



Travel Pattern of Private Car Owners, Along the Western Bypass, Niger State, Nigeria

Ummulkhair Hussaini

Department of Urban and Regional Planning, Federal University of Technology Minna, Nigeria.

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ABSTRACT

Recently, bad transport planning as well as poor implementation has been documented in Minna, as a result of insufficient data which is required to make forecasts of patterns of future trips, and enable improved transport amenities. The western bypass that was initially designed as an arterial road, is now being plied on as an access road, due to location of various structures and land uses, along both sides of the road, posing a risk to the residents' health and safety. Increased usage of private cars for trip making, has caused a reduction in efficiency of the road system, due to slow movement of vehicles, due to traffic gridlocks, and accidents. Provision of improved access to information, is requisite to improving transportation planning, in such a manner that is not just sustainable but also exposes the environment to a minimal level of risk. The aim of this study therefore, is to examine travel pattern of car owners along the Western by-pass in Minna, so as to provide data and information that will aid transportation planning and forecasting along that route. Reconnaissance survey, questionnaire administration and traffic counts were used to obtain data, for this study. Obtained data were analyzed using descriptive statistics. Results revealed that 8040 car trips were made during the week, 6230 were made during the weekend and trip generating factors include unavailability of public transport vehicles, lack of safety, inefficiency and inconvenience of public transport vehicles, and poor quality of service rendered by drivers/riders of public vehicles. This study recommends the provision and improvement of public modes of transport, monitoring of services rendered by public drivers, provision of parking facilities, public awareness, installation of toll gates and imposition of heavy penalties on defaulters.

Corresponding Author's E-mail:

hussainiummulkhair01@gmail.com

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1.0 Introduction

Traffic pertains to the movement of individuals and vehicles collectively, whereas transportation involves the transfer of people and goods between different locations. Transportation encompasses the entire process that includes both traffic and transport activities (Aung Thu Ra *et al.*, 2014). Transportation planning is the art and science of providing and managing transportation facilities in a manner that ensures an efficient movement of commuters and freights within a given spatial entity (Okoko, 2006). Traffic and transportation survey is a variant that provides factual infor-

mation about traffic volume, source and destination points, parking availability, incidents and delays, road infrastructure, and road conditions (Imimole, 2014).

In the realm of transportation research, it is frequently crucial to have an understanding of the quantity of journeys undertaken, as well as imperative to categorize these journeys based on the areas where they commence and conclude. Travel surveys furnish details and data regarding travel trends, diverse land utilizations within the zones of trip origin and termination, the timing of journeys as they transpire throughout the day, the moti-

vations behind these trips, and the chosen means of transportation (Harsh, 2015). Travel patterns give an understanding of movement of humans, describing when, why and how these movements take place in different areas. The data gathered through travel surveys plays a vital role in elucidating the frequently utilized routes or vehicular movements within a specific region. These travel patterns can be incorporated into travel demand models, along with anticipated population and employment figures, to facilitate the estimation and prediction of forthcoming traffic levels on roads within that locality. This aids in preventing the strain on road infrastructure from becoming excessive. Sufficient and pertinent data are essential to initiate essential processes of planning, designing, constructing, and maintaining the road network. This network is intended to effectively handle both present and future traffic flows without compromising the quality of service (Ministry of works and Transport Botswana, 2004).

Due to swift urbanization and economic expansion, the process of motorization has been gaining momentum within urban areas of developing nations (Biddulph, 2007) and the increasing reliance on the motor vehicle, particularly the private cars, is reflected in the increasing population all around the globe, but in varying degrees between the cities of the advanced and the developing nations (Soyebo and Ajayi, 2015).

Recently, bad transport planning as well as poor implementation has been documented in Minna, as a result of insufficient data which is required to make forecasts of patterns of future trips, and enable improved transport amenities, that would cater for the increasing population. The western by-pass that was initially designed as an arterial road, for the purpose of collecting traffic from various residential neighborhoods, in order to reduce potential threat to the populace, is now being plied on as an access road, in close proximity to residents, therefore posing a threat to health and safety of the populace. An increase in population in the metropolis,

has led to the erection of structures for commercial, industrial, public/institutional and residential purposes, along both sides of this arterial road. On-street parking is prevalent due to unavailable parking facilities along this major traffic corridor. Increased usage of private cars for trip making, has caused a reduction in efficiency of the road system, due to slow movement of vehicles as a result of traffic gridlocks, and also accidents. Provision of easy access to information is necessary to improve transportation planning in a way that is sustainable and poses a minimum level of risk to the environment.

This study therefore, aims to examine travel pattern of car owners along the Western by-pass in Minna, so as to provide data and information that will aid transportation planning and forecasting along that route. To achieve this aim, the following objectives were set; (i) to assess the number of car trips, time of travel and peak periods of traffic, and (ii) to identify trip generating factors along the western by-pass.

