawa State, Nigeria. Multi-stage sampling techniques were used to select the respondents for the study. This sampling techniques allows smaller groups to be successively selected from large populations to form the sample population and makes data collection more practical for large populations, especially when a complete list of all elements of a population does not exist. A total of 254 well structure questionnaires were administered to the respondents with the help of a research assistant. The data collected were analysed using frequency, percentage and regression analysis. The study found that the common modes of transport are; bus, car, tricycle, motor cycle, bicycles, wheelchair and trekking. The spatial distribution of trips of the respondents shows some form of regularity in spatial dimension which are influence by the pattern of Land uses both residential and non-residential which serve as the basis for trip generation and trip attraction in Yola North Local Government Area. The regression analysis for trip generation shows that types of transport and reasons for mode choice accounts for about 76% of the sum total of the variation on the dependent variable. Similarly, trip attraction shows that the trip attraction of cripples was found to be explains by variables of household size, reasons for mode choice, distance of trips, educational levels and age of the cripples. These variables therefore, accounts for 0.98% of the total variation in trip attraction of cripples. Based on the findings of the Study, the study recommended that Public transport system should introduce transport fare concessory per trip for cripples. This will help in building a caring and inclusive transport system for cripples in the study area.

Keywords: Cripples, Disaggregate, Land Uses, Trip Attraction, Trip Generation

INTRODUCTION

The analysis of trip generation and attraction is the first stage in the sequential

approach to travel demand forecasting. The demand to travel is regarded as a derived demand. According to Galtima (2002), three factors responsible for travel demand

are as follows; (i) the nature of the land use activities and accessibility, (ii) Transport system within the mobility area. (iii) The demographic character and socio-economic characteristic of the population. The inter play of these factors creates the pattern of urban trips which vary according to cities depending on their peculiarities. Globally, urban areas are made up of different land uses ranging from educational, commercial, industrial, and institutional among others, these land uses constitute the origin and destination of trips in an urban area. The higher the density of the land uses the high degree of trips generation and attraction to the land use (Serah, 2020).

Transportation in urban area as the means of accessing facilities, utilities and service is affected by land use pattern, urban structures and socio demographic factors resulting in differing travel patterns (Shravani, 2019). According to Kashem *et al.*, (2014) urban sprawl can negatively impact urban transportation system in many ways. For instance, when sprawling development patterns results to sparsely located housing, employment, and other facilities it reinforces dependence on private automobiles. Urban sprawl has impact on transportation particularly in terms of the location of employment centres and commuting times. Higher density employment may be associated with higher commuting times while low-density workplace locations are associated with lower commuting times (Malpezzi 1999; Sultan 2000; Crane & Chatman 2003). Sultana and Weber (2013) reported that the growth of urban areas with recent housing developments would results in longer

commuting time than older part of the cities, but the commuting time tends to subside as these areas age.

Filitowish (2011) noted that trip generation and attraction changes with change in population characteristics such as household size, marital status, age, household employee, number of vehicles owned in the household, school going children, children not going to school, number of licensed drivers in the household and annual household income. Adetunji (2013) observed that women spend more time on transit which invariably reduces the number of hours devoted to productive activities in Ilesa and many other similar cities in Nigeria. Various factors influence trip pattern positively and negatively, for instance narrow path and buildings contribute negatively by creating traffic congestion while, well planned cities offer high degree of connectivity (Shariff & Shah, 2008). Adetunji (2013) reported that trips to work, schools, postal services, recreational centres, health centres, relatives, shops/markets and banks are undertaken in order to procure services, which are available in specific locations and that the frequency, pattern and complexity of these trips are usually influenced and constrained by physical, demographic, cultural and socioeconomic factors. Analysing the trip generation and trip attraction of Cripples is very expedient so as to provide transport facilities that will ensure the safety, convenience and comfortable of their trips in urban area. In addition, trip generation and trip attraction analysis predict the future pattern and factors that influence trip distribution in urban areas. The aim of this study is to

analyse the trip generation and trip attraction of Cripples in Yola North Local Government Area, Adamawa State, Nigeria.

MATERIALS AND METHODS

Study Area

Yola North Local Government Area is located between latitude $09^{\circ}16' N$ and $9^{\circ} 20' N$ and longitude $12^{\circ} 26' E$ and $12^{\circ} 30' E$. It has a total land area of 109sq. km (Malgwi, 2019). Yola North L.G.A has a total population of 199,674 out of which 144,244 and 121,507 were males and females respectively (National Population Commission, 2006).

