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Vehicular Trip Bytraffic Assignment Model in Maiduguri Metropolis

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Abstract

In this research work two trips are considered namely House hold trip and Commercial trip. A house hold trip is a person trip or auto driver trips made by residents within a specified area and for defined purposes, while a commercials trip is a trip made by the commercial vehicles within a specified area and for a defined purpose. Normally, surveys of commercial vehicle are carried out in conjunctions with the home-interview study. If the complete pattern of travel within the survey areas is desired, this phase of the survey must be carried out with the same care as, and in a manner similar to the home interview study. In this case planners may collect extensive data on socio-economic characteristics of house hold and relate such information of house hold travel. To collect data a kind of survey is carry out, which includes home interview, telephone, and mail survey. The home interview method involves identifying a sample of all of the households within the area, arranging for interviews, and questioning respondents about trips made by person in their respective households the previous day, such relationships are extremely valuable for making forecasts of future travel by person who reside in the study area. In the causes of study, data was collected through the form of verbal interview and by passing questionnaires to the various household in the study area. Traffic assignment is the stage in transportation planning process where in the trip; inter-changes are allocated, to different part of network forming the transportation system. The traffic assignments help to reduce the time consumption for car drivers. In the research work a value was test to verify the model equation for the traffic assignment method. From the calculation, by diversion curve method, the traffic reduced from 445 vehicle/h from modugani through Monday market to Bama road, reduced to 361vehicle/h through kyarami to Bama road with the reduction of total number of 84vehicle/h.

Introduction

Transportation has a very important role to play in general development of the country and especially in its economic development. It has been described as the vein and arterial for the flow of the economy of the Nation. In a developing country like Nigeria the goal of industrial development can be achieved through an efficient transportation system. Our social, cultural and political institutions can be built up and life of the people in general can be enriched only through efficient transportation systems. Maiduguri being the capital state of Borno located within the northern part of the country and is presently witnessing rapid growth in population, economic activity, vehicular ownership and hence rapid traffic growth. Increasing urbanization gives rise to vexing problems of congestion. If metropolitan areas are to grow and prosper, it will be imperative to plan and build vast new facilities for public and private transport. These, as well as existing resources must be operated, so as to provide the largest possible free flow of traffic. But if a reasonable level of amenity is to be maintained, the added facilities must be planned to make a sparing, efficient use of land, to be convenient to use, and to make a positive esthetic contribution to the environment of both users and bystanders. Transportation facilities are the basic requirement for community growth and development. With the huge capital investment required to finance urban projects of all kinds, the consequences of not planning have became more acute than ever, successful solutions to the complex mobility problems confronting urban areas throughout the nation require the full energies and imagination of many professionals, but particularly of the traffic engineer. Transportation in general and particularly highway transport play an essential role in the life of any communication today. Good highways transport facilities are the result of sound planning. More and more is it now being recognized that transport planning cannot be and must not be isolated from land use planning. Also when planning for the future, account must be taken for the vehicles in which people wish to travel and move their goods. In recent years, planners have developed methodologies for estimating the distribution of future traffic over an entire transportation network. These procedures, which have been used for both urban and statewide. System, involve

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the use of computer simulation programmed comprised typically of five types of models: i.e

1. Land used
2. Trip distribution
3. Trip generation
4. Traffic assignment
5. Model split

The models are mathematical equations and procedures that collectively relate travel patterns to land use, demographic characteristics, and parameters of the transportation system. The models are developed and "calibrated" for a given study area so as to reproduce existing travel patterns as determined from actual count. Assuming the basic relationships between travel, land use, and socio-economic characterics remain constant over time, planners use the models to evaluate future alternative land used and transportation system (Pignataro L, J 1973). Among the five models mentioned above, the Traffic assignment model and Trip generation will be used for these analalysis of result.

Literature Review

Traffic engineering has been defined as "that phase of engineering which deals with the planning, geometric design and traffic operations of roads, streets and high ways, their networks terminals, abutting lands and relationship with other mode of transportation for the achievement of safe, efficient and convenient movement of persons and goods". Traffic engineering, unlike most engineering disciplines, deals with problems which are not only dependent on physical factors but very often include the human behavior of the driver and the pedestrian and their inter-relationships with the complexity of the environment. The traffic engineer must instead be sensitive to a variety of disciplines, because what he does, and what he fails to do, affects very large numbers of people, whether they are road users or not.