1.1 Study Area

Minna serves as the capital city of Niger state, one of the 36 states in Nigeria. Its geographical coordinates are situated between latitude $9^{\circ}71'$ North and Longitude $6^{\circ}33'$ East (Ministry of Lands and Housing Minna, 2012). Historical evidence indicates that the emergence of Minna can be attributed to the presence of Muslims along ancient Saharan trade routes, the establishment of the Kano to Baro railway in 1911, and the extension of the Lagos to Jebba railway line in 1915. Consequently, Minna evolved into a central hub for the collection of diverse agricultural products like cotton, fruits, ginger, yams, and shea nuts. The city has held the status of Niger state's capital since 1976 and has gradually expanded into a prominent administrative centre. Minna has two major ethnic groups (Gbagyi and Nupe), and two major religions (Islam and Christianity). Minna is estimated, to comprise 463,000 people, consisting of 54% males, and 46% females (Niger State Planning Commission, 2011).

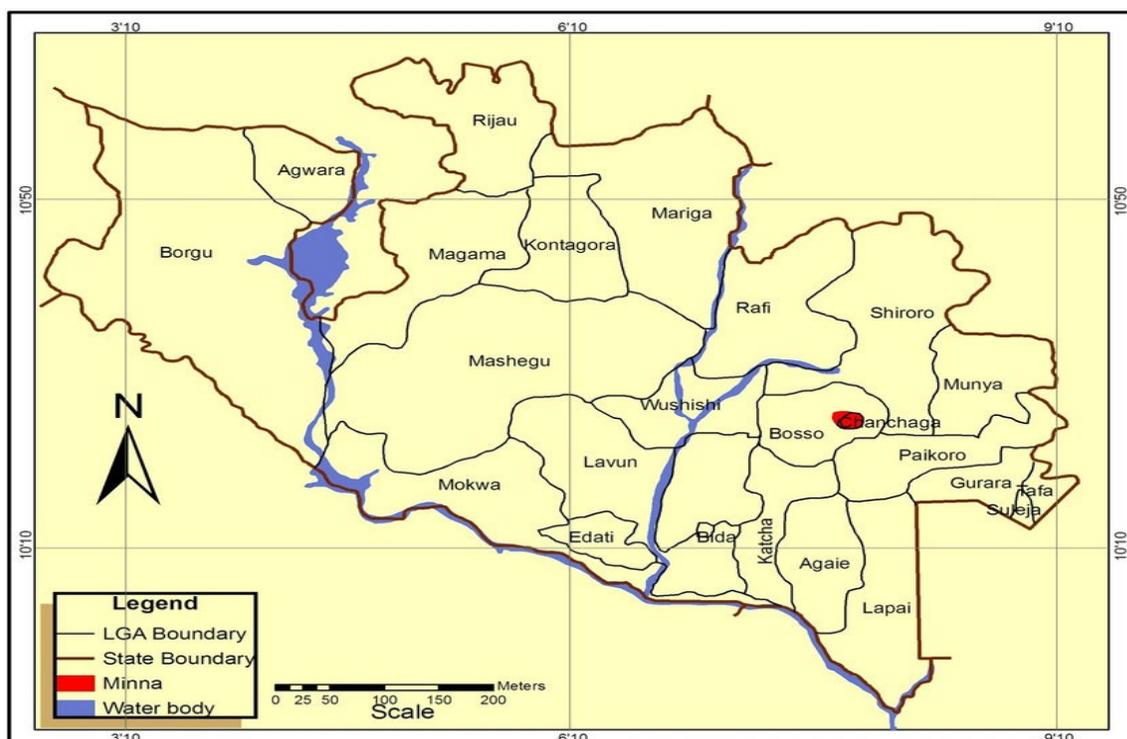


Figure 1: Map of Niger State
Source: Ministry of Lands and Housing, 2012

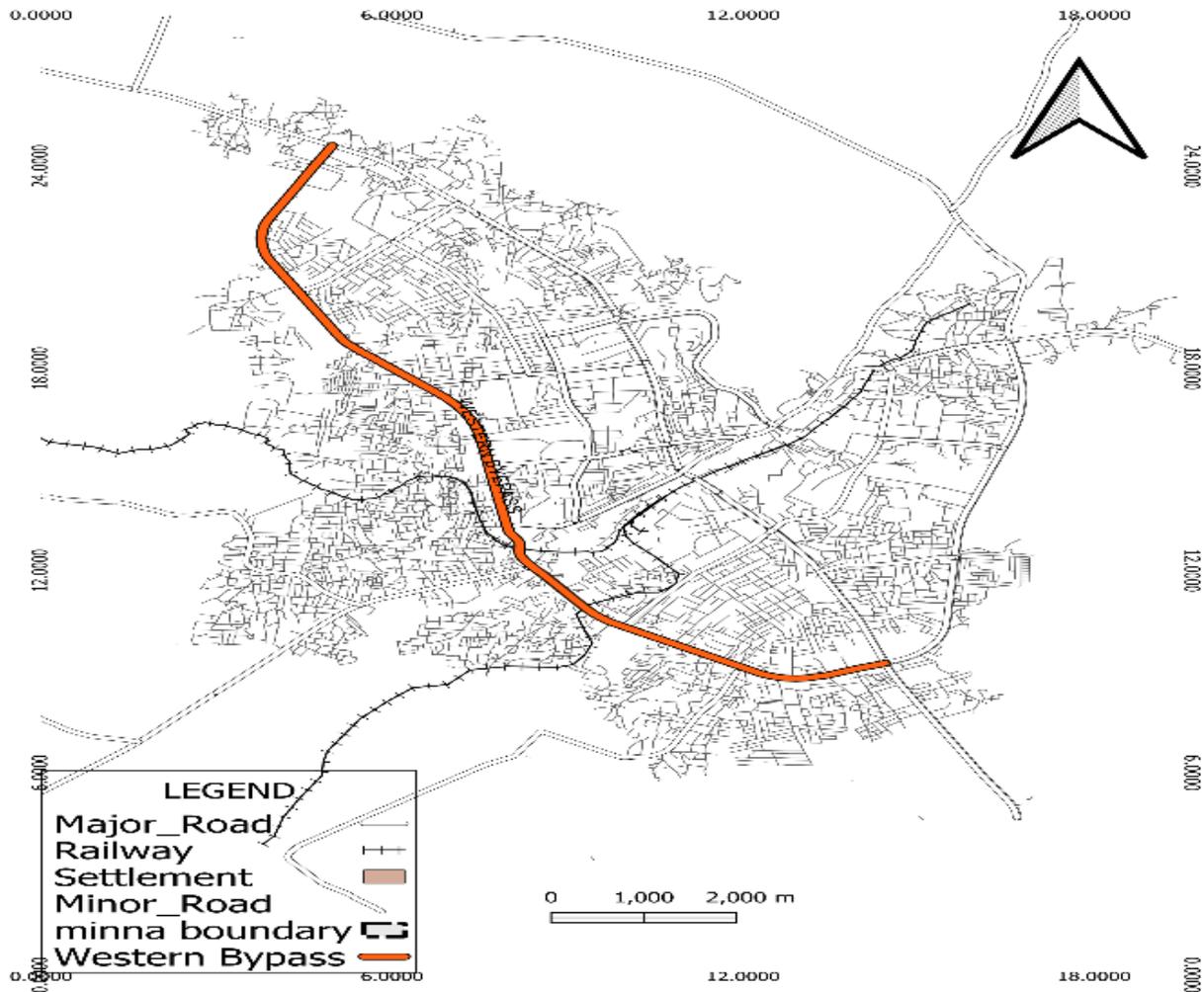


Figure 2: Map of Minna
Source: Author's, 2018

2.0 Review of Related Literature

2.1 Theoretical Underpinning

Theory of Planned Behaviour

The Theory of Planned Behaviour (TPB), proposed by Ajzen (1991), focuses on the formation of intentions to engage in specific behaviors, rather than being a theory of discrete choice. It is often categorized as an expectancy-value theory, as established by Fishbein and Ajzen (1975). This categorization is due to its fundamental premise that an individual's attitude towards a particular behavior is shaped by aggregating the products of subjective probabilities of the behavior's occurrence and the positive or negative evaluations of all relevant expected outcomes tied to that behavior. The TPB is designed to anticipate an individual's personal intentions related to a