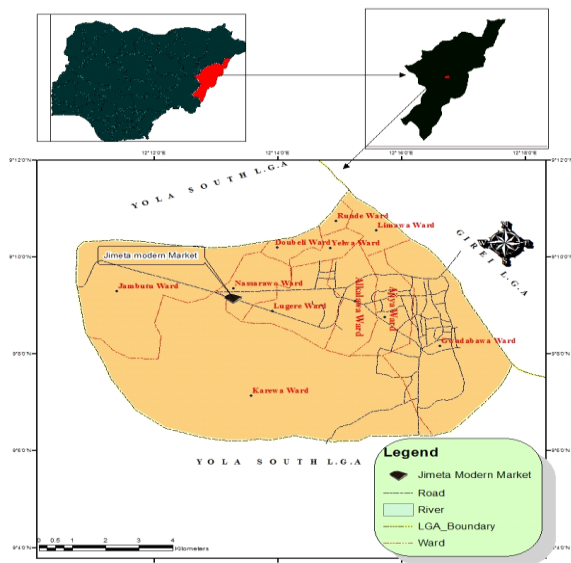


Figure 1. Yola North Local Government Area showing political ward (Source: Adamawa State Ministry of Land and Survey)

Yola North Local Government Area Has West African Savannah climate characterized with dry and rainy season (Binbol & Zemba, 2007). The study area has conventional form of rainfall. During dry season, the Harmattam wind which is a

dusty wind from the Sahara Desert impedes visibility resulting to road clashes. Similarly, during rainy season rainstorm and wind storm impedes visibility thereby resulting in road traffic accident. Yola North L.G.A is divided into eleven political wards namely Ajiya, Alkalawa, Doubeli, Gwadabawa, Jambutu, Karewa, Limawa, Luggere, Nasarawo, Rumde and Yelwa. Each of the eleven wards has micro zones of commercial, educational, religion, institutional, recreational and residential land use. The residential land use is clearly stratified in term of population density as low, medium and high density (Ilesami, 1999). The low-density areas 80 Unit, Dougere, Old G.R.A, Legislative Quarters among other are well planned units where Government officials reside while the medium density areas this include; Clark Quarters, Bekaji, F.C.E Quarter and high-density areas are; Shinko, Jambutu, Upper and Lower Luggere, Doubeli, Yelwa Nassarawo are made up of common people with little or unplanned buildings (Zemba *et al.*, 2013). These land uses generate and attracts volume of trips.

Yola North L.G.A is traverse by trunk A, B, and C roads network. It has six roundabouts with one of the roundabouts (Police roundabout) having five roads radiating from it. Majority of the trunk A and B roads are dualized with traffic lights at some major intersections of the roads. However, only one traffic light is fully functional (Total Junction). Some of the roads were characterized by pot holes and stagnant water during rainy season while others are under-construction. The common public mode of transport in the area is the tricycles commonly known as *Keke Napep* which

usually carries three passengers. Other modes of transport include; buses, taxi. The study area has many unauthorized park and bus stops. Similarly, motorists in the study area often violates right of ways and traffic signs and regulations.

Data Collection

The data for this study were sought from both primary and secondary sources. The primary data were sought via the administration of well-structured trip survey questionnaire for one week. The secondary data were sought from the National Population Commission (NPC) and the archive of the Adamawa State Ministry of Land and Survey 2006 and 2019 respectively. Categorical data collected such as age, educational levels, types of transport, reason for mode choice were transformed into nominal data for mathematical application. Only cripples that are 18 years and above that are domiciled in the study area filled the one-week trip survey questionnaire. Because only individual 18 years and above are allowed to be registered with the Association of Cripples in the study area. The administration of the trip survey questionnaire was carried-out with the help of a research assistant (the Secretary National Association of Cripple Yola North Chapter).

Multi-stage sampling techniques were used to select the sample for the study. A total of 254 were chosen as a sample. This gave equal chance to the respondents to be selected. In determining the sample size for the study, formulae as expressed in Ba *et al.*, (2014) was used as follows;

$$n = \frac{N}{1 + N(e)^2}$$

Where n = sample size

N = total population

e = level of significance (5%) i.e. 0.05

$$n = \frac{692}{1 + 692(0.05)^2} = 254$$

Therefore, the sample size for the study are 254 cripples from Yola North Local Government Area. Socio-economic data, mode of choice, reasons for mode, trips generation and trip attractions were analysed using descriptive statistic percentage and frequency.

