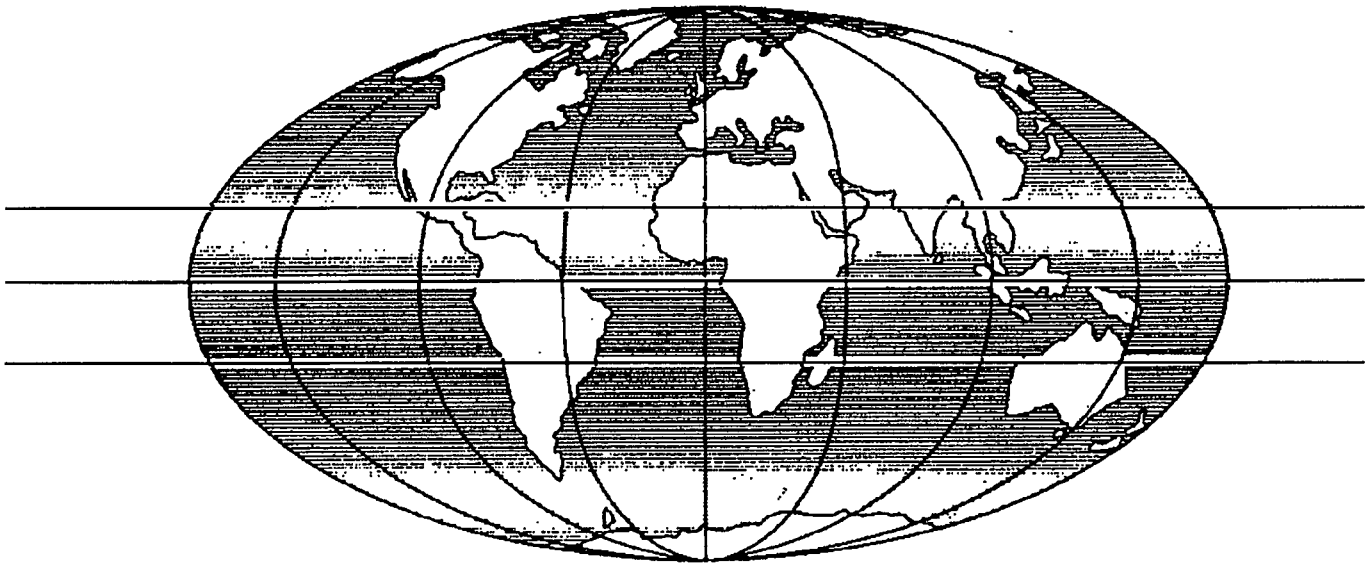**TRANSPORT RESEARCH LABORATORY**

ODA

TITLE   Travel characteristics of urban households in Harare, Zimbabwe

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TRAVEL CHARACTERISTICS OF URBAN HOUSEHOLDS IN HARARE, ZIMBABWE

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Abstract: This paper describes the results of a travel behaviour study implemented in Harare, Zimbabwe which the authors believe is the first of its kind to have been implemented in the city. The objective of the study was to examine daily trip and travel patterns undertaken by urban households in Harare. Relationships between factors such as income, trip rate, distance and trip purpose are assessed. Modal split trends as well as gender issues are also analysed. The findings significantly contribute knowledge and understanding on travel characteristics in a typical African capital city.

Keywords: behaviour, pattern, urban, rate, characteristic.

1. INTRODUCTION

Extensive research has hitherto been carried out on travel characteristics and behaviour in many cities but mainly in cities of the developed world. Such studies were initially prompted by the growth in use of the motor car which brought profound changes in travel behaviour after the Second World war (Jones et al 1983, Johnston 1983). Clearly, the increasing reliance on the motor car, meant that early studies on travel demand were calibrated at the level of the traffic analysis zone (Pas 1990) and the techniques were oriented to address the problems of traffic flow rather than behavioural responses (Domenich and McFadden 1975).