behavior by taking into account their attitudes towards the action, the subjective norms they perceive, and their sense of perceived control over performing the behavior. Behaviour denotes a visible act and an intention is the appropriate immediate reason for a behaviour that describes motivation behind the behaviour.

The Theory of Planned Behaviour (TPB) has found application in forecasting various behaviors. Its underlying premise presupposes that when multiple options are available, a selection is crafted from among them, hinging on the comparative potency of intentions associated with those behaviors. It is important to note that intentions are influenced not only by attitudes towards the behaviors but also by additional factors

(Ben-Akiva *et al.*, 1999). The theory, in essence, forecasts and clarifies personal intentions to engage in a behavior through the interplay of three key elements: attitudes towards the action, subjective norms, and the perceived level of control over performing the behavior. Behaviour denotes a visible act and an intention is the appropriate immediate reason for a behaviour that describes motivation behind the behaviour.

Attitudes describe all relevant beliefs about the consequences of the act subjective to evaluation of those outcomes. **Subjective norms** are the summed product of an individual's belief about significant others' expectations weighted by the motivation to conform to them. **Perceived behavioural control** refers to a person's perception about his/her own capability to perform an act and does not deal with the amount of control a person actually has. It is a function of control beliefs and perceived facilitation. The control belief may be based on past experience, own or others, and/or second-hand information. Habits, like all other variables not included in the Theory of Planned Behaviour, are said to act indirectly on behaviour mediated by attitudes, subjective norm and perceived behavioural control (Sonja, 2004).

