

# TRAVEL BEHAVIOUR IN CAPE TOWN, DAR ES SALAAM AND NAIROBI CITIES

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## ABSTRACT

Public and non-motorised transport facilities in urban centres in Africa are less than what is justified by the demand. This may be due to the way the urban transportation problem has been formulated and travel surveys carried out with a focus on establishing demand for travel by car. The aim of this study was to document travel behaviour in the three cities without bias to any of the modes so that issues hindering the sustainable modes may be identified and investigated. Household interviews were conducted by experienced interviewers using similar questionnaires across the cities. The questionnaire included a place based trip diary and questions to capture demographics data. Analysis was carried out using SPSS and Excel software to produce demographic and trip characteristics summaries and charts. The results indicate that the demand for non-motorised travel is higher in Dar es Salaam and Nairobi compared to Cape Town. Gross trip generation rates increased with income only slightly. However, for Nairobi and Dar es Salaam non-motorised trip rates declined with income. Usage of public transport for the trip to work and to school is highest in Dar es Salaam.

The comparison of travel behaviour in terms of mode choice for different trip purposes and trip rates between the three cities revealed similarities and differences that can be accounted for by demographics, level of income, culture, urban form and transport policies. NMT and public transport play a critical role in all the three cities. Policies to encourage use of NMT and public transport are recommended for the case of Cape Town while Dar es Salaam and Nairobi cities need to consider how to provide for the existing high demand for these modes. In addition, the City of Dar es Salaam should address planning issues causing the low proportion of NMT mode usage for the trip to school.

## 1 INTRODUCTION

The three cities were selected for study on the basis of their universities' involvement in a collaborative research programme through the African Centre of Excellence for Studies in Public and Non-motorised Transport (ACET) which is a collaboration of three universities: University of Cape Town, University of Dar es Salaam and University of Nairobi. The three cities, like many cities on the continent and the rest of the world, are facing increasing pressure on the transport infrastructure and public transport services. Consideration of increasing congestion and the contribution of urban transport to global warming and other consequences has raised concern about the sustainability of current approaches and the need to consider alternative more sustainable approaches. The foundational hypothesis underpinning the ACET research programme is that the car based pattern of urban transport (after the West) in African cities is due to the formulation of the transport problem as a congestion problem and thus solutions are developed that increase the capacity of the road network to accommodate more automobiles during the peak hour. The increase in capacity leads to further traffic generation and the cycle continues. An alternative to this approach is studying travel behaviour and identifying ways to promote the more sustainable modes of transport. Project One of the ACET research programme therefore focused on documenting travel behaviour to provide a base for the projects studying non-motorised transport, public transport, city re-structuring and travel behaviour change.

It is necessary to travel when an activity has to be undertaken away from the individual's location and thus travel is considered a derived demand. Land use patterns determine the travel characteristics of any city. Physical and socio – demographic elements of a city affect trip-making frequency, distance travelled, travel mode choice and time of travel. Thus travel behaviour differs from city to city because of the diversity of the factors affecting travel. There is thus a need to study travel behaviour and the socio-demographic elements to provide a foundation for understanding and the formulation of strategies for sustainable transport. The need for such study was noted by Howe and Bryceson (2000) for the case of Dar es Salaam. More generally the Warren Centre (2002) advocated better ways to manage travel demand or reduce the number of trips made by cars through development of mind-set that seeks to reduce number of trips through avoiding or combining trips and diverting others to more sustainable modes of transport. Travel survey and analysis provide the raw material for policy formulation, prediction of demand and the understanding of issues around travel behaviour and thus has to be undertaken regularly and for specific research and other studies.

The objectives of the study were therefore to:

- i) Establishing a comprehensive and comparable travel behaviour data base for the three cities: Cape Town, Dar es Salaam and Nairobi;
- ii) Compile travel behaviour information for the case study cities, and
- iii) Compare the results across the case study cities.

This paper is limited to reporting on the results on the comparison of socio-demographic factors, trip rates, trip purpose and modal split across the cities. We have excluded comparison on travel time and distance, transport expenditures, trip purpose by gender and age due to space limitation.