Currently, travel behaviour is increasingly being studied from what Jones (1983) termed the "activity approach". In this context, travel is studied by examining the daily activity patterns of the household. The activity patterns entail the movement of individual members of the household to enable them to participate in activities at different locations. As Jones (1990) succinctly put it; "....household organisation lies at the heart of an understanding of

travel behaviour". Thus, analysis on travel behaviour has taken a comprehensive approach by focusing on household socio-economic factors that influence trip making as well as addressing all travel modes including non-motorised means of transport such as walking and cycling. Results of such studies suggest that shorter trips are made by foot while longer trips tend to rely on some form of motorised transport (Johnson 1983, Maunder 1983, Maunder 1984). A greater proportion of journeys by women tend to be local, short and principally for shopping (Grieco et al 1989) and accompanying children to school (Maunder 1983). Such trips are mainly undertaken on foot. The work trip tends to be the predominant one and is mainly undertaken by males (Webster, 1977; Maunder, 1984; and Mbara et al 1995). Jones (1990) further noted that most of the journeys to work were simple and direct, meaning that there is very little involvement in personal business in the course of the work journey.

The travel behaviour study of Harare discussed in this paper provides useful insights as well as contributing additional knowledge on travel characteristics of urban households. As far as the

authors are aware, this is the first travel characteristics study of Harare to be comprehensively conducted and reported on. The objective of the study was to examine daily trips and travel patterns undertaken by household members. Relationships between factors such as income and trip rate, distance and trip purpose are assessed. Modal split trends as well as gender issues are also analyzed.

2. RESEARCH SETTING

The study was conducted in Harare, the capital and principal commercial centre of Zimbabwe. The main road network in Harare is a radial system connecting the various residential areas with the Central Business District (CBD). The high density areas which are low income residential areas are located mainly to the south and south western part of the city while the low density areas (high income residential areas) are located to the northern parts of the city. Apart from a few residential areas which are located near the CBD and industrial areas, most of the residential areas are located considerable distances from places of employment. Chitungwiza, a wholly high density area is located 25 kilometres away from the central business district (CBD) and industrial employment centres. Figure 1 below shows the structure of the city of Harare.
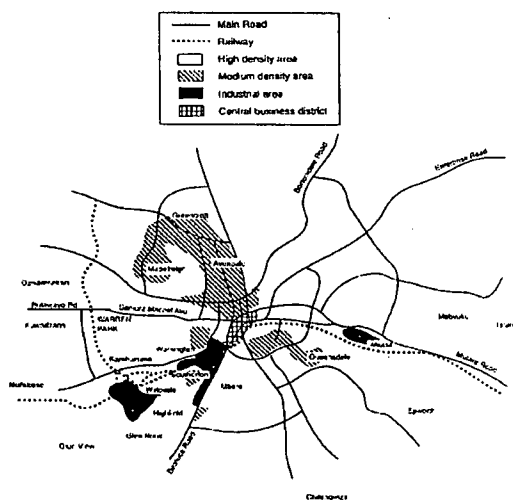

Fig. 1 Harare: Structure and Land Use

In 1992, the population of Greater Harare was 1.46 million (Central Statistical Office 1992). Assuming a 5 percent annual growth rate, the current population is estimated at 1.8 million. The sex ratio (defined as the number of males per 100 females) was 105 in 1992. The level of vehicle ownership is low but, higher than one would, typically, associate with a city in the developing world. In 1992, the number of vehicles per 1000 population for the whole country

was estimated at 41. In urban areas, the ratio would be considerably higher than the average national figure. Presently, vehicle ownership is likely to be much higher due to the liberalisation of the economy and the removal of constraints which have made it easier for individuals to acquire motorised vehicles from both domestic and external markets.