RESULTS AND DISCUSSIONS

Socio-Economic Characteristics of the Respondents

The socio-economic characteristics of the respondents were shown on Table 1.0. The main variables discussed are sex, age, income and occupation of the respondents. These variables play an important role in determining volume of trips generation and attraction.

The gender distribution of the respondents shows that about 84% of the respondents were males while 16% were females this result concurred with the findings of Odufuwa (2008) where he reported more male respondents than female. Majority of the respondents 43% fall between the ages of 31-40 years, those between the ages of 20-30 years accounts for 25% of the respondents while those between 41-50 years constitutes 11%. The result further reveals that 16% of the respondents were above 50 years of age.

However, those below 20 years of age account for the least 4% of the respondents. It pertinent to note that majority of the respondents are within their youthful stage (20-40 years) this makes trip very expedient

in accessing facilities, utilities and services. Out of the 254 respondents, 25% had informal education, 13% had primary education. Those with secondary education account for about 30%, similarly, 27% of the respondents had NCE and diploma while 4% had various degree.

Table1: Socio-economic Characteristics of the Respondents

Variables	Frequency	Percentage (%)
Gender		
Male	213	83.86
Female	41	16.14
Age		
<20 year	11	4.33
20-30 Years	64	25.20
31-40 Years	109	42.91
41-50 Years	29	11.42
Above 50 Years	41	16.14
Educational Level		
Informal education	64	25.20
Primary education	34	13.39
Secondary Education	76	29.92
NCE/ Diploma	69	27.16
Degree	11	4.33
Occupations		
Applicants	6	2.36
Students	44	17.33
Beggars	39	15.35
Business	56	22.05
Men/women		
Civil Servants	109	42.91
Income Level		
< 10,000	44	17.33
10,000-30,000	101	39.76
31,000-50,000	49	19.29
51,000-70,000	44	17.33
Above 70,000	16	6.29

Source: Field Survey (2019)

The occupation of the respondents shows that 2.3% were applicants, students constitute 17%, those that were into begging accounts for 15% business men and women constitute 22% while civil servants accounts for 43%. The income of the respondents may influence their trips.

The result shows that about 17% earned below 10,00 Naira monthly, 40% earned between 10,000-30,000 Naira in a month, 19% earned between 31,000-50,000 Naira. The result further shows that those who earned 51,000-70,000 Naira constitute 17% of the respondents, while 6% earned above 70,000 Naira monthly. The high income earned by the respondents could be as a result of the cultural and religious belief of the urban dwellers in which they give alms to the less privileged along major roads, shopping malls, markets, banks and places of worship amongst others. The findings of this study is in disagreement with the finding of Odufuwa (2008).

Mode Choice of the Respondents

The mode of transport plays a very important role in the analysis of trips, because it is the medium through which all the trips are undertaken Table 2.

Table 2: Mode Choice of the Respondents

Mode of Transports	Frequency	Percentage (%)
Trekking	13	5.12
Wheel Chair	178	70.08
Bicycles	-	-
Motor cycle	37	14.57
Tricycle	15	5.90
Car	3	1.18
Bus	8	3.15

Source: Field Survey (2019)

Table 3.0 shows the various modes of transport in Yola North L.G.A, the modes of transport are; bus, car, tricycle, motor cycle, bicycles, wheelchair and trekking. The result reveals that 4.94% of the respondents undertake trips by trekking, 69.96% uses wheelchair. Next to the wheelchair is the motor cycle which

accounts for 14.45% of the respondents' mode choice. The results reveal that tricycle which is the common mode of transport in the area accounts for only 6.08%, car and bus accounts for 1.52% and 3.04% respectively.

Spatial Distribution of Trip Generation and Trip Attraction

The trip generation and trip attraction of Cripples in Yola North Local Government Area shows some form of regularity in spatial dimension these were influence by the pattern of Land uses (both residential and non-residential), which serve as the basis for trip generation and trip attraction.

Table 3: Trip Generation and Trip Attractions of Land uses

Land uses	Trip		Trip	
	Generation (%)	Attraction (%)	Generation (%)	Attraction (%)
Commercial	89	20.18	138	31.29
Educational	16	3.63	35	7.94
Religion	19	4.31	52	11.79
Institutional	29	6.58	54	12.25
Recreational	18	4.08	24	5.44
R. High	179	40.59	79	17.91
R. Medium	73	16.55	26	5.90
R. Low	18	4.08	33	7.48

Source: Field Survey (2019)

The trip generation and trip attraction of the respondents on Table 4.0 reveals that about 61% of the trips of cripples in the study area were generated from residential areas. The high-density residential areas were older settlement in the area (Ajiya, Limawa, Gwadabawa, and Luggere) accounts for

40.59% of the trip generation of cripples. This part of the city (high density residential) attracts relatively low volume of trips amounting to 17.91% of all the trips. Table 3.0 shows the pattern of Land uses, trip generation and trip attraction of Cripple in Yola North Local Government Area.