## 2 METHODOLOGY

### 2.1 Selection of survey method and development of the questionnaire

The first task of the study involved the selection of the survey method and the development of appropriate instrument. This is the standard practice due to the absence of a standardized approach (Richardson et al 1995; Stopher and Metcalf 1996). The survey was carried out using face to face interview given its viability and effectiveness over other methods as demonstrated in previous travel surveys in the three cities. The question of the form of travel diary to adopt was settled through an experiment conducted in 2008 in Cape Town and Dar es Salaam. The experiment involved three forms of travel diary namely trip based, activity based and place based. Results obtained indicated that the place based instrument was suitable for the cities as it gave the greatest trip and trip stage recall and least recording item non-response error (Behrens and Masaoe, 2009). The task of compiling the questions to be included in the questionnaire involved all the ACET project leaders so as to maximize the usefulness of the database to the projects. The proposed questionnaire was further refined through interactions between the researchers and the staff of the market research firm that won the tender for the data collection and management contract. A dummy database was developed on the basis of the questions and pre-tested and further tested and refined using the pilot study data.

Data captured through the questionnaires for each household included age, car ownership, gender, occupation, relationship to the youngest member, physical characteristics, transport expenditure, household income and type of dwelling. The travel diary for each member who travelled captured trip chain for the previous day together with their corresponding places visited, modes used, cost incurred, time lapse for a single complete trip and accompanying members.

### 2.2 Sample size and field procedures

Travel survey sampling usually target households rather than individuals since the household is a good predictor of travel behaviour. Sample size determines the degree of reliability of the results, but it is constrained by the resources available and the survey instruments to be employed. According to Blunden and Black (1984) a desirable sample size of four percent and a minimum sample size of one percent are recommended for the case study cities (inhabitants exceeding one million). Although our sample sizes was about half the recommended minimum it was considered adequate for the purpose of the research, i.e. documenting travel behaviour in comparable format across the three cities and not predicting travel demand.

The use of similar questionnaire and a market survey firm to coordinate the field work across the cities ensured comparable results. Field workers were recruited and briefed by the staff of the market survey firm. When the interviewers were in field they followed the following steps (for elaboration see Maganga and Masaoe, 2010).

- I. Selection of households for interview based on random sampling,
- II. Interview in households including completing travel diary on previous day,
- III. Scope and time of survey: complete at least three households starting from 4 pm, each survey day, and

- IV. Quality assurance: monitoring of field survey and completed questionnaires by field team leaders. Effect Corrections and submit for computer entry.

### 2.3 Analysis

Data collected, checked and corrected in case of any error were coded for inputting in Statistical Package for Social Sciences (SPSS) Version 16 and Microsoft Excel (2007) programs for analysis. Data was analysed for each city including compilation of demographic summaries as well as trips purposes and their modal split in relationship to age, gender, and income with brief discussions included in draft reports for Cape Town (Del Mistro, 2011), Dar es Salaam (Maganga and Masaoe, 2010) and Nairobi (Makajuma, 2011). Comparison across the cities was then carried out for the selected items and the results are presented and discussed below.

## 3 RESULTS AND DISCUSSION

### 3.1 Demographics

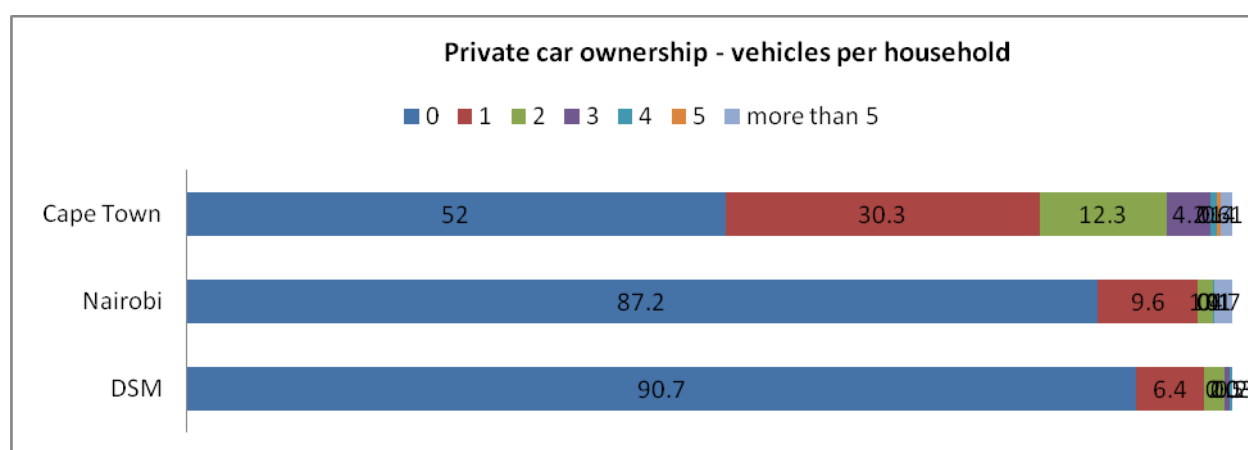
Table 1 below presents the gender and age distribution of the sampled population of the three cities. There are many similarities although the following differences can be pointed out:

- i) Cape Town has a higher proportion of an aged population. It is the most developed city of the three and some of its characteristics are similar to cities in developed countries.
- ii) Dar es Salaam had the highest number of persons per household and a highest proportion of the age group 13 to 17 years (this is the age of children attending secondary school). The culture and stage of development of the city are likely explanations, and
- iii) Nairobi has the highest proportion of working class age group (18 to 60 years of age) - 77.6 percent compared to Dar es Salaam's 66 percent and Cape Town's 63 percent. This is explained by a significant proportion of the working class maintain their families away from the city.

The proportion of households earning more than 1000 US \$ was 35 percent, 16 percent and 7 percent for Cape Town, Nairobi and Dar es Salaam respectively. This is reflected in the car ownership levels for the three cities shown in Figure 1. The proportion of households owning one or more cars corresponds broadly to these income ranges.

**Table 1: Comparison of sampled population by gender and age**

Gender/age categories	Cape Town		Dar es Salaam		Nairobi	
	Number	Percent	Number	Percent	Number	Percent
Number of Households interviewed for each city	2002		2009		2002	
Persons per household	4.0		8.1		4.8	
Male	3483	43	7,595	46.8	4589	47.8
Female	4052	50.1	7,948	49	4388	45.7
Subtotal	7535	93.1	15,543	95.8	8977	93.5
Children below 5 years	514	6.4	680	4.2	623	6.5
Unspecified gender	44	0.5	8	0	0	0
Total	8093	100	16,231	100	9600	100
Age of household members in years						
0 - 4	555	6.9	680	4.2	623	6.5
5 - 12	1,001	12.4	2,057	12.7	962	10.0
13 - 17	734	9.1	2,264	13.9	521	5.4
18 - 40	3114	38.5	8631	53.2	6485	67.6
41 - 60	1996	24.7	2122	13.1	961	10.0
Above 60	669	8.3	349	2.1	48	0.5
Refused to answer	24	0.3	128	0.8	0	0.0
Total	8,093	100	16,231	100	9,600	100



**Figure 1: Comparison of private car ownership**

### 3.2 Trip rates and modal split

The trip rate (number of trips per person per day) was 2.3 for Nairobi, 2.52 for Dar es Salaam and 1.70 for Cape Town. Trip rate varied only slightly with income, for example in Nairobi the trip rate was 2.3 for the lowest income, 2.2 for the intermediate income and 2.4 for the highest income range. For Dar es Salaam it was 2.51 for the lowest and intermediate income groups and 2.79 for the highest income groups. For Dar es Salaam and Nairobi this rate is higher than the trip rate of round 2.0 reported for many cities (Hyodo *et al*, 2005). The study reported that for cities in developing countries the proportion of walking trips were in the range 30 to 40 percent of all trips while for Cape Town, Dar es Salaam and Nairobi the proportion was 38%, 85% and 72% respectively. This is a very high proportion but consistent with the low level of car ownership and low levels of income which makes even the public income unaffordable for the lowest levels of income. The high proportion of walking is also accounted by the method used in the study namely the use of place based diary and the prompts used during the interview which helped the recall of walking trips which are easily overlooked when using the methods employed in the other studies.

On the other hand Dar es Salaam and Nairobi showed a tendency for the high income to use NMT modes very rarely. This is illustrated in Figure 2 for the case of Dar es Salaam. In Nairobi and Dar es Salaam no trip to work by bicycle was reported by persons from households earning more than USD 860 and USD 485 respectively. For Cape Town the use of bicycles is more evenly distributed among the income groups. The reason behind may need to be explored but could be a culture that assigns high status to access to private car or perhaps the poor condition of the NMT paths or even the risk associated with the mode.