Public transport, comprises conventional buses, minibuses and emergency taxis. The Zimbabwe United Passenger Company (ZUPCO), now wholly owned by Government, operate conventional and minibuses. The present fleet is 750 comprising 640 conventional and 110 minibuses. The fleet has decreased from approximately 830 buses in 1993/94. Until 1982, ZUPCO was the sole supplier of public passenger transport in Harare. From December 1982, "emergency taxis" (ETs') which are privately owned and operated small capacity vehicles of a station wagon type (Peugeot 404 being the predominant ones) were authorised by Government to operate in order to improve the service offered by ZUPCO. The limited capacity of these vehicles had an insignificant impact on the level of public transport provision. The emergency taxi fleet grew from approximately 630 in 1988 (Maunder and Jobbins 1988) to about 2,600 by July 1993 (Mbara 1994) and then fell to about 1,500 by 1996 (Department of Physical Planning 1996). The decline in the emergency taxi fleet resulted from the government's policy of liberalising urban public passenger transport services in August 1993, when private individuals were for the first time allowed to operate vehicles with a seating passenger capacity in excess of 7 passengers. These vehicles, which are officially known as "commuter omnibuses" have increased at an unprecedented rate since their inception in Harare. For example, in January 1994, there were 530 commuter omnibuses operating and by December 1995, they had increased to 2,355 (Ministry of Transport and Energy, 1995). The introduction and expansion of the commuter omnibus fleet has significantly increased the capacity of the urban passenger transport system of Harare because, while the majority of the vehicles are small minibuses, there are also large articulated buses with a carrying capacity of 118 passengers. Maunder and Mbara(1995) estimated that the capacity of the bus fleet increased by 17 percent between the short period of January to September 1994.

3. RESEARCH METHODOLOGY

The travel behaviour study was conducted at the end of January 1996. Data were collected using a comprehensive two part questionnaire. The first part collected information on socio-economic characteristics of households, while the second part

obtained information on trips made by household members. The "recall diary" survey method was used. This method records all trips undertaken during the previous twenty four hours of a week day. In the study, a trip was defined as a single one way journey using any means of transport. For instance if someone travels from home to work that would constitute a trip. If the same person drives from his/her work place during the lunch break to visit a friend and back, this would be recorded as two separate trips. The return home journey after work constitutes a fourth trip. In other words, "trip chains" are disaggregated into direct single journeys.

In order to ensure that the data collected were representative, the city was divided into 10 different sectors covering all high and low density residential areas. Approximately, the same number of households were to be interviewed in each sector. A target sample of 500 households was set, but in the end 473 questionnaires were successfully achieved.

4. RESULTS

4.1   *Household characteristics*

Table 1 below summarises the key household characteristics from the sample data:

Table 1 Key household characteristics

DESCRIPTION	
Average Household Size	7.8
Average Age	25
Average Monthly per Capita Income	Z$909
Average Monthly Household Income	Z$7090*
Average Number of Cars Owned per Household	0.54
Sex Ratio	102

*1US$ = Z$ 14 (JANUARY 1996)

The household size approximates to 7.8 persons per household with low income areas averaging 8.8 and high income areas 6.7. The definition of a household was taken as all persons living in the home; including lodgers, domestic servants etc. The average age approximates to 25. The average age in high density areas (i.e. low income) is marginally lower than that of the low density areas. The sex ratio (defined as the number of males per 100 females) is 102 which is almost the same as the 105 sex ratio cited in the CSO (1992) report.

Household average monthly income is approximately Z$7 090 with an average per capita income of $909 per person. However, there are marked differences between low and high density areas. The average household income in low income areas equates to

Z$4 860 (per capita income of Z$552) whilst in high income areas   it is three times higher at approximately Z$13 000 (Z$1 940 per capita).

Vehicle ownership is closely related to the level of household income. Overall vehicle ownership, (that is, all vehicles) equates to 0.87 vehicles per household. In high and low income residential areas, total vehicle ownership is 1.95 and 0.52 per household respectively. Private car ownership is also related to income. In high income areas, the level of ownership is about 1.32 cars per household and only 0.29 cars per household in low income residential areas with an overall average of 0.54 cars per household. The level of bicycle ownership is generally low and similar for high (0.38 bicycles per household) and low (0.34 bicycles per household) income areas. In high income areas, bicycles are mainly used for leisure trips while in low income areas, their primary purpose is to provide transport to employment places.

4.2   *Trip purpose*

The majority of trips(59%) are made for work and educational purposes as illustrated in Figure 2.