Relationship between TPB and Transportation

According to Anable *et al.*, (2006), a number of psychological based research on determinants of car usage during the last decade have been dependent on two theories, one of which is the Theory of Planned Behaviour. Initially, this the-

ory was mainly applied to areas in the health sector. It however has been found to be useful in explaining transportation related behaviour such as modal choice, in recent times. The Theory of Planned Behaviour (TPB) places significant emphasis on the role of contextual limitations. To illustrate, when individuals formulate an intention regarding the use of cars or buses, their considerations extend beyond their personal attitudes towards these transportation options. They also assess the level of complexity associated with using them. This aspect is denoted as "perceived behavioural control." Another determinant of intention is the influence of social norms. In TPB, social norms are conceptualized as the perception of social pressure, which entails expectations concerning the extent to which influential individuals or references will endorse the performance of a certain behavior, such as choosing a specific mode of travel.

Zhu *et al.* (2012) have delved into the effects of attitudes, social norms, and the desire for car ownership among university students in China. The findings indicate that socio-psychological factors carry the most significant influence, exerting nearly double the impact compared to utilitarian considerations, when it comes to determining private car ownership. Consequently, the study recommends that strategies aimed at altering attitudes towards cars and reshaping societal norms should play a pivotal role in influencing decisions about purchasing cars and utilizing them for personal transportation.

Relationship between TPB and Transportation in Minna

A study conducted by Ojekunle and Owoeye (2018) analyzed the spatial pattern of household travel in Minna City, Nigeria. Trip generation and attraction is significantly different among different residential densities in the city. There is need to create spatial balance in the location of services needed and land use activities across the residential densities and also provide an effective and efficient public transportation system to the city residents especially along the main traffic corridors.

Owoeye *et al.* (2018) explains that socio-economic characteristics of households, are a major determinant on how urban residents travel in relation to various trip attraction centres in Minna. Socio-economic characteristics of households significantly influence travel behaviours and trip generation of urban residents in Minna, Nigeria. However, gender, marital status and educational status have little or nothing to do with travel behaviours of residents in Minna.

2.2 Literature Review

Soyebo and Ajayi (2015) stated that, starting from the year 2000, the global count of vehicles has exhibited a consistent growth trajectory, expanding by 3.6 percent annually until 2010. This trend culminated in a worldwide total of more than one billion operational vehicles. The travel demand model comprises a four-step process, encompassing trip generation and trip distribution, among other components, mode choice and trip assignment (Shen, 1994). The main factors impinging on trip production include; income, vehicle ownership, household structure, family size, value of land, residential density, and accessibility (Haseeb, 2017).

Hasselgren and Tore (2016), reported that "the Stockholm County has been increasing greatly over several years in number of residents. Symbolically, Stockholm is growing by two buses a day, congestion has turned out to be an attribute of Stockholm life due to traffic and transport". Evren and Akad (2001) described the rapid increase of car ownership in Istanbul, which matches up to nearly one car per two persons, leading to the problem of traffic congestion. Car owners tend to utilize cars a lot of times, for very long periods. Haberl *et al.* (2012) described that over 40% of all trips on

workdays in Austria are leisure trips. On weekends this trip purpose is even more dominant. Traffic of foreigners approaching and leaving vacation resorts, daily tourists and local traffic mix especially on Saturdays. Destination and departure time choice depend very much on season and weather conditions.

Space for parking is required in all environments (Carmona *et al.*, 2010) and indiscriminate parking has an impact on transport development (Okoko, 2006) such as; traffic congestion, degradation of the pedestrian environment, accidents, restraint in levels of accessibility and waste of precious time (Soyebo and Ajayi, 2015). Since planning has to do with the future, forecasting is very vital (Imimole, 2014). The Ministry of works and transport, Botswana (2004) stated that the concept of forecasting the expected use of the road system in terms of traffic freight and flow, is usually an accepted method in both developing and developed nations, and is important in the execution of an appropriate planning, design and management of the road network. It enhances the potential to categorize novel patterns and calamities, as well as to grasp their nature and aftermath. Prediction can be carried out over either a brief or an extended period. Obtained data can be projected through various approaches, including geometrical or arithmetic population projection formulas. Cellular signalling data (CSD) is seen as a much better approach for sourcing data needed for transportation planning and forecasting, than the regular survey methods currently used, due to the prevalence of cell phone usage. It has great potential that should be exploited to advance human mobility studies (Wang *et al.*, 2018).