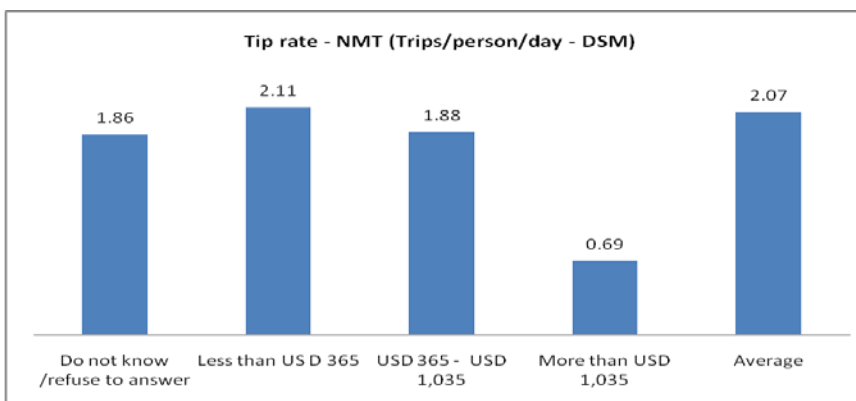


Figure 2: NMT trip rates by income

It is apparent in Figure 3 that the modal split for the trip to work is similar for Dar es Salaam and Nairobi while for Cape Town the proportion of trips by private car is more than six times that of DSM and Nairobi which is explained by the higher car ownership (see Fig. 1). The higher share of NMT trips for Nairobi compared to Dar es Salaam may be explained by the differences in the structure of two cities. The share of trips on motorcycles, taxis and other modes is lowest for Nairobi (0.3%) and highest for Dar es Salaam (2.1%). Use of bicycles and motorcycles is limited to the lower income groups for Dar es Salaam and Nairobi while for Cape Town it is not limited to any income group but the modal share is only one percent. All income groups use public transport and walking while the private car is used more by the higher income groups.

The differences in public transport and private car use across the cities suggest that different strategies may need to be developed for Cape Town on one hand and Dar es Salaam and Nairobi on the other. Cape Town may need to promote the use of sustainable modes by motivating change from private car use in favour of public transport. Dar es Salaam and Nairobi may wish to make better provision for the existing high demand for the NMT and public transport modes.

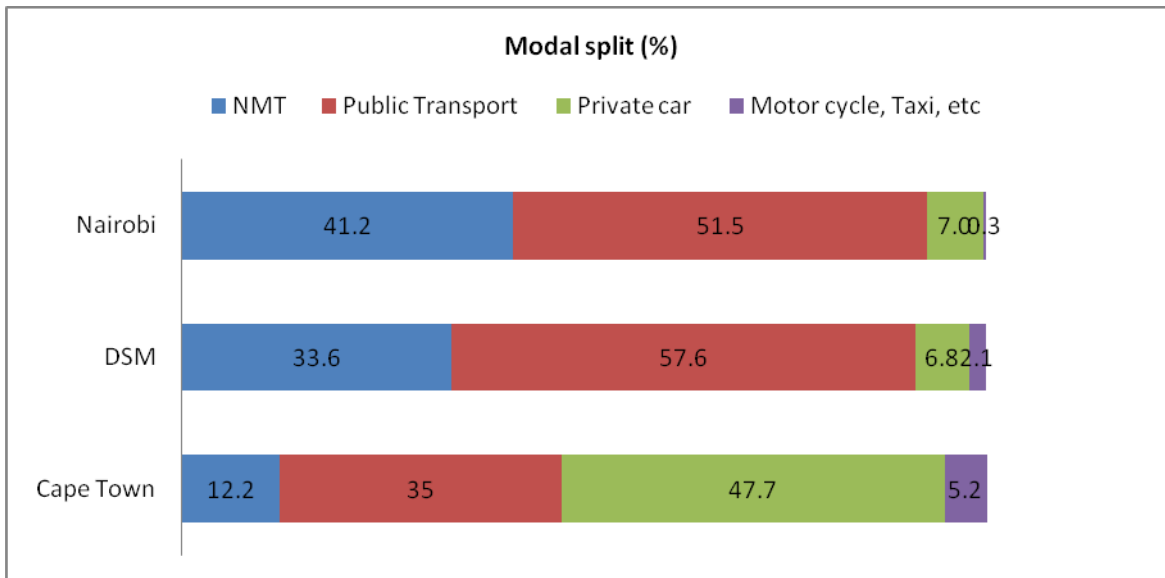


Figure 3: Comparison of modal split of the trip to work

Figure 4 presents the modal split for the trip to school. Private transport usage is very limited in Nairobi (1.4%) and Dar es Salaam (1.5%) while for Cape Town (21.2%) it is quite extensive and as a result the use of public transport for the purpose is much smaller compared to the other cities. The use of NMT in Cape Town (59.2%) and Nairobi (68.9%) compared to Dar es Salaam (48.6%) could be explained by the differences in distance from home to school across the cities. In Nairobi most of the schools are located within walking distance (93.4% of the NMT trips were by walking) while in Dar es Salaam many scholars attend schools that are far away by choice or necessity.