Fig 2: Journey Purpose
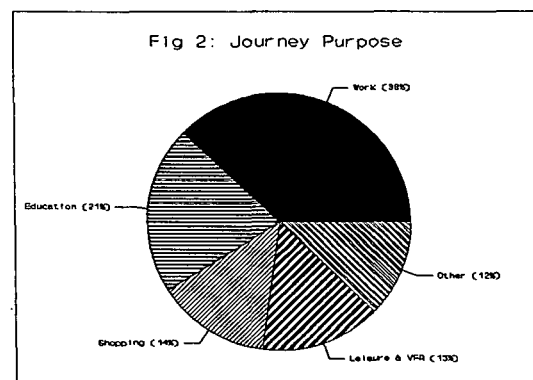
Travel for work purposes is the key journey purpose followed by travel for educational reasons. Fourteen percent of trips were for shopping while leisure and visiting friends and relatives (VFR) constituted 15 percent and "other" 12 percent. The trips in the "other" category were for attending funerals, and church services and visiting hospital.

5. TRIP RATE

For analytical purposes, the trip rate was considered in terms of the household and the individual. An average of 12.16 trips per household are made daily with 1.56 trips made per capita. Trip rates vary with income. The average trip rate per capita in high income areas equates to 1.91 as compared to 1.49 for

the low income areas. The higher trip rate in high income areas probably reflects the higher level of car ownership. The presence of a vehicle undoubtedly increases the propensity to travel particularly for long distance trips and discretionary journeys.

Using the percentage trips made for each journey purpose in Figure 2, the proportion of trips made per household and per capita are as shown in Table 2.

Table 2 Proportion of trips made per household and per capita

TRIP PURPOSE	AVERAGE TRIPS PER HOUSEHOLD	AVERAGE TRIPS PER CAPITA
WORK	4.62	0.59
EDUCATION	2.55	0.33
SHOPPING	1.71	0.22
LEISURE & VFR	1.82	0.23
OTHER	1.46	0.19
TOTAL	12.16	1.56

On the basis of the average trips per capita in Table 2, and the present estimated population of 1.8 million, the number of daily trips currently being made in Harare for each trip purpose have been estimated as shown in Table 3. The total number of daily trips made in Harare approximate to 2,808,000.

Table 3 Total daily trips made by trip purpose

| TRIP PURPOSE	ESTIMATED DAILY TRIPS
WORK	1,062,000
EDUCATION	594,000
SHOPPING	396,000
LEISURE & VFR	414,000
OTHER	342,000
TOTAL	2,808,000

6. MODAL SPLIT TRENDS

Table 4 below, shows trends in modal split based on household surveys conducted throughout the city from 1988 and include the current study findings.

The trends since 1988 shows that ZUPCO and the emergency taxis' share of the market at first increased but has declined from 25% to 11% and 18% to 5% in the last 3 years respectively. The commuter omnibus sector has significantly increased its share from 4% in 1993 to the present 21%. Personal car usage which had been declining since

1988 increased its share from 14% to 18% between 1994 and 1996. Walking continues to be the predominant mode of travel throughout the period and the walk mode share has also increased in the last 3 years to equate to the level first identified in 1988.

The modal split results generally are consistent with trends in public transport provision outlined earlier. The ZUPCO and emergency taxi fleets have declined while the commuter omnibus fleet has increased. The increase in the private car share is clearly a reflection of the increase in the number of cars coming on to the market as a result of trade liberalisation. For the majority of people without access to a private car, walking minimises travel costs at a time when costs for most basic needs are increasing at an unprecedented rate. Clearly, the affluent can afford to drive while the less affluent even find public transport expensive and therefore resort to walking. The bicycle appears to be of negligible significance in terms of travel, possibly due to the high initial purchase cost but also due to safety and security considerations as well as the location of most low residential areas being on average 15 kilometres from the CBD which therefore does not favour the use of a cycle as a mode of travel.

Figure 3, which is based on the data of the latest study, portrays the percentage number of trips undertaken by each mode.

Fig 3: Trips undertaken by mode
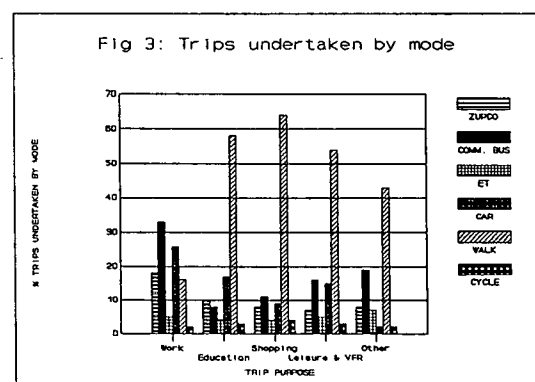
It is evident from Figure 3 that commuter omnibuses, ZUPCO buses, private car and walking are the predominant modes for work trips. For education, shopping, leisure and other trips, walking is the major mode though the car is significant for education trips in the affluent northern suburbs. On the basis of the percentage modal split for January 1996, the total number of trips currently made by each mode can be estimated as shown in Table 5.