There are three main system of traffic engineering system viz:

a) Road users
b) The vehicle, and
c) The road.

The three traffic engineering systems are discussed as follows:

Road Users

Road users, including driver and pedestrians', are one of the three main elements of automobile transportation because the user is a major part of the system, human limitations and behavior must be understood and taken into accounts in all traffic engineering and design matters. The success of traffic engineering measures depends heavily upon the users. An understanding of not only average physical and mental limitations, but of the range of user performance, is critical to proper exercise of traffic controls and operating measures. Since human factors affect every phase of traffic engineering, for example, traffic laws and ordinances must be made "reasonable", so as not to breed contempt for all laws among drivers, controls devices must be designed with consideration of their primary function as a medium of communication with drivers. Because human performance varies from individual to individual, consideration must be given to a typical or an average, characteristics, for example, a traffic signal timed to permit an average pedestrian to cross the street safely may cause a severe hazard to the elderly and others whose capabilities fall below those of the "average" pedestrian.

There are some characteristic as relate to road users:

Characteristic of Drivers

Some driver's characteristics are reaction time, experience, eye sight, fatigue, sense of judgment or gap acceptance, age and level of literacy .Deficiencies in these elements contribute to almost every accident, physical limitations, however, account for only a small proportion of accidents, since these limitations may be compensated for by slower or more careful driving.

Reaction to External Stimuli

Reaction involves a series of elements which are closely related to human physical factors:

i) Perception
ii) Identification or interrelation
iii) Judgment or emotion and
iv) Reaction or volition.

Pedestrian Factor

Pedestrian control is greatly needed because of the high injury and fatality rates due to traffic accidents. Special pedestrian sidewalks, cross walks, special pedestrian barriers, safety zone and islands, pedestrian tunnels and over passes, and highway lighting, as well as enforcement control.

The Vehicle

Vehicle is one of the three systems of traffic engineering. The number of vehicle registered in the world is been increasing throughout. Therefore, the traffic engineer must study the vehicles in order to design and plan for future road user. Vehicles vary widely in form, characteristics, and the purpose for which they are used. A design check should be made to ensure that the largest vehicle expected at that location can negotiate the designated turns, particularly where pavements are curved. It is important that fire fighting and other emergency equipment should be capable of maneuvering on all city streets.

Definition

P	=	Passenger vehicle
SU	=	Single unit truck or bus

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WB-40 = Semi trailer combination.
WB-50 = Semi trailer combination

The Road: Is one of the three systems of traffic engineering. The geometric design of highways includes the visible elements of high way or street. It deals with the grade line or profile, horizontal and vertical alignments, the several components of the cross section, sight distances, and intersections. Geometric design is intimately related to the capabilities and limitations of the roadway user and his vehicle, who will use the road and how often is also most important. Towards that end, traffic volume speed, and composition are three major items to be considered in striving to provide safe, efficient, and economic traffic operations. In preparing the design of a new highway or the redesign of an old one, the highway engineer must give attention to the following basic considerations:

i) The design must be adequate for the estimated future traffic volume both average daily traffic and design peak hour, for the character of vehicles, and for the design speed.
ii) The design must be safe for driving and should instill confidence in the majority of drivers.
iii) The design must be consistent, and must be avoid surprise changes in alignment, grade, or slight distance.
iv) The design must be complete; it must include the necessary roads side treatment and provide essential traffic control devices, such as makings and signs, and proper lighting.
v) The design must be as economical as possible relative to initial costs and maintenance costs.

There are a number of non engineering considerations which are important components of the overall design process. In term of these, the highway engineer should attempt to achieve:

i) A design that is esthetically pleasing the user and to those who live along the highway.
ii) A design that is beneficial to the social and community values of the adjacent area.
iii) The design should flow with the environment.

Trip Classification

Trip is a one way person movement by a mechanized mode of transport having two trips ends that is origin and destination, or a trip can be defined as a one-way movement made between two places. By definition a trip has two ends. Viz: its origin (where the trip is produced, e.g. home) and its destination (to which the trip is attracted, e.g. work), it is normally necessary to develop separate sets of generation equation to predict the trip starting from and attracted to, each zone within the survey (i.e. internal trip).