Increase in volume of traffic is a worldwide phenomenon in urban areas and not just peculiar to developing cities, due to factors such as; income, vehicle ownership, household structure, family size, value of land, residential density, urbanization, accessibility, indiscriminate parking, amongst others. This increase has caused congestion and accidents which can be managed through proper forecasting, prediction and employment of the CSD in transportation.

3.0 Methodology

Primary data, sourced from reconnaissance survey, questionnaire administration and traffic counts were used for this study. Roadsides, junctions, parking spaces, public buildings and commercial areas, along the by-pass, were points for conducting travel surveys. In a four-week survey, questionnaires administered to car owners, at different times of the day, provided information on reasons for travel. Daily traffic counts were conducted, from which a daily number of car trips along the by-pass, during the week and weekends, were estimated. Information about peak periods on this route, was collected through field observation and traffic counts.

Simple random sampling was used to select individual car owners as respondents. Krejcie and Morgan's (1970) method of calculating sample size was used to determine the size for data collection. The sample size of 384 was obtained from the total population of the study area. Obtained data were analyzed using descriptive statistical processes through Microsoft excel. Results were presented using charts and tables.

4.0 Results and Discussions

4.1 Number of Car Trips, Time of travel and Peak Periods along the Western By-pass

Number of Car Trips and Time of travel along the By-Pass

The number of car trips made along the western by-pass on a weekday and on a weekend, and times of travel are shown on tables 1 to 3.

Table 1: Travel Pattern of Cars on a weekday

Time of Travel	Number of cars
8am-9am	1200
9am-10am	850
10am-11am	720
11am-12pm	720
12pm-1pm	650
1pm-2pm	850
2pm-3pm	1000
3pm-4pm	650
4pm-5pm	900
5pm-6pm	500
Total	8040

Source: Field Survey, 2018

An average of 8040 cars traveled along the road from 8am to 6pm on a weekday. About 1200cars travel from 8am-9am, 850cars travel from 9am-10am, 850cars between 1pm- 2pm, 1000cars between 2pm-3pm and 900cars between 4pm-6pm.

Table 2: Travel Pattern of Cars on a Weekend

Time of Travel	Number of cars
8am-9am	350
9am-10am	550
10am-11am	700
11am-12pm	700
12pm-1pm	750
1pm-2pm	850
2pm-3pm	780
3pm-4pm	600
4pm-5pm	550
5pm-6pm	400
Total	6230

Source: Field Survey, 2018

An average of 6230 cars traveled along the road from 8am to 6pm on a weekend. About 700cars travel from 10am-11am, 700cars between 11am and 12noon, 850cars between 1pm-2pm and 750cars between 2pm-3pm.

Peak periods of travel along the western by-pass

Figures 3 and 4 show the peak periods of travel by private cars along the western by-pass. The peak periods during the week are between the hours of 8am-10am, 1pm-2pm and 4pm-5pm. The peak periods of car trips during the weekend are between the hours of 10am-3pm.



Figure 3: Peak periods of travel on a weekday

Source: Author’s Analysis, 2018

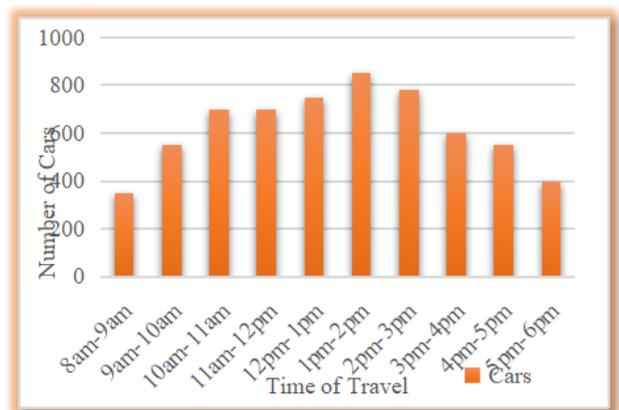


Figure 4: Peak periods of travel on a weekend

Source: Author’s Analysis, 2018

Peak periods during the week, within the hours of 8am-10am, are when people leave for work and school, between 1pm-2pm are due to trips made after school hours (picking children up from school and taking them home) and during lunch breaks at work, while those between 4pm-5pm are from trips made at the end of work, due to movement from the offices back to households. Peak periods during the weekend, within the hours of 10am-3pm, are when people travel for social activities (weddings, funerals, family gatherings, birthdays, naming ceremonies, amongst others) and shopping. This implies that the bypass collects and distributes a larger vol-

ume of private vehicular traffic on weekdays than weekends, due to compulsory trips (school and work trips) made during the week. According to Ortuzar and Willumsen (2001), majority of trips in the morning peaks are usually compulsory (either to work or education) and this is not the case in the off-peak period.

4.2 Trip Generating Factors along the western by-pass

Purpose of Trip along the western by-pass

Findings reveal that the purposes of travel along the western by-pass by private vehicle owners, include work, school, shopping, social activities, recreational activities, and business (Figure 5).