Table 4 Modal split trends

YEAR	ZUPCO Stage Bus	Emergency Taxi	Commuter Omnibus	Meter Taxi	Motor Car or Cycle	Cycle	Walk	Other	TOTAL
1988	18	7	--	0.5	30	1.5	42	1	100
1991	24	10	--	1	16	1	45	3	100
1992	31	9	--	1	17	5	36	1	100
1993	23	18	1	1	16	3	38	--	100
1994 (Jan)	25	18	4	1	14	3	35	--	100
1995 (Sep)	20	9	16	0.5	14	5.5	34	1	100
1996 (Jan)	11	5	21	0.5	18	2.5	42	0	100

Source; Transport Research Laboratory/Department of Physical Planning Home Interview surveys 1988-1992
University of Zimbabwe/Transport Research Laboratory surveys 1993-1996

Table 5 Estimated daily trips made by each mode

MODE	ESTIMATED DAILY TRIPS
ZUPCO	308,880
Emergency taxi	140,400
Commuter omnibus	589,680
Metered taxi	14,040
Car	505,440
Cycle	70,200
Walk	1,179,360
TOTAL	2,808,000

Fig 4: Cumulative percentage number of passengers and distance travelled

7. TRIP LENGTH

Trip length has been analyzed by considering three aspects, namely; overall trip length, trip length by individual mode and finally trip length by trip purpose.

Considering all trips by all modes, there is a linear relationship between the number of trips made and the distance travelled. The number of trips made decrease as the distance travelled increases. Figure 4 portrays the cumulative frequency of trips made and it illustrates the majority of trips are below 5 kilometres.
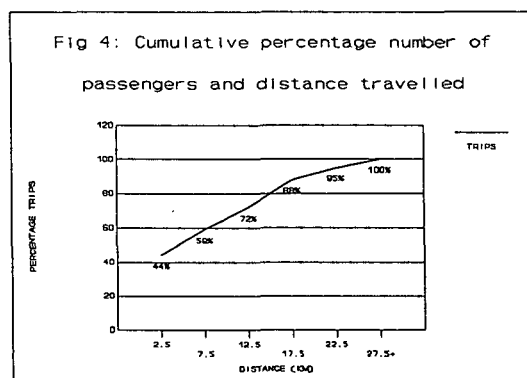
Eighty percent of trips occur within a distance of less than 15 kilometres and only 6 percent are in excess of 25 kilometres. The average distance travelled by each mode is shown in Table 6. As would be expected, distance travelled using motorised modes is longer than for non-motorised transport. Cycling and walking with distances ranging from 1.5 to 8.2 kilometres tend to be localised.

Table 6 Average distance travelled by each mode

MODE	ZUPCO	COMMUTER	ET	TAXI	CAR	CYCLE	WALK	OVERALL
AVERAGE DISTANCE (kms)	12.9	14.1	10.9	16.5	14.5	8.2	1.5	11.2

The longest distances are travelled by meter taxi. Passengers using commuter omnibuses travel longer distances than ZUPCO bus passengers despite the fact that the majority of commuter omnibuses are small vehicles which are not economic to operate on

long routes. The relatively longer distances travelled by commuter omnibuses result from the total withdrawal of ZUPCO buses on the 25 kilometre City - Chitungwiza route. This route is the longest in the network and is now solely served by commuter

omnibuses.