Trip are generally classified into the following

i) Home based trips and
ii) None home based trips.

House Hold Trip

This is a person trip or auto driver trips made by residents within a specified area and for defined purposes. In this case planners may collect extensive data on socio-economic characteristics of house hold and relate such information of house hold travel. To collect data a kind of survey is carry out, which includes home interview, telephone, and mail survey. The home interview method involves identifying a sample of all of the households within the area, arranging for interviews, and questioning respondents about trips made by person in their respective households the previous day, such relationships are extremely valuable for making forecasts of future travel by person who reside in the study area.

Commercial Trip

This is a trip made by the commercial vehicles within a specified area and for a defined purpose. Normally, surveys of commercial vehicle are carried out in conjunctions with the home-interview study. If the complete pattern of travel within the survey areas is desired, this phase of the survey must be carried out with the same care as, and in a manner similar to the home interview study. The samples of vehicles are usually selected at random from numerical or alphabetical registration lists: customarily the sample rate for Lorries and similar heavy vehicles is twice that in the home-interview survey. Similarly, a kind of direct interview to the driver should be made by asking questions to them on the choices of road,

Home Based Trips

Home based trip which are defined as household trips with one home or residential trip ends. The home end is regarded as the production end of the trip irrespective of the direction of the trip.

About three quarters of all trips are home based, i.e. they arise or terminate at a residence.

Non-Home Based Trips

Non-home based trips are defined as the household trips with neither ends at home. In this case then origin is regarded as the production end and the destination as the attraction end. In another word a non-home based trip are mainly those between attracting lands uses, for example from work to a restaurant, shopping to the cinema, surgery to a hospital, etc.

Methodology

Trip generation is the allocation of trips associated with the traffic zone. It normally consist of daily passing trips produced by residents in that zone and for the same zone the number of daily passing trips attracted to that zone. Trip generation is a term used in

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the transportation planning to cover the field of calculating the future number of trip ends in a given area. The objective of the generation stage is to understand the reason behind a particular trip making behavior and to produce mathematical relationships to synthesize the making pattern on the basis of observed trips, land-use data and household characteristic. Transportation studies have found that 80 to 90 percent of all trips made by residents of urban areas originate or end at home. Residential land use therefore is a highly important trip generator. For this reason, and also because it exhibits a predictable pattern much of the research on trip generation has been obtained by making a home interview questioner, which was distributed to the various household. The area of study within the metropolis was two zones that is Abbaganaram state housing low cost Maiduguri and Moduganari.

Data Analysis

Analyses of collected data starts with the step commonly known as trip generation. As it has been defined earlier that trip generation is a term used in the transportation planning to cover the field of determining the future number of trip ends in a given area.

Traffic Asgnmesint

Traffic assignment is the stage in transportation planning process where in the trip; inter-changes are allocated, to different part of network forming the transportation system. In another word it can be said to be a process of determining the links of the transportation system on which trips will be loaded. Trips end where there is no choice of travel mode that is from non-car owning households, are accumulated as public transport trip ends. Choice trip where the car is available are separated by the modal choice procedure into trips and public being accumulated and the car trips assigned to the network. Usually it will then be found that the proposed road network is overloaded and some car trip will need to be restrained if a car cannot be used then some trips will not be made at all, while other trips will be transferred to public.

Traffic assignment help to

(i)Determine the deficiencies in the existing transportation system by assigning future trips to the existing system.

(ii)Evaluate the effects of limited improvements and additions to the existing transportation system by assigning estimated future trips to the improved network.

(iii)Develop construction priorities by assigning estimated future trips for intermediate years to the transportation system proposed for those years.

(iv)Test alternative transportation system proposals by systematic and readily repeatable procedures.

(v)Provide and design hour traffic volume on highways and turning movements at junctions/inter sections.