The non-residential land uses generate 39% of the trip volume. The commercial land use alone generates 20.18% of the total volume of trips. The major areas of commercial activities are; Jimeta modern Market, Jimeta Shopping complex, and Jimeta old Market. A great deal of commercial trips is generated and attracted to Jimeta Modern Market especially in the morning and evening when businesses are about to open and close around 8:30 am and 16:30 hours respectively. Educational land use account for least of trips only 3.63% of the trips were generated from educational land use. The pattern of trip attraction reveals that, residential land use subdivided into high, medium and low-density account for 31.29% of the trip attraction. The religion and institutional land uses attract 11.79% and 12.25% trip respectively. The educational and recreational land uses attract the lowest volume of trips 7.94% and 5.44% respectively. It is pertinent to note that, the analysis gives a spatial distribution of Trip generation and attraction without analysing the fundamental factors that were responsible for this trip generation and attraction. Therefore, the inclusion of Land uses factors makes forecast of the trip generation and attraction of cripples possible in Yola North Local Government Area.

Table 4: Purpose of Trips of the Respondents

Purpose of Trips	Frequency	Percentage (%)
Work	191	21.66
Leisure	122	13.83
Meeting	34	3.85
Religion	224	25.40
Begging	52	5.90
Educational	78	8.84
Business	61	6.92
Shopping	51	5.78
Visitation	69	7.83

Source: Field Survey (2019)

Purpose of Trips of the Respondents

The purpose of the trips undertaken by the respondents is very important in determining the volume of trips generated and attracted by each individual land uses in the study area. Results from Table 4.0 shows that majority of the trips 25% were for the purpose performing religious rite. Work trip including both private and public work accounts for about 22% of trips in the study area. Trips undertaken for the purpose of attending a meeting and shopping account for the least in 3.8% and 5.8% respectively. According to an interview with the respondents, they asserted that meeting is not always and shopping for the family is carried out by women and children. The result further reveals that trip for the purpose of leisure account for 13.8% the leisure activities includes; watching football matches, attending marriage and chambers among others. Trip for the purpose of conducting business account for 6.9% of the trips, while trip for the purpose of begging and visiting a friend, relations account for 5.9% and 7.8% respectively. Trips undertaken for gaining both formal

and informal education account for only 8.8% of the total trips. It is pertinent to note that majority of these trips were undertaken using public transport system as most this, left the respondents at the mercies of the public transport operators in terms transport fare, comfort and choice of route.

Modelling Trip Generation and Trip Attractions

In order to determine the factors that influence trip generation and trip attraction of cripples in the study area, linear regression model was adopted. Table 1.0 shows the operational definition of independent (x) and dependent (y). It can be conceptualized that there are set of variables.

$x_1, x_2, x_3, \dots, x_n$

To explain the trip generation and attraction of Cripples in Yola North Local Government Area. Correlation analysis was carried out to identify variables that have positive relationship with dependent variable. Therefore, age x_1 , educational level x_2 , household size x_3 , types of transport x_4 , reasons for mode choice x_5 , distance x_6 , time x_7 were identified to have a significant relationship with the dependent variable. The linear regression used can be expressed as follows (Galtima, 2002).

$$Y = f(x_1, x_2, x_3, x_4, x_5, x_6, x_7)$$

These can be expressed by regression equation as thus

$$Y = a + b_1x_1 + b_2x_2 + b_3x_3 + \dots + b_7x_7 + e$$

Where Y = dependent variable (trip generation and trip attraction respectively)

x_1 = age

x_2 = educational levels

x_3 = household size

x_4 = types of transport

x_5 = reason for mode choice

x_6 = distance

x_7 = time taken

a = Regression constant

$b = b_1, b_2, \dots, b_7$ regression co-efficient

e = the error term

The approach used in this study is similar to Adekunle and Ganiyu (2014) to examine modal choice for journey to work in Ilorin, Nigeria. The technique has the potential of identifying the contribution of each independent variables on the dependent variable. The regression analysis was run using Statistical Package for Social Sciences (SPSS). Version 20.0 and the results are shown below