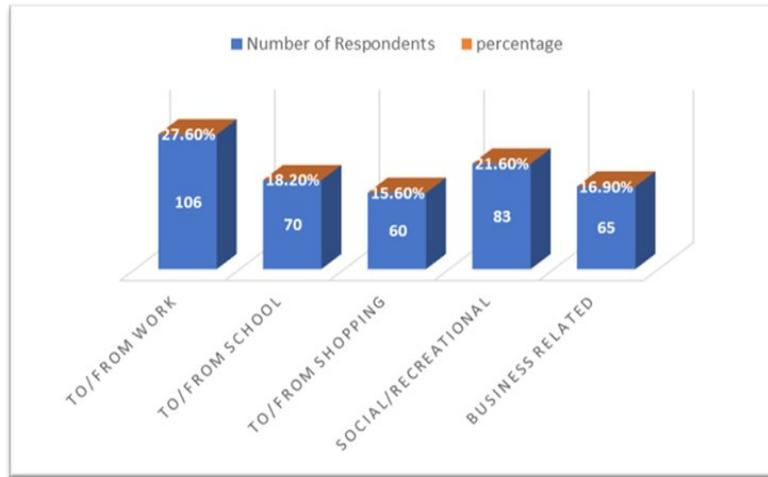


Figure 5: Trip Purposes along the western by-pass

Source: Author’s Analysis, 2018

About 27.6% of respondents, travel on the western bypass because of work, 21.6% travel for social and recreational activities, and 18.2% drive their children to or from school. Business related trips by 16.9% of respondents are made by workers in the private sector (mechanics, entrepreneurs, farmers, artisans) for various business dealings. Shopping especially on weekends is the reason for travel by 15.6% of respondents. The central market, and various shopping malls are located along the western bypass, leading to private car

trips along this route. This is in line with Osoba (2012) that business areas generate high traffic, increasing with the growing population. Road traffic congestion from time immemorial amounted to one of the major challenges of a high rate of urbanization.

Income Level of Car Owners

Figure 6 shows income levels of different car owners that travel along the western by-pass

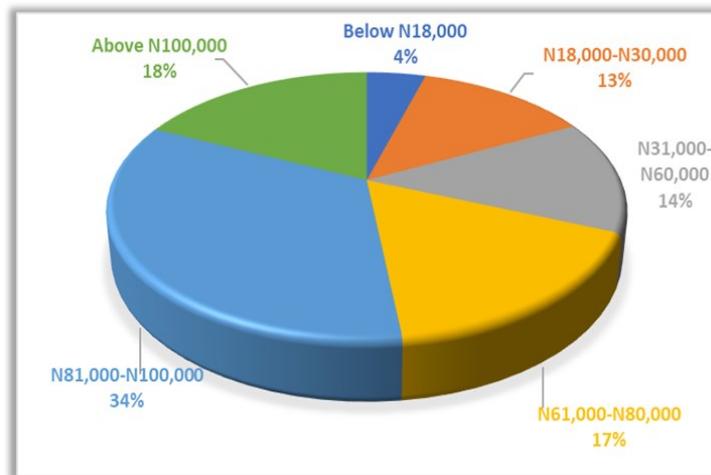


Figure 6: Income of car owners

Source: Author’s Analysis, 2018

Majority of car owners, about 34% earn between N81000-N100000 monthly, 18% earn above N100000, 17% earn between N61000-N80000, 14% earn between N31000-N60000, 13% earn N18000-N30000 and 4% earn below N18000. This, considering the minimum wage at N18000, implies that almost all car owners along the by-pass earn significantly above the minimum wage which allows them the opportunity to afford the purchase of private vehicles. Trips are heavily dependent on socioeconomic characteris-

tics such as income levels and car ownership (Ortuzar and Willumsen, 2001)

Factors Influencing the Decision of Car Owners to use Private Vehicles

Table 3 shows factors that influence the decision of commuters to use private vehicles instead of public vehicles, and the level of satisfaction with these factors, while plying the western by-pass

Table 3: Factors influencing the decision of car owners to use private vehicles

Factors	Degree of satisfaction (Number of Respondents)							
	Not satis- fied	%	Fairly satis- fied	%	Satisfied	%	Very satis- fied	%
Availability of public transport	251	65.4	82	21.4	40	10.4	11	2.9
Safety in using public transport	196	51.0	93	24.2	77	20.1	18	4.7
Efficiency/Effectiveness of public transport	202	52.6	86	22.4	78	20.3	18	4.7
Convenience in using public transport	194	50.5	93	24.2	74	19.3	23	6.0
Quality of service by public drivers/riders	168	43.8	103	26.8	99	25.8	15	3.9
Cost of public transport	58	15.1	139	36.2	174	45.3	13	3.4
Quality of road infrastructure	88	22.9	80	20.8	211	54.9	5	1.3

Source: Author's Analysis 2018

About 65% of the respondents were not satisfied with the availability in public transport. There are no available buses or other forms of mass transit, only tricycles and motorcycles are available. 51% are not satisfied with the safety in using public vehicles for trips. Motorcycle and tricycle riders are not usually careful while making trips along this route, which has caused a lot of road crashes. Protective gears such as helmets are also not provided to passengers. Public transport modes are not efficient enough for making trips along this route, as 52.6% of respondents were not satisfied with efficiency/effectiveness of public transport. These motorcycles and tricycles usually decide where the trip ends and do not necessarily arrive at the exact destination of a passenger, especially in cases where destinations are around areas with poor accessibility.