The assignment process is therefore useful to the transport planner because of the need to evaluate how the proposed transport system will work and to the highway engineer for geometric design of individual links and intersections. In the assignment stage the route to be travelled is determined and inter-zonal flows are assigned to the selected routes. The choice of the route is made on the basis of a number of criteria such as journey time, length, cost, comfort, convenience and safety. However, journey time is often considered as the sole criteria since length and cost can be considered as functions of timing zone centroid mode are e in most cases. There are four methods by which the assignment may be made. These are: All or nothing assignment, assignment by used of diversion curves, capacity restrained assignment and multipath proportional assignment.

Procedure

Traffic assignment generally involves 3 basic steps, namely:

a. **The description and coding of the network:**

The highway network is broken into links and modes. A link is a section of a highway network between two intersections, there 2 types of modes, namely: zone centroid modes, and intersection modes where 2 or more links meet.

b. **The determination of the Minimum Time path:**

The minimum time path is the shortest route from one zone centroid to another zone centroid. Travel time between each pair of modes is recorded on the links. The various travel times between a mode and starting zone centroid are the calculated to determine the minimum paths between them. The sequence of modes which defines links comprising the minimum path between any 2 zone centroids is called tree.

c. **The Assignment Stage:**

All traffic flows from each zone are assigned to every other zone by appropriate minimum path and the total flows are aggregated on each link defined network. Trips between zones are assigned to the links on the minimum path routes between them.

All or Nothing Assignment

This is the simplest techniques and it's based on the assumption that vehicles travel or move from zone or origin to zone of destination along the path of least (i.e. shortest journey time) resistance which is normally measured in terms of time. For each zone centroid selected as origin a set of shortest routes from the origin

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to all the other zone centroids is referred to as a minimum tree. When the trips between two zones are assigned to the minimum path between the zones, then the assignment is said to take place on all – or nothing basis. There are obvious difficulties with such simplified approach, some of which are inherent in the other assignment methods. It is obviously incorrect to assume that all trips commence and terminate at a zone centroid. If the length of the links within the zones is small compared with length of the minimum link path, then the errors may not be so serious.

Because of it simplicity, travel time is usually employed as a measure of link impedance, time may not be precisely.

Capacity Restrained Assignment

It is a process in which the travel resistance of a link is increased according to a relation between the practical capacity of the link to another volume assigned to the link. The capacity restrain assignment takes account of the capacity of the system between a pair of zones. The technique clearly restrains the number of vehicles that can use any particular corridor and in fact the whole system, if assigned volumes are beyond the capacity of network, and redistribute the traffic to realistic alternative routes.

Because of the iterative nature of the calculation involved the capacity restraint technique is carried out entirely by an electronic computer. The practical capacity and the journey time of each link of the network is fed into the computer and as assigned volume on each link approaches the practical capacity, the computer automatically lowers the assumed speeds on the affected links. Thereby making these links less attractive to traffic. If a link is found to be overloaded then a new journey time which makes allowance for the effected of congestion on speed Is assign for that link.

The relationship between journey time (for speed) and volume on each link in a transport network can be expressed by the equation known as Frank-Wolfe algorithm. Dafermos (1968) applied the Frank-Wolfe algorithm (1956, Florian 1976) which can be used to deal with traffic equilibrium problem. Suppose we are considering a highway network. For example each link there is a function stating the relation between resistance and volume of traffic. The bureau of public roads (BPR) developed a link (arc) congestion (or volume-delay, or link performance) function given by the equation below:

$$\mathbf{T=T_O[1+0.15(v/c)^4\}}$$

(Frank-Wolfe algorithm)

T= journey time (or speed) at which assigned volume on travel on the appropriate link or link travel time at the assigned volume

$\mathbf{T_O}$ = Base journey time at zero volume
= journey time at practical capacity equal to 1.74

C = Practical capacity.

V = assigned volume.

With this equation the speed at which the assigned volume of vehicle could theoretically travel on a link can be determined.

Assuming now that the link measuring 1.5km long along the prison road has a practical capacity at 6000 vehicle per day and the speed at that load, it is found that the link has 8000 vehicle per day, assigned to it. At what speed can the assigned volumes of 8000 vehicle per day travel on the link.