The summary of the regression analysis shows that types of transport, reasons for mode choice, number of trips and time taken have statistical relationship with trip generation As Shows In Table 6.0. The findings concurred with the earlier studies of Galtima (2002) in Maiduguri Metropolis. The regression result reveals that any change in independent variables will result to changes in trip generation. For instance, types of transport and reasons for mode choice accounts for about 76% of the sum

total of the variation on the dependent variable (Trip generation).

$$Y_1 = 2.522 + 0.397x_4 + 0.367x_5 + 0.122x_8 + 0.045x_2 + 0.233x_7$$

The regression result for trip generation in Table 6.0 reveals that the five variables of types of transport (x_4), reasons for mode choice (x_5), number of trips (x_8), educational levels (x_2) and time taken for the trips (x_7) jointly constitute 0.84% of the total variation in trip generation of cripples in the study area. Therefore, trip generation of cripples in the study was found to be explained by factors of types of transport, mode choice, educational levels and time taken for a trip.

The model summary of regression equation for trip attraction shows that the trip attraction of cripples in the study area was found to be explains by variables of household size, reasons for mode choice, distance of trips, educational levels and age of the cripples. These variables therefore, accounts for 0.98% of the total variation in trip attraction of cripples as shows in Table 7.0. These findings of the Study is in agreement with the studies of Adekunle, and Ganiyu, (2014) Modal Choice for Journey to Work in Ilorin metropolis.

Table 5: Operational definition of independent (x) and dependent (y) variables

Notations	Variables	Measurement
x1	Age	Years of respondents
x2	Educational levels	Primary, Secondary, Diploma/NCE, Degree
x3	Household size	Total number of people in a house
x4	Types of transport	Vehicles used for the trips
x5	Reasons for mode choice	Motivation for using a vehicle for trip
x6	Distance	Total distance covered for all the trips in kilometres
x7	Time taken	Total time spent for all the trips from boarding to alight in minutes Aggregate trip for a week
x8	Number of trips	Total volume of trips origin from all land uses
Y1	Trip generation	Total volume of trips attract by all the land uses
Y2	Trip attraction	

Source: Malgwi (2019)

Table 6: Summary of Regression Result for Trip Generation of Cripples

Dependent variable	Independent variables	Regression co-efficient	Level of significance	T-value
Trip Generation	Constant	2.522	0.006	2.455
	Types of transport (x4)	0.397	0.004	3.042
	Reasons for mode choice (x5)	0.367	0.006	2.870
	Number of trips (x8)	0.122	0.055	0.942
	Educational Levels (x2)	0.045	0.073	0.349
	Time taken (x7)	0.233	0.007	1.806

R = 0.838, R² = 0.771, Adj R = 0.710, Std Error= 5.123, F = 3.661, Sign F = 0.006

Table 7: Summary of Regression Result for Trip Attraction of Cripples

Dependent variable	Independent variables	Regression co-efficient	Level of significance	T-value
Trip Attraction	Constant	6.328	0.004	3.656
	Household size (x3)	0.158	0.273	1.110
	Reasons for mode choice (x5)	0.280	0.005	1.765
	Distance of trips (x6)	0.112	0.425	0.655
	Educational Levels (x2)	0.287	0.107	1.645
	Age (x1)	-0.567	0.568	-0.576

R = 0.978, R² = 0.768, Adj R = 0.634, Std Error= 3.328, F = 2.423, Sign F = 0.005

CONCLUSION

This study analysed disaggregate trip generation and attraction of cripples in Yola North Local Government Area, Adamawa State, Nigeria. From the study, the following conclusion can be drawn; The results reveal that tricycle is the common mode of transport in the area for cripples. The trip generation and trip attraction of the respondents reveals that majority of the trips of cripples in the study area were generated from residential areas. However, Educational land use account for least of trip in the study area. Furthermore, the analysis of trips based on purpose shows that majority of the trips are for the purpose performing religious rite. While shopping and meeting trips account for the least trip. The regression analysis of the result shows that variables of types of transport, age, educational levels, household size, reasons for mode choice, distance of trips and time taken for a trip explains trip generation and attraction.

Recommendations

Based on the findings of the Study, the following recommendations were made:

- i. Government should provide transport furniture and facilities such as disabled lane when new road are constructed or upgraded as most of the cripple in the study area uses tricycle this will ensure their safety and security against reckless road users.
- ii. Government should introduce public mass transit and Bus stops at regular

interval along major arterial roads. The mass transit should have seats written boldly strictly for disabled. Similarly priority should be given to disabled (Cripples) in which other passengers can be asked to relinquished seats for cripples.

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