In respect to distance travelled by trip purpose, it is evident from Table 7 that work trips with an average of 14.2 kilometres are by far the longest. Education and shopping trips which are mainly local are generally undertaken on foot. Statistically, there are significant differences between the distance travelled for work trips with distances for other trip purposes. There are however no significant differences between the distances travelled for education and shopping.
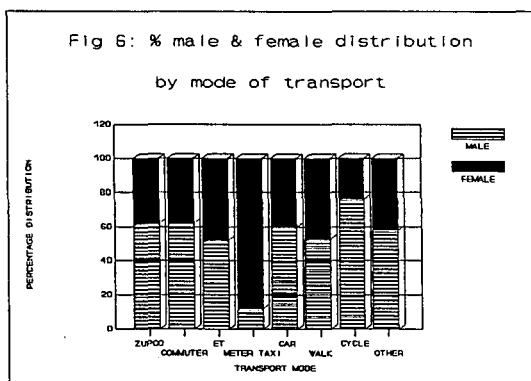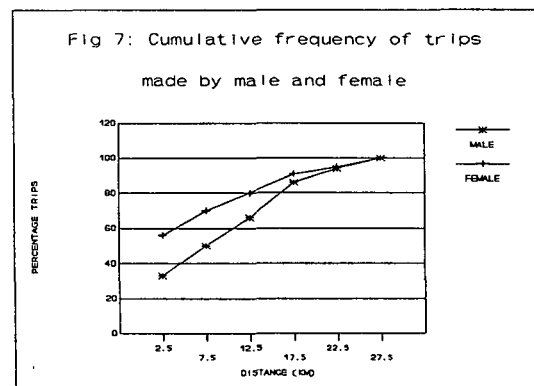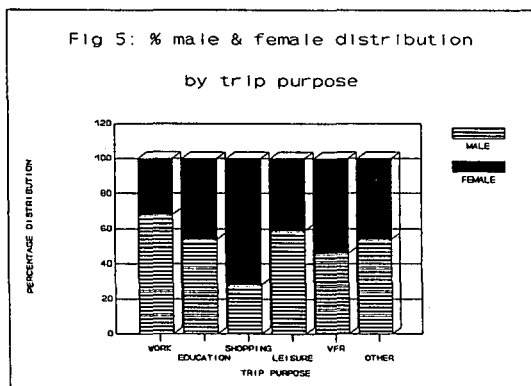
Figures 5 and 6 depict the results of trip purpose and mode used by gender respectively.

The analysis of trip purpose by gender shows that education, leisure, visiting friends and relatives, and other trips are evenly split. There are however major differences for work and shopping trips.

Table 7 Distance travelled by trip purpose

TRIP PURPOSE	WORK	EDUCATION	SHOPPING	LEISURE & VFR	OTHER
DISTANCE (km)	14.2	3.9	3.5	6.0	7.8

Fig 5: % male & female distribution by trip purpose

Fig 7: Cumulative frequency of trips made by male and female

Fig 6: % male & female distribution by mode of transport

Sixty eight percent of work trips are made by males with only 32% being made by females. However, 72% of shopping trips are made by females compared to only 28 percent by males. These results sustain the traditional held view that the female's primary responsibility is the home. Thus most of the trips females make are local and short distance as shown in Figure 7. Below 7.5 kilometres, the proportion of trips made by women is much higher than by men. Seventy percent of trips undertaken by women are within a 7.5 km distance compared to 50 percent by their male counterparts.

The three main motorised forms of public transport, namely, ZUPCO bus, commuter omnibus and emergency taxis are predominantly used by males. The car and bicycle are also more widely used by males than females. The only mode which is extensively used by females than males is the meter taxi. Trips on foot are evenly distributed between males and females. The greater use of meter taxis by females compared to males may be due to the unavailability of a car either due to a lack of ownership or due to it being committed for the work trip by males. Another possible reason could be security of the mode which provides a door to door service for females to travel in a safe and comfortable environment.

Culture and community attitudes may be attributed to the low percentage of cycling by women. Attitudes are such that few women cycle in urban areas. Secondly, cycling is perceived to be a security risk with potentially high accident rates due to the interaction and exposure of the cycle to all other modes of motorised transport.

9. FARES AND EXPENDITURE ON PUBLIC TRANSPORT

Data were obtained on fares paid for all trips used by public transport. The calculated average fares for each mode are shown in Table 8.