Solution

$$\mathbf{T = T_O[1+0.15(v/c)^4\}}$$

V =800vehicle/day, c=6000vehicle/day, $\mathbf{T_O}$**=j**ourney time at practical capacity

The journey time T, at which the assigned volume of 800veh/day can travel on the link is calculate as:

$$\mathbf{T = T_O[1+0.15(v/c)^4\}}$$

$$\mathbf{=1.74\ [1+0.15(800/600)^4\}} \quad =2.56\text{min}$$

Speed =Distance/Time=1.5/2.56x60=35Km/h

Assignment by the Use of Diversion Curve

This is one of the frequently used techniques and it adopts the concepts of travel resistance. It is based on the assumption that a route with a high travel resistance, for example a busy urban street with bus stops, parked cars, numerous intersection and pedestrians will not be use by as many drivers as comparable to the route with low travel resistance. Those trips from moduganari preferred to follow through kyaremi park road via G.R.A for the trip of Bama road just to avoid the congestion along the post office road via Monday market. Travel resistance is measured in terms of distance travel, speed cost and level of service. The most commonly used diversion curves is the travel time ratio which is. 'S' shaped. The percentages of stage using motor way vary from 100% at the ratio of 0.5 or less to 100% at a time ratio of 1.5 or more. Appropriately 42% of the trips are assigned to the motorway if travel time by both motorway alternative routes is equal, that is at travel time ratio of 1.00.

The following formula fits diversion curves

$$\mathbf{P = 100/1+ (t_C)^6}$$

Where P = percentage of traffic diverted to new system

$\mathbf{t_C}$ = travel time ratio

=time on new systems/time on old

For example, to relieve congestion along the Monday market for trip coming from moduganari to Bama road considering kyarimi via GRA is taking to be as by -past for the trip along Bama road it takes 25mins where the

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time for the travel via the Monday market road is 30 min to Bama road, the flow between moduganari to Bama road is 445 vehicles per hour to assign the flow between the bypass and the Monday market road is as follows:
Using the equation $\mathbf{P = 100/1+ (t_C)^6}$
$\mathbf{t_r}$ = travel time ratio
=time on new systems/time on old
=25/30=0.83
Therefore diverted traffic to the Kyarimi park road
$\mathbf{P = 100/1+ (t_C)^6}$
$\mathbf{=100/1+(0.83)^6}$
=81.13%
Therefore diverted traffic to the Kyarimi park road
=(81.13/100)x445=361vehicle/h
By using the diversion the traffic reduced to 445-361=84vehicle/h

Multi-Path Proportional Assignment

In urban areas there are many alternative routes between given origin and destination and in actual fact trip makers would be distributed over all these routes. This is because trip makers will be unable to judge route of least cost accurately and different trip makers will make different decision Multi path proportional assignment attends to simulate this situation by assigning proportions of the trips between any two zones to a number of alternative routes.

Travel Estimation

Travel can be defined, very broadly, as the motion of an object. The objects of interest to the transportation planner are people and goods. In order to plan transportation facilities it is extremely important to know how (by what mode) people or good travel and for what purposes. The aim of this heading is to estimate the number of travels in the study zone. The study zone was the state low cost Abbaganaram which has a population of about 4,807 people resident in the estate. Out of these population for a particular day one house can make a trip of 4 people. The other zone of the study was moduganari area which has a population of about 8,500 people who were resided in the zone. Therefore in order to estimate the travel in these two particular zones of study an average value of trip per house hold is taken. Then the travel is estimated as follows:
Considering the low cost, from table 1 the average trip per household in a day = **115/30 = 3.833**

= 4 person trip/day/house.
There are 606 houses in the estate therefore the total trip per day is equal to = 606x4= 2424 trip/day.
Therefore the estimated travel in a day = **2,424 for the state low cost**.

By considering the second zone, that is moduganari which has population of about 8,500. From table 2 the average trip/house = 56/17= **3.29 trip/day/house**
There are about an average no of 7 people in one house. Then 1,224 houses are expected in the zone.
From above, the estimated travel in day = **3.29x1, 224 = 4026.96**
= **4026.96 trips/day (for moduganari area)**

To project this value for both the two zones in order to estimate the trip generated in a year (2013) is given by (total population present) + future population). Multiply by the numbers of days in a year. Ie Average trip/day/house = 4 trip at state low cost. Total trip generated in the whole zone = 606x4 = 2424 trip/day.
Future trip in the coming year = 2424 x 115x134.21/238
= 2493.7 trip/day.

