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TRIP PATTERNS IN AKURE, NIGERIA: A LAND-USE ANALYTICAL APPROACH

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ABSTRACT

Data on trips in land use parcels of Akure, a developing capital city in Nigeria, were collected and analyzed. Distance of each land use area from the central business district (CBD) was found to have played a significant role in trip attraction to it, while residential density was a major determinant of trip generation. Average numbers of daily work trips generated per capita ranged between 0.97 and 2.0, which compares with 0.8 to 2 specified in literature for developing cities. Total daily trips per capita for Akure-Nigeria (2.56) is higher than that of Mumbai-India (1.81), Chennai-India (2.08), and Harare-Zimbabwe(2.19). Availability, convenience, cost and promptness were found to be the major determinants of modal choice in the study area.

INTRODUCTION

Extensive research has hitherto been carried out on travel characteristics and behaviour in many cities but mainly in cities of the developed world. However, attempts have been made to extend the research to cities of developing countries. Some of the authors that have conducted research in this regard are: Maunder (1984), Fouracre and Maunder (1987), Fouracre and Turner (1992), Astrop (1996), Mbara and Maunder (1997), Howe and Bryceson (2000), Cervero (2000), Sung et.al (2001), among others. Cities of the developing world that have been considered include Delhi, Jaipur, Patna, Pune and Vadodera in India; Harare in Zimbabwe; Dar Es Salaam and Morogoro in Tanzania; Nairobi and Eldoret in Kenya; Johannesburg in South Africa and Kumasi in Ghana among others.

The authors analyzed the effects of income, public transport systems, travel cost, city structure, household structure, location, trip length, and demography on travel behavior. This research is aimed at assessing the relationship between land use and trip patterns in Akure with a view to determining the modal split and reasons for choice of modes. Emphases have been placed on the influence of land use on the pattern of trips without undermining the importance of other socio-economic factors. Trips undertaken to places of

vocation were considered as work trips while shopping, leisure, religious activity- related trips, and those made while visiting friends and relations were considered to be recreational trips. The findings of this research will provide a rational basis for transportation planning in the study area and other similar cities.

The Akure metropolis is the capital city of Ondo State, Nigeria. It is located in the northern part of the state around latitude 7° 15' North and longitude 5° 15' East and has an area of approximately 30.02 square kilometers. Its population was estimated at 353,211 according to 2006 census. This consisted of 175,495 (49.68%) males and 177,716 (50.32%) females who are mainly civil servants, traders and peasant farmers. The town was not planned ab-initio and as a result there are minimal functional relationships between the various land use areas. This disaggregated location of land use coupled with the morphological linearity of the town, its sparingly developed road network and ineffective traffic management, often create a chaotic pattern on major roads and large demands on public transport during rush hour. This large demand exerts a great strain on available facilities and because of institutional and funding constraints, conventional transit systems are not presently available. Hence some unconventional para-transit public transport modes like motorcycles (okada)

and private vehicles not registered as taxis known as “Kabu-kabu” act as supplements. The road pattern in Akure metropolis is shown in Figure 1.

METHODS

Data on intra city travel behaviour were collected in five residential land use areas of Akure metropolis namely: low, medium and high density residential; commercial (which is interspersed with residential buildings akin to that of high density residential); and military zone. The data were collected through intensive home and road side interviews. Figure 2 shows the major land use areas of Akure metropolis.

The home interview was conducted using a comprehensive two-part questionnaire. The first part collected information on socio-economic characteristic of households, while the second part obtained information on weekly trips made by household members. The data include: household size, sex, age and marital status of respondents. Others are nature of employment, household income, vehicle ownership, origin and destination of trips, modes of transport used in making trips,

factors affecting choice of mode, frequency of trips within the week among others. For the survey, trip chains are disaggregated into direct single journeys.

Considering the population in the residential area of Akure (which is about 80% of the entire populace), a sample size of 1 in 10 (10%) was adopted, as suggested by Bureau of Public Road (1954), O’ Flaherty (1974) and Salter (1989). Every 10th household on each street was interviewed in all the land use areas considered. The administered questionnaires were sorted and the information obtained analyzed.

RESULTS AND DISCUSSION

Figures 3 and 4 illustrate the total number of daily work and recreational trips generated and attracted by each land use area. The high density residential area generated the highest number of daily work trips of 10,920 while the military zone generated the lowest (236). This indicates that higher density areas generate higher work trips. This trend is also similar for recreational trips except that the volume generated by the medium density residential (8,236) zones is higher than that of high density residential areas (4,560).