About 50.5% of respondents were not satisfied with the level of convenience in the use of public transport modes; Tricycles usually carry passengers exceeding their carrying capacity, causing discomfort. 43.8% were not satisfied with the quality of service rendered by public drivers/riders, ranging from delay in arrival due to several stops during the trip, and disobeying transportation rules and regulations. This implies that there is a poor level of traffic management along this route causing various impediments to the public transportation system, in line with Evren and Akad (2001), that when the level of car usage is high, management of traffic is not adequate, disobedience to the traffic rules is on the high side and, public transport is inadequate.

The quality of the road infrastructure also encourages the use of private cars, as the majority of respondents (54.9%) are satisfied with the quality. The road is completely tarred, almost free of potholes due to regular maintenance (although substandard) and is also adequate in width, making it suitable to drive on, for daily activities. This is in agreement with Handy *et al.* (2004) that it is hypothesized and found that roadway design can affect travel behaviour. Specifically, a connected road network provides improved accessibility.

Findings reveal that challenges of transportation along the western by-pass are; unavailability of public transport vehicles; Lack of safety, inefficiency and inconvenience of public transport vehicles; Poor quality of service rendered by drivers/riders of public vehicles; Inefficiency of the road system, traffic gridlocks and on-street parking, accidents and; Poor transportation planning due to insufficient data.

Conclusion

Private car owners travel along the western bypass at differ-

ent times during the day, depending on the purpose of the trip. Peak periods of travel along the western by-pass on weekdays, are around 8am-10am, 1pm-3pm and 4pm-5pm. While traffic is at its peak between 12pm-3pm on weekends. Available modes of public transport include tricycles and public motorcycles. Car owners travel along the by-pass for various purposes due to the poor state of public transportation systems, their income level, and the good quality of the road, all of which lead to increased private vehicular traffic on the western by-pass in Minna.

The Theory of Planned Behaviour was generally successful in explaining travel behaviour by car owners along the western by-pass. Attitude influenced modal choice because all relevant views about the costs and consequences of travel were considered by commuters which led to the choice in using private cars. While making the intention to use cars, car owners in Minna take into consideration the difficulties that exist in using public transportation modes along the by-pass, which is the perceived behavioural control. Social norm however does not influence their choices because the intention to use private vehicles is not influenced by the choices of significant people in the society, but it is rather influenced by income level of car owners and purposes of trips.

Recommendations

This study therefore, recommends;

The provision and improvement of public modes of transport, through construction of bus bays, lay-bys, bus terminals and Rail transit system revitalization, to reduce the reliability on cars during inter-city travels, thereby reducing the volume of traffic on the road.

Provision of Service lanes along the road, to allow safe access to buildings, without major delay or disruption in the flow of traffic.

Monitoring of services rendered by public drivers, provision of parking facilities and public awareness should also be provided to improve the attitude of road users and car owners along the western by-pass in Minna. Toll gates should be constructed to enable road pricing that will be used to obtain fees for standard maintenance of transport infrastructure.

Imposing heavy penalties on defaulters of traffic rules and regulations should also be adopted.

Introduction of Cellular Signaling Device (CDS), to ensure improvement in acquisition of traffic data along the by-pass.