Considering state low cost which have a present population of about 4,807 person by 2013 it will be expected to be about = (4,807 + 3/100 x 4807) = 4951 people

The value calculated above is the present trip made by 17 houses in the study zone. Now to protect this value in order to get the whole entire area of study is as follows:
Average value = 58.06/17= 3.41 trip/house hold/day
Therefore the total trip/day of the whole zone = 3.29x 1, 224 = 4026.97trip/day present population = 8,500 in 2013 the population = 8,174.94
The future trip in the next coming year 2014 will be equal to 4026.96 + 255x56/118 = 4147.97/trip/day
While 3% is the growth rate as calculated from the national population commission census based on the census conducted in Maiduguri 1991.

Conclusion

The two zones considered in the study: are the Abbaganaram state low-cost housing estate and the moduganari ward both in Maiduguri metropolitan .In the state low-cost housing zone, 30 households were sample and interview. It was estimates that the zone within, there is an average of 4 trip/day/house with total 606 houses, 2424 person trip/day with estimated within the zone. In Moduganari zone 17houses were sampled and interview. It was estimated that there are 7people /house and 3.29 trips/day /household, and with 1224 houses, 4027 person trip/day was determined.
The deduced base trip pattern of household in each zone, the future trip generation could be estimated with known population growth and trip assignment allocated to the road links using the known trip assignment models. Hence for new settlement with similar household pattern, travel characteristic and environmental factors, the

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prescription on transportation applied to these two zones could be applied with little adjustment.

Recommendation

The result obtained can be used for the trip estimation. With this regard I will therefore recommend that for better accurate result the following things should be considered:

1. In carrying out such study a group or team of interviewers should be provided so that all the forms of collecting data shall be applied i.e. Home interview, cordons, survey- external, internal cordon or screen line counts, commercial vehicle survey, survey of existing Transport facilities and inventory on land use and economics activities.
2. It requires the use of computer therefore it needs to carry out the data analysis by the use of computer for simplicity and accuracy.
3. Awareness should be made to the respondents so that data should be collected easily.
4. Use of traffic police during the 0-d survey.

References

[1] B.E Wald (1941) Associate Editors Transportation & Traffic and Hand Book
[2] Keeper L.E (1976)_The institute of Traffic engineering Delhi India
[3] Flaherty, C.A. (1983) Highways and Traffic Engineering 2nd Edition Vol. I Edward --- London
[4] Hobbs F.D. (1973) Traffic Planning 2nd Edition
[5] Kundiri A (1986) Control Traffic flow with aid of a grade separation (unpublished)
[6] Mohammed A (1987) Hand out on urban and regional planning
[7] Pignataro L.J (1973) Traffic Engineering Theory & practice Prentice-Hall, Inc Engineering
[8] Salter R.J (1974) Highway Traffic Analysis and Design 2nd edition
(1980) London
[9] Wright P.H. Paquette R.J (1974) Highway Engineering, 4ht edition New York, John Whiley & Sons
[10] Dafermos Stella C and F T Sparrow. The traffic Assignment problem for general Network "J of res of the National bureau of standards. pp91-118.1969.
[11] Florian, Mache led, Traffic equilibrium method Springer verlage 1976

TABLE 1
Vehicular Trip (State Low Cost) Abbaganaram Household Interview (Questionaire Data)

S/No	No of person in household	No of person trip	Average age(yrs)	Destination	Age	Relative income of household per anum	Time of travel	Purpose of journey	Car ownership	Average time
1.	10	5	19	p. office (3) BSMC	25 20 22 15 43	N39,610 (5 EMP)	30 min 30 min 10 min 10 min	Work school	Nil	22.0
2.	11	6	17	Warlord	40 14 13 12 10	N21,800	50 min 15 min 10 min	Work school	1	18.3
3.	13	3	17	Bama road (2) konduga .	15 15 17	N84,000 (3EMP)	30 min 30 min 20 min	School	1	26.7