FIGURE 1
MAP OF AKURE, NIGERIA SHOWING ROAD PATTERNS

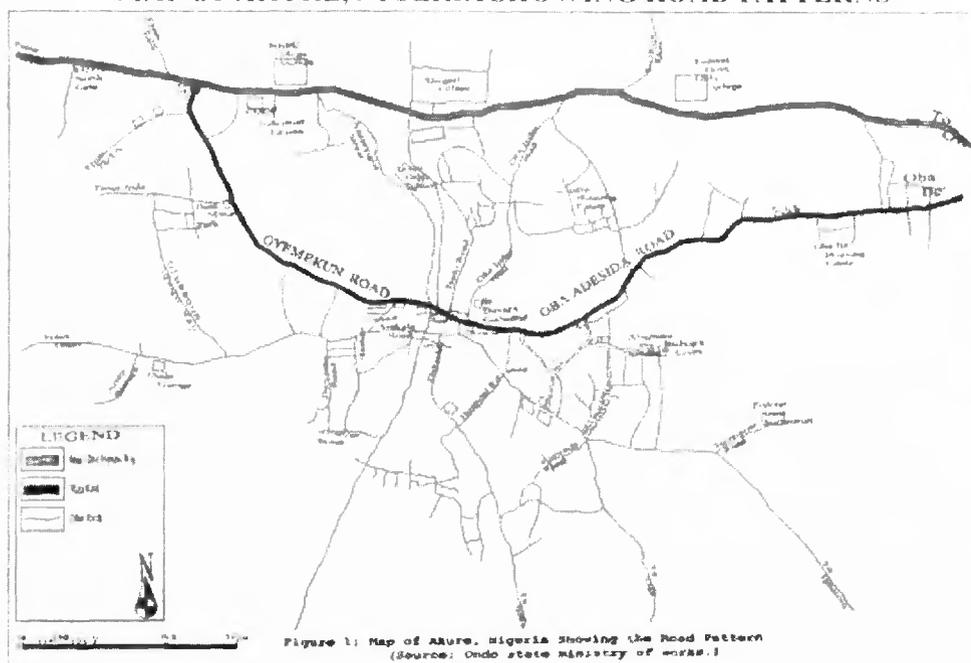
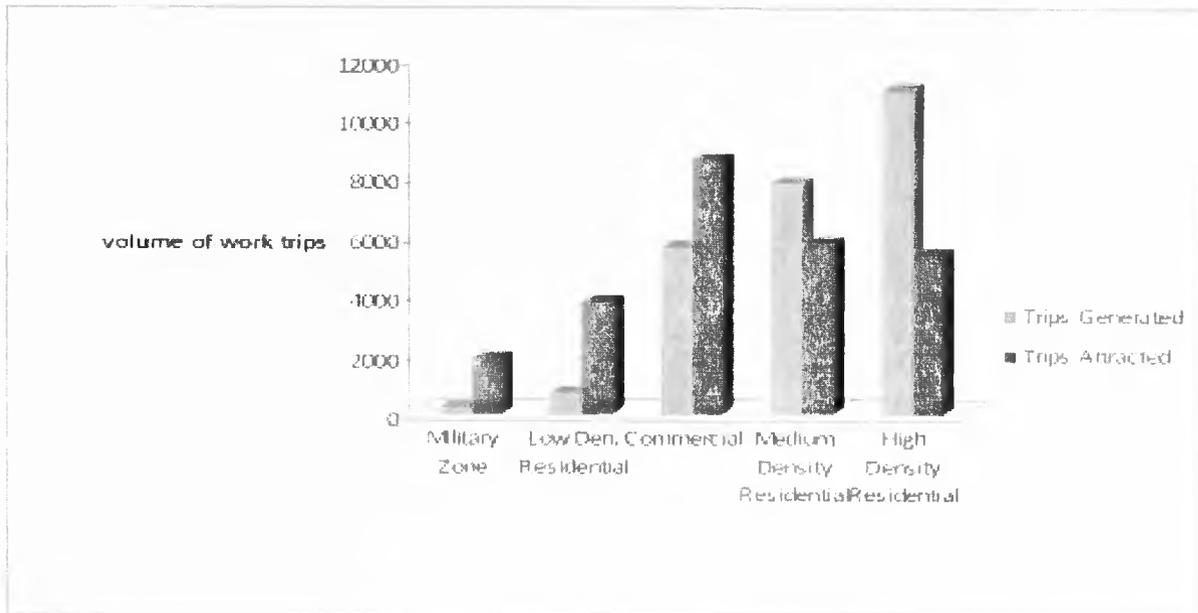


FIGURE 3
WORK TRIP GENERATION AND ATTRACTION



CBD and operates like an urban village as earlier explained.