The average fare for public transport systems range from $1.82 (ZUPCO buses) to $17.50 (metered taxis). The fare for metered taxis at $17.50, (the highest of all the four modes) would be expected due to the nature of the service provided by this mode. However, for the other three public transport modes, the fares are consistent with the average and maximum authorised fares. The actual authorised average fare for ZUPCO at the time of conducting the study was $1.81 while the maximum authorised fares for commuter omnibuses and emergency taxis were $2.90 and $2.35 respectively. The latter two modes tend to charge flat fares which are close to stipulated maximum while ZUPCO charges graduated fares.

Table 8 Average fares for public transport services

MODE	CALCULATED AVERAGE FARE (Z$)
ZUPCO	1.82
COMMUTER	2.60
EMERGENCY TAXI	2.25
METERED TAXI	17.50

The present share for each mode can also be compared to fares charged. The commuter omnibus whose market share of 21 percent is the highest when compared to ZUPCO (11%) and emergency taxi (5%). Commuter omnibuses have also the highest average fares. This suggests that the market for commuter omnibuses is based on factors such as frequency and availability of service rather than fares. Commuter omnibuses whose vehicle population is presently three times that of the ZUPCO fleet are also serving some routes which have been abandoned by ZUPCO. The emergency taxi, whose market share has also fallen, charges fares which are marginally lower than the commuter omnibuses but in terms of comfort and reliability, the emergency taxi cannot compare, hence the present popularity of the commuter omnibuses.

10. DISCUSSION

The results of the Harare household surveys can be compared with recent survey results undertaken in Accra (Ghana), Pune (India), and Medellin (Colombia) by the Transport Research Laboratory.

In Accra, Turner et al (1995) and Grieco et al (1996) found that community culture had a strong effect on travel behaviour, Different ethnic communities within Accra either encouraged the use and ownership of bicycles or disassociated themselves from using such a mode of transport. Northern Ghanian migrants living in Accra appear to accept the bicycle as a mode of transport whereas southern Ghanian communities actively discourage its use. Neither groups however accept adult females riding bicycles resembling the findings of Harare. In Pune, similar findings were observed with few females other than students cycling but more and more adult females are owning and operating motorised scooters, mopeds and motorcycles (Palmer et al 1996, Astrop et al 1996, 1996, Maunder et al 1997). Cultural attitudes are beginning to change in terms of female use of such vehicles but not in terms of cycle use. As in Harare however, if personal vehicles are possessed in a household, males appear to have priority in terms of usage before females. Most trips by females in Pune and Medellin (Astrop et al 1996) are local and generally for escorting children to school or for shopping for the household. In all the three cities as in Harare, trips by public transport modes and on foot are the major travel modes used by residents and the major reasons for travelling comprise journeys for employment and educational purposes. Thus, despite different types of public transport being available in cities of various continents, travel behaviour does appear to be relatively uniform throughout the urban environment.

11. SUMMARY AND CONCLUSION

This study on household travel characteristics is the first of its kind to be conducted in Harare. Data were collected from a representative household sample covering the entire city. The findings significantly contribute knowledge and understanding on travel characteristics in a typical African capital city.

The results have shown marked differences in income, car ownership levels and trip rates between high and low income areas. The high income areas have a higher propensity to travel as evidenced by higher trip rates.

In terms of modal split, walking with a current 42 percent of the market share is the key mode. ZUPCO's share of the market has declined and the recently introduced commuter omnibus has increased its share to become the major public transport mode as a consequence, emergency taxis are being marginalised. The results on modal split are consistent with the actual trends in growth in the public transport fleet. The ZUPCO and emergency

taxi fleets have declined while there has been an unprecedented growth in commuter omnibuses. However, the growth in commuter omnibus fleet, poses serious policy implications. As the majority of the commuter omnibus vehicles are small minibuses, they are causing severe congestion in the central area notwithstanding their role in improving public transport services.

As might be expected, trips by motorised forms of transport tend to be longer in comparison to those made by non-motorised means of transport.

While education, leisure and visiting friends and relatives are evenly split between male and female, there are marked differences for work and shopping trips. For work trips, the majority of travellers are male while the burden of carrying goods on shopping trips is predominantly undertaken by women generally on foot. As a consequence, males tend to travel longer distances than females. Females make greater use of metered taxis than males but for all other modes, males predominate.

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