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4.	6	4	24	Kwashe (2) M. market (2)	38 29 23 6	N150,000 (2 EMP)	30 min 30 min 25 min 25 min	Work shop school	1	27.5
5.	11	1	37	Unimid	37	N50,000	30 min	Works	1	30.0
6.	16	8	29	P. office (3) M. market (4) Mass L.G.A	67 10 19 22 25 29	N120,000	30 min 30 min 10 min 25 min 30 min 30 min	Per.Bus school	Nil	20.8
7.	5	1	42	Damaturu road	42	N50,000	40 min	Works	NIL	40
8.	8	2	47	M. market baga road	46 47	N18,000	30 min 25 min	Shop	Nil	27.5

Table 1 cont.
Vehicular Trip (State Low Cost) Abbaganaram Household Interview (Questionaire Data)

S/NO	No of person in household	No of person trip	Average age(yrs)	Destination	Age	Relative income of household Per Month	Time of travel	Purpose of journey	Car ownership	Average time
9.	10	5	23	Bama. road Rm.poly (4)	38 25 18 22 12	N37,000 (2 EMP)	35 min 35 min 35 min 35 min 35 min	Works school school school school	1	31.0
10.	3	3	36	P. office	51 28 29	N84,140 (3 EMP)	25 min 25 min 25 min	Works works works	Nil	25.0
11.	5	2	39	Wulari P. office	40 37	N18,960	15 min 30 min	Works	Nil	22.5
12.	2	2	40	Shehu Pal. (2)	42 37	N6,000 (2 EMP)	10 min	Works	Nil	10.0

ISSN: 2277-9655
Impact Factor: 1.852

13.	15	5	22	Govt. house P.office (2) Bama road (2)	45 28 13 11	N120,000 (2 EMP)	30 min 25 min 25 min 30 min	Works school	1	22.0
14.	12	5	22	Govt. house (2) P. office (2)	43 24 12 7	N84,000 (2 EMP)	30 min 25 min	Works school	1	27.0
15.	5	2	30	Custom (1) P. office	19 40	N30,000	10 min 30 min	Works	1	20.0
16.	8	2	17	El-kanem	43 14 12 9 7	N30,000	15 min	Work school	Nil	15.0

TABLE 1 cont.
Vehicular Trip (State Low Cost) Abbaganaram Household Interview (Questionaire Data)

S/NO	No of person in household	No of person trip	Average age(yrs)	Destination	Age	Relative income of household Per Month	Time of travel	Purpose of journey	Car ownership	Average time
17.	10	4	19	Abba Gana (3) market	36 12 10 16	N12,660	15 min 15 min 15 min 30 min	School works school shop	1	18.8
18.	8	5	29	Bama road (2) Damb.Rd.(2) Bagg Rd ((1)	43 33 35 25 20	N50,000 (4 emp)	30 min 30 min 20 min	Works works school	1	26.0
19.	2	1	36	Bama road	36	N12,000	25 min	Works l	Nil	25
20.	12	4	27	Bama Rd (3) P. office	41 28 9 11	N39,000 (2 emp)	25 min 20 min	Works schools	1	17.5
21.	7	5	21	Custom FGC MA T.H.	38 30 15	22,022	10 min 25	Works school Work	Nil	13.0

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Impact Factor: 1.852

				FGC Custom	13 9		min 20 min			
22.	10	5	28	Custom (2) P.off Mafoni Shehu Place MA,T.H	49 18 20 19 35	N15,000	10 min 29 min 15 min 10 min 25 min	Works	1	17.0
23.	7	5	20	P. office FGC FGC GRA GRA	21 18 15 41 6	N17,735	25 min 25 min 25 min 25 min	School school works school	Nil	25.0
24.	3	3	30	M market moduganari P. office	45 28 17	N56,160 (2 emp)	20 min 30 min 25 min	Shop social Rec. pers. Bus	Nil	25.0

Table 1 cont.
Vehicular trip (state low cost) abbaganaram household interview(questionaire data)