References

- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes* 50, 179–211 (ISSN 0749-5978).
- Anable, J., Lane, B., Kelay, T. (2006). *A review of public attitudes to climate change and transport: summary report* (Research report), Department for Transport, London. Retrieved from <http://www.dft.gov.uk/pdf/pgr/sustainable/climatechange/areviewofpublicattitudestocl573>
- Aung Thu Ra, Wyityi Win, Maung Hlaing (2014). Studies of the Status of Transportation Condition (TC) in Yangon, Myanmar. *International Journal of Emerging Technology and Advanced Engineering* 27-33 (ISSN 2250-2459, ISO 9001:2008 Certified Journal, Volume 4, Issue 5, May 2014) Myanmar
- Ben-Akiva, M., McFadden, D., Garling, T., Gopinath, D., Walker, J., Bolduc, D., Borsch-Supan, A., Delquie, P., Larichev, O., Morikawa, T., Polydoropoulou, A., and Rao, V. (1999). Extended framework for modeling choice behavior. *Marketing Letters* 10, 187–203.
- Biddulph M. (2007). *Introduction to Residential Layout*. First edition. USA: Elsevier
- Carmona, M., Tiesdell, S., Heath, T. and Tanner, O. (2010). *Public Places- Urban Spaces, The Dimensions of Urban Design*. Second edition. USA & Canada: Routledge
- Evren G. and Akad M. (2001). Transportation Planning Problems in Developing countries. Retrieved June 5, 2018 from http://www.iasi.cnr.it/ewgt/13conference/143_evren.pdf
- Fishbein, M., Ajzen, I. (1975). *Belief, attitude, intention, and behavior: an introduction to theory and research*. Addison-Wesley, Reading, MA.
- Haberl, M., Neuhold, R., Cik, M. and Fellendorf M. (2012). Trip generation and distribution of leisure traffic, *A case study in Austria*. Retrieved July 27, 2018 from http://transp-or.epfl.ch/heart/2012/latsis2012_submission_24.pdf
- Handy, S. & Boarnet, M. & Ewing, R. & Killingsworth, R. (2002). How the built environment affects physical activity: Views from urban planning. *American journal of preventive medicine*. 23. 64-73. 10.1016/S0749-3797(02)00475-0.
- Harsh M. (2015). Origin- Destination survey-slideshare retrieved April 17, 2018 from <https://www.slideshare.net/mobile/kezangkl11/origin-destination-survey>
- Hasselgren B. and Tore, E. (2016). Challenges for transportation planning and organization in the Stockholm region. *Transportation Research Procedia*, 14: 538-546. Retrieved on August 15, 2018, from <http://www.sciencedirect.com/science/article/pii/S2352146516301107>
- Imimole W.O. (2014). *Town Planning Principles, Techniques and practice*. First edition. Benin city: Ukwa I printing press.
- Krejcie, R.V. and Morgan, D.W. (1970). Determining Sample Size for Research Activities Education and Psychological Measurement. *Journal of Education and Psychology*. 30: 607-610.
- Ministry of Lands and Housing Minna (2012). *Map of Niger State showing Minna*. A brochure published by the Niger State Geographic Information System Center. Niger State.
- Ministry of works and Transport, Botswana, (2004). Traffic Data Collection and Analysis retrieved on April 17, 2018 from <https://www.vegvesen.no/globalassets/om-oss/om-organisasjonen/internasjonalt-virksomhet/botswana-guideline-9-traffic-data-collection-and-analysis-2004.pdf>
- Niger State Planning Commission, (2011). *Facts and Figures about Niger State*. State Bureau of Statistics
- Ojekunle, J. A., and Owwoye. A. S. (2018). Spatial Pattern of Household Travel in Minna Metropolis, Nigeria. *International Journal of Research - Granthaalayah*. 6. 276-288. 10.5281/zenodo.1283377.
- Okoko, E.E. (2006) *Urban Transportation Planning and Modeling*. Millennium Publishers, Akure.
- Ortuzar, J. de D. and Williamson, L.G. (2001). *Modelling Transport* (3rd ed.) John Wiley & Sons, Chichester.
- Osoba, S.B. (2012). Appraisal of Parking Problems and Traffic Management Measures in Central Business District in Lagos, Nigeria. *Journal of Sustainable Development*, 5, 105.
- Owoeye A. S. (2018). Households' Socio-Economic Characteristics and Urban Travel Behaviours in Minna Metropolis, Nigeria. *International Journal of Research Publications*, 9(1).
- Shen P. (1994). Efficient Methods for Trip Generation and Distribution Forecasts: A case study. Retrieved August 2, 2018 from <http://trid.trb.org/view/457>
- Sonja, F. (2004). The Prediction of Travel Behaviour using the Theory of Planned Behaviour. *Traffic and Transport Psychology*. 481-492. 10.1016/B978-008043925-9/50045-1
- Soyebo O. O. and Ajayi, O.O. (2015). Assessment of Parking Space Demand in University of Ibadan, Ibadan, Nigeria: Case Study of Faculties of the Social Sciences, Law and Education. *International Journal of Scientific & Engineering Research*, Volume 6, Issue 1, ISSN 2229-5518. Pages 665-677
- Wang, Z., He, Y. S. and Leung Y. (2018). Applying mobile phone data to travel behaviour research: A literature review, *Travel Behaviour and Society*, Volume 11, 2018, Pages 141-155, ISSN 2214-367X, from <https://doi.org/10.1016/j.tbs.2017.02.005>.
- Zhu, C., Zhu, Y., Lu, R., He, R., & Xia, Z. (2012). Perceptions and aspirations for car ownership among Chinese students attending two universities in the Yangtze Delta, China. *Journal of Transport Geography*, 24(0), 315-323. doi: 10.1016/j.jtrangeo.2012.03.011.