The numbers of daily work and recreational trips generated per capita for each land-use area are shown in Table 1. The average number of daily work trips generated per capita ranged from 0.97 to 2.0, which compares favourably with the range of 0.8 to 2 specified by Fouracre and Turner (1992) for developing cities. The average numbers of daily recreational trips per capita ranged from 0.67 to 1.92. These values indicate that recreational trips are not necessarily made daily. The medium density residential zone generated the highest number of daily recreational trips per capita, perhaps due to the fact that the zone has the highest number of cars in the study area, as earlier explained.

The ownership of a vehicle undoubtedly increases the propensity to make trips, particularly for discretionary journeys. The total daily trips per capita, for Akure, Nigeria are obviously higher than the values of 1.81, 2.08 and 2.19 for Mumbai-India, Chennai- India and Harare- Zimbabwe. The value for Harare was obtained by projecting that given by Palmer et.al (1996) and Mbara et.al (1997) using a growth rate of 5 %, while the values for

Mumbai and Chennai were obtained by projecting those given by the Indian Ministry of Urban Affairs and Employment (1996) using the specified growth rates of 4.6% and 6.9% respectively.

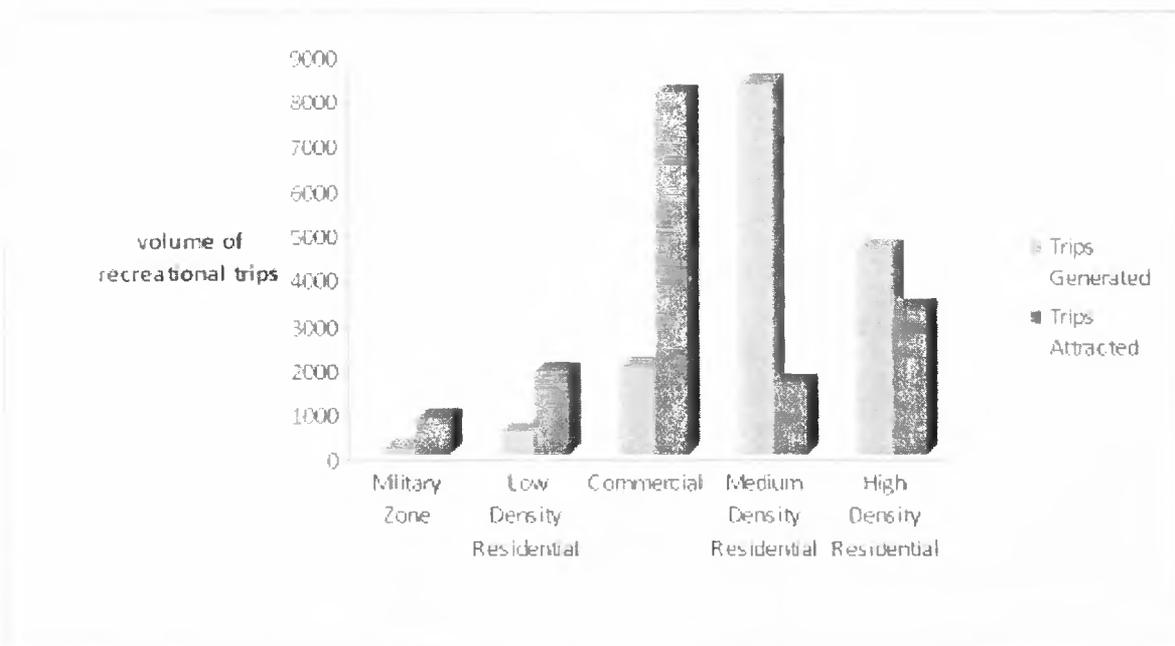
A comparison of mean car ownership rates (per household) between Akure- Nigeria, Accra-Ghana, and Pune- India has been made. The average number of cars per household in Akure (0.24) is lower than that in Accra (1.24) and Pune (0.63). The values for Accra and Pune were projected from those given by Palmer et.al (1996) using a growth rate of 5 %.