S/No	No of person in household	No of person trip	Average age(yrs)	Destination	Age	Relative income of household Per Month	Time of travel	Purpose of journey	Car ownership	Average time
25	6	5	22	Ram poly (2 Bama road(2) GRA	20 28 21 24 28	N18,000	25 min 25 min 25 min	School	Nil	24.0
26	4	4	21	P. office GRA market(2)	38 22 6 19	N60,000	25 min 20 min 25 min 30 min	School shop	Nil	25.0
27	10	5	23	M. market Baga road Bama	24 35 30	N180,000 (4 EMP)	25 min 20	Shop works school	1	25.0

ISSN: 2277-9655
Impact Factor: 1.852

				road(3)	11 13		min 25 min 30 min	school		
28	6	3	22	Damat.road Ram. Poly Uninaid	35 25 6	N72,000 (2 EMP)	30 min 25 min 30 min	Works school school	1	28.3
29	6	4	20	Fed Sec. El-kanemi Coll. Shehu Gar.	28 28 8 5	N42,096 (2 EMP)	30 min 30 min 30 min 30 min	Works school	1	30.0
30	7	3	34	State Sec. Ramat (2)	32 27 15	N42,096	20 min 25 min 25 min	Works school school	Nil	23.3
	Total=.238	Total=115								

Table 2.
Vehicular trip moduganari household interview (questionaire data)

S/No	No of person in household	No of person trip	Average age(yrs)	Destination	Age	Relative income of household Per Month	Time of travel	Purpose of journey	Car ownership	Average time
1.	7	4	40	M. market. Ahmadu B. “ Monday M.	62 26 32	N34,000	20 min 10 min 10 min 20 min	Shop school per Bus “	Nil	15
2.	14	3	41	M. market “ “	50 35 37	N15,000	20 min “ “	Shop “	Nil	20
3.	10	5	27	Bama R.	41	N25,000	40	Works	Nil	21

ISSN: 2277-9655
Impact Factor: 1.852

				TH Bocolis Gvt. Cool Market “	28 17 15 35		min 15 min 10 min 20 min “			
4.	17	5	34	Pri H. Q. FGC market “ “ “	45 15 14 47 47	N60,000	40 min 25 min 25 min 20 min	Works school “ Shop “	Nil	26
5.	6	5	23	Unimaid umarari Baga Rd (3)	41 33 16 14 12	N28,080 (2 EMP)	35 min 40 min 30 min “ “	School works per Bus other	Nil	33
6.	7	3	33	Jajeri Market. “	27 22 50	N34,000	35 min 25 min “	Per. Bus shop “	Nil	26.3
7.	8	5	22	State Sec. L. (state) Ram. Poly Pri. A. Bello	34 29 22 14	N14,156 (2 employ)	15 min 15 min 10 min “	Works “ School “	Nil	12.5
8.	4	4	23	Baga R. Pri. P. office “ Gwange R.	40 28 12 10	N10,000	30 min 15 min “ 25 min	Work school “ shop	Nil	23.7

Table 2 cont.
Vehicular trip moduganari household interview (questionaire data)

S/No	No of person in household	No of person trip	Average age(yrs)	Destination	Age	Relative income of household Per Month	Time of travel	Purpose of journey	Car ownership	Average time
9.	7	2	16	Custom	27	N34,800	25	Works	Nil	25

ISSN: 2277-9655
Impact Factor: 1.852

				custom	11 9		min “	Works		
10.	10	12	14	central B.P office	43	N35,000	20 min 12 min	Works Works	Nil	17.5
11.	2	2	31	Baga R. P. office	35 27	N167,000 (2 EMP)	25 min 15 min	Works Works shop school	Nil	30
12.	6	3	42	Abba GRA “ “	32 28 65	N80,800	25 min “ “	School works	Nil	25
13.	4	2	30	Ramat poly K/Kasama	37 32	N50,000 (2 EMP)	10 min 20 min	Works school	Nil	15
14.	3	4	22	State Sec. L. state FGC	6 28 32	N31,200 (2 EMP)	15 min “ 30 min	Works school “ School “	Nil	20
15.	4	4	27	T. Hosp. M market university	4 30 19 17	N84,440	25 min 20 min 30 min 20 min	Works works school School	Nil	23.8
16.	2	2	31	University Baga Road	27 34	N50,000	30 min 30 min	School work	Nil	30
17	7	2	29	custom market	27	N7,000	25 min 20 min	WORK	N11	22.5
	Total=117	Total=.56								

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