Figure 5 shows the proportion of work trips generated by mode in the study area. On the average, 55% of the trips were undertaken by taxi cabs while 20%, 10%, 9% and 6% were undertaken by private cars, mini buses, motorcycles and walking respectively. This shows that 74% of work trips in the metropolis are undertaken by para-transit modes. The proportion of recreational trips generated by mode in the land-use areas considered is given in Figure 6. On the average, 44% of the trips were undertaken by taxi cabs while 29%, 11%, 10% and 6% were undertaken by private cars, mini buses, motorcycles, and walking respectively. This

**TABLE 1
CAR OWNERSHIP OF HOUSEHOLDS AND DAILY TRIPS PER CAPITA**

Land-use Area	No of Households Sampled	Number of Cars	Number of Cars per Household	Daily Recreational Trips per Capita	Daily Work Trips per Capita	Total Daily Trips per Capita
Low Density Residential	120	72	0.60	0.67	0.97	1.64
Medium Density Residential	497	99	0.20	1.92	1.74	3.62
High Density Residential	420	73	0.17	0.91	2.00	2.91
Commercial	248	40	0.16	0.72	1.90	2.62
Military zone	23	18	0.78	0.68	1.29	1.97
Average			0.24	0.98	1.58	2.56

**FIGURE 4
RECREATIONAL TRIP GENERATION AND ATTRACTION**



shows that 65 % of recreational trips in the metropolis are undertaken by para-transit modes.

Figure 7 illustrates the factors affecting commuters' choice of para-transit modes for work trips in the study area. The factors considered include cost, speed, availability, absence of alternatives, comfort and convenience. The analyses revealed that the majority of those who patronize taxi cabs do so because they are readily available and convenient. Reasons adduced by commuters for patronizing motorcycles are that they are the only available alternative along their routes and that they are convenient and faster especially during the rush hours. Those who patronize mini buses do so because they are cheaper.

Figure 8 illustrates the effect of monthly income on choice of mode in the study area. It was observed that medium and high income earners (greater than \$300 per month in Nigerian context)

mostly make use of their private cars, while low income earners (less than \$300 per month) mostly make use of taxi cabs. However, low income earners receiving less than \$50 per month resort mainly to walking.

CONCLUSION

This study on the pattern of trips in Akure Nigeria is one of the attempts to extend research on travel characteristics and behaviour to cities of the developing world. The findings show that distance of each land use area from the central business district plays a dominant role in work trip attraction to it while trip generation by the land-use areas increased with residential density. The low volume of work and recreational trips generated and attracted by the military zone is due to the fact that socio-economic activities are confined within the barracks. These complexes are equipped with

FIGURE 5
PROPORTION OF WORK TRIPS GENERATED BY MODE

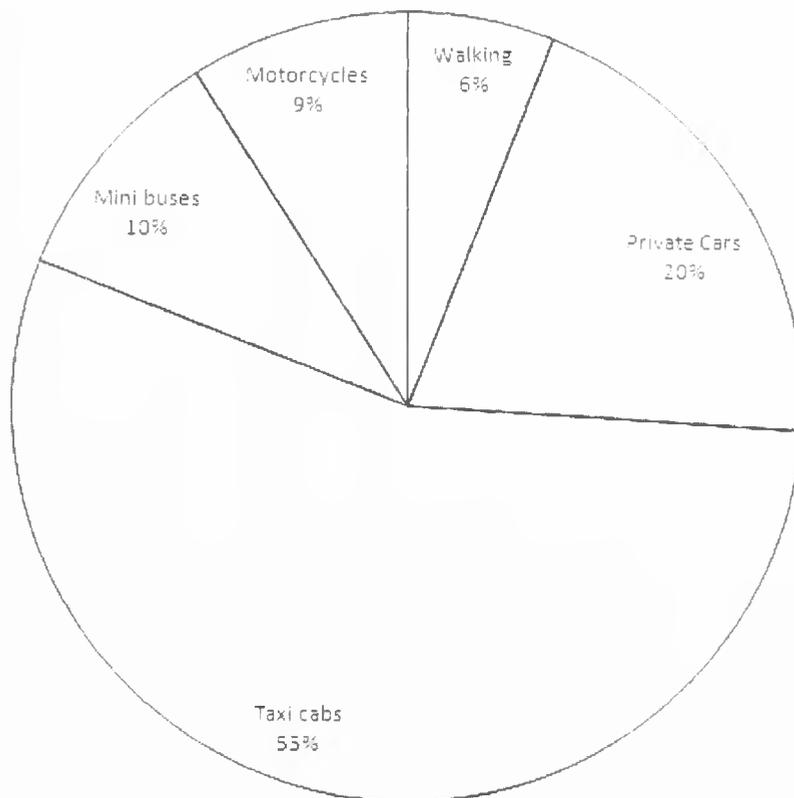


FIGURE 6
PROPORTION OF RECREATIONAL TRIPS GENERATED BY MODE

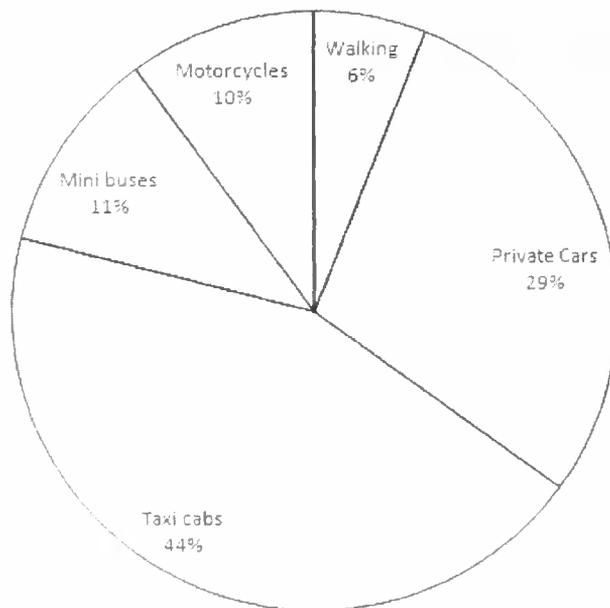


FIGURE 7
FACTORS AFFECTING CHOICE OF WORK TRIP PARA-TRANSIT MODES

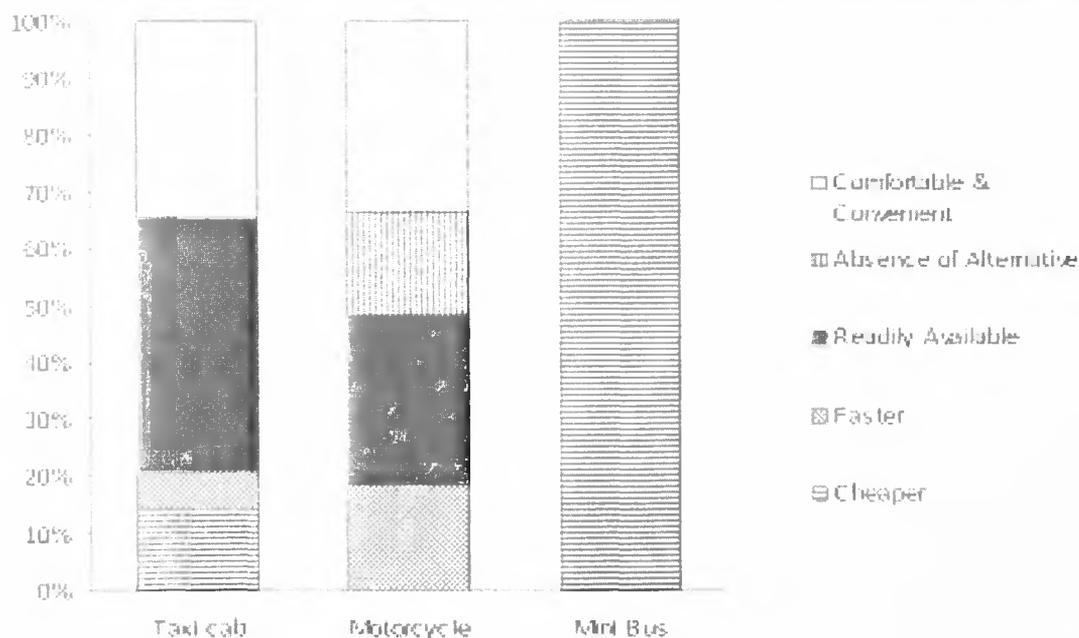
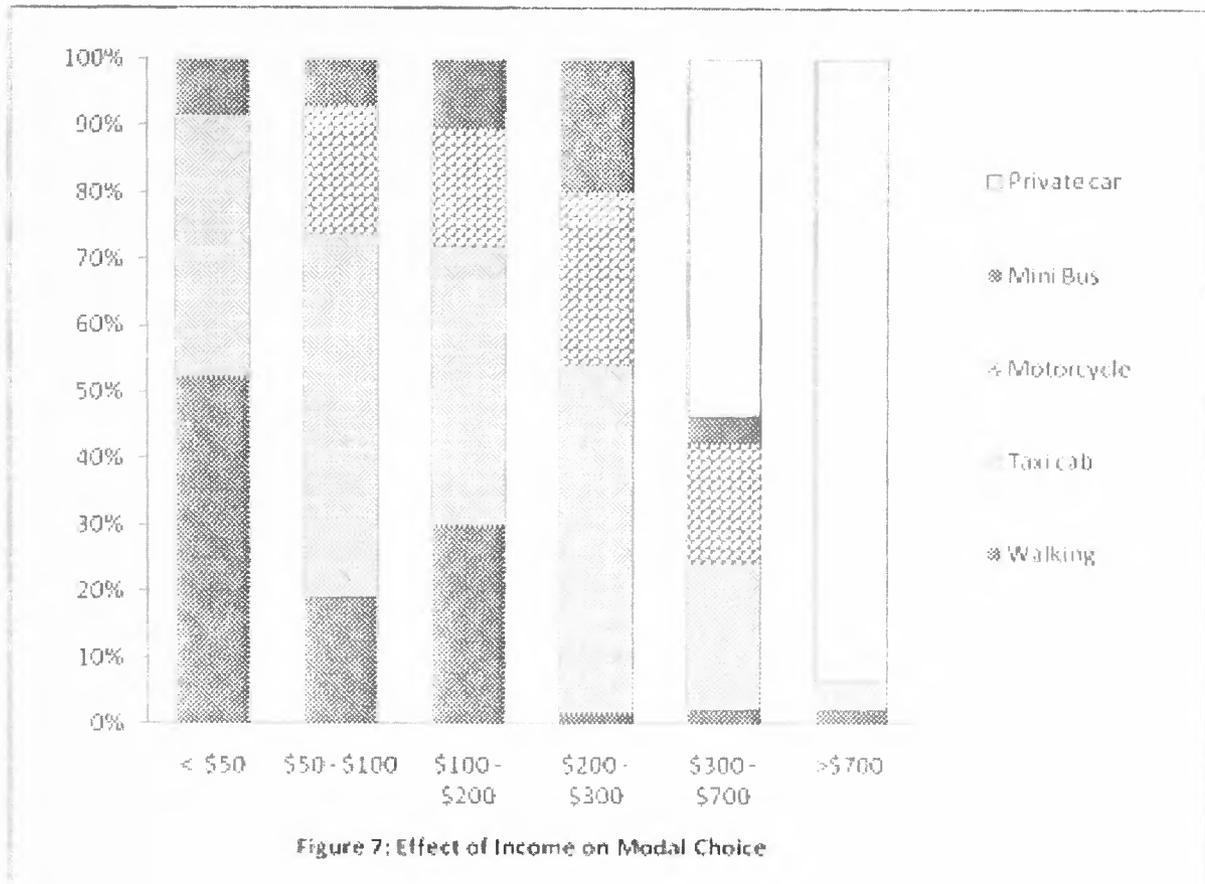


FIGURE 8
THE EFFECT OF INCOME ON MODAL CHOICE



necessary facilities. The range of work trips generated per capita in Akure compares favourably with that specified by Fouracre and Turner (1992) for developing cities, while the average daily trips generated per capita in the study area is higher than those for Mumbai-India, Chennai-India and Harare-Zimbabwe.

It has also been established that ownership of a vehicle increases the propensity to make trips, particularly for discretionary journeys. Para-transit modal choice in the study area has been found to depend on availability, convenience, cost and promptness. The fact that a higher proportion of trips in the study area were undertaken by modes

other than private vehicles underscores the dominance of public para-transit. As such improvement of service delivery by the modes and creation of an enabling environment for their operations should be prioritized.

The findings of this study could be used by planners in developing nations and possibly UN and other economic development agencies in forecasting intra-city trips and providing facilities to accommodate them. It could also be a basis for conducting similar studies in developing cities of the world.

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