It is clear that the travel behaviour observed in Cape Town on one hand is different from what was observed in Dar es Salaam and Nairobi on the other hand. The objectives of their transport policies towards sustainable travel will be necessarily different. Indeed it has been reported that there are policies to promote walking in South Africa while such policies are not warranted in most African countries where people walk as a matter of necessity (WHO, 2009). Improvement of NMT facilities to meet the high demand should be the priority in most African countries.

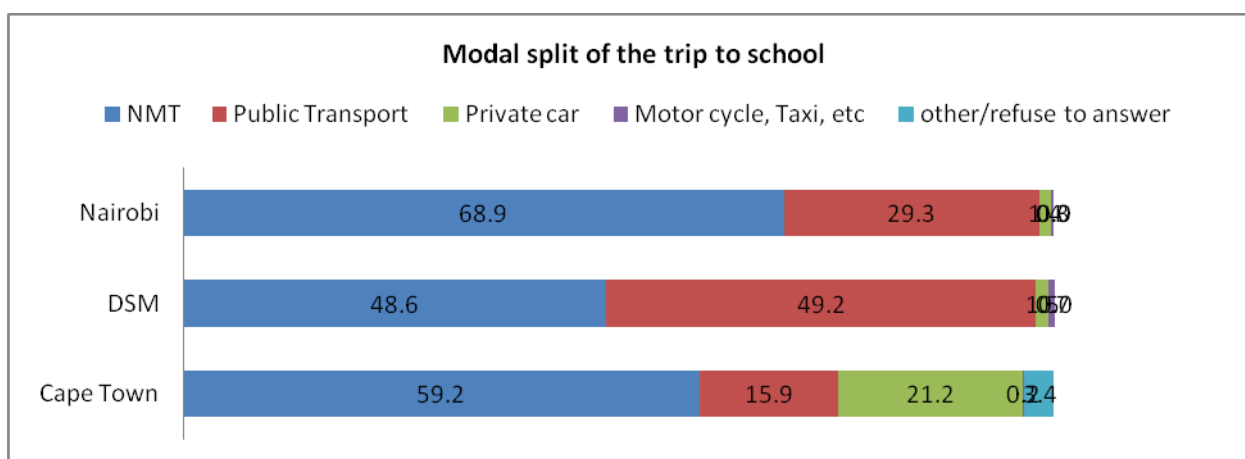


Figure 4: Comparison of modal split of the trip to school

### 3.3 Trip purposes

The activities inducing people to travel are captured by trip purpose. Table 2 presents the percentage of trips for each purpose. The higher proportion for the school trips in Dar es salaam (about twice that of Nairobi) is due to the higher proportion of the school age group 13 to 17 years as shown in Table 1 above (the proportion of this age group in Dar es Salaam is more than twice that of Nairobi). Otherwise the results confirm the similarity of activities taking place in urban centres with variations accounted for by culture, demographics, level of development, income and level of employment among other factors.

Table 2: Comparison of Trips by Purpose

Trip Destination	Cape Town	Dar es Salaam	Nairobi
Home	37.0	45.7	40.2
Work	17.5	15.2	23.2
Pre-school	0.8	0.5	0.8
School	8.9	15.5	7.8
Tertiary education	1.1	0.9	1.2
Shops	5.3	7.2	5.3
Offices/Other places of business	1.1	3.5	0.6
Health/dental care	0.9	0.9	0.7
Family/friend	3.8	4.1	1.9
Entertainment	0.2	0.5	0.3
Restaurant	0.2	1.6	1.3
Sport/recreation	0.6	0.7	0.3
Place of worship	1.2	0.9	0.5
Other place within the city	1.3	0.2	3.2
Other place, outside of the city	0.1	0.1	0.1
Did not go anywhere (else)	20.0	2.6	12.3
Total	100.0	100.0	100.0

The results were compared with travel surveys carried out by JICA in thirteen cities reported in Hyodo *et al* (2005). The cities were Tokyo and Hiroshima (Japan); Tripoli, Damascus, Cairo (Middle East); Phnom Penh, Manila, Chengdu, Jakarta and Kuala



Lumpur (Asia); Belem and Managua (South America) and Bucharest (Europe). The results were broadly comparable except for the lower trip rate of 1.70 for Cape Town compared to the range of 1.97 for Cairo to 2.81 for Tokyo. However, Cape Town's proportion of walking trips (38 percent) was within the typical 30 to 40 percent reported for developing cities while Nairobi's 72 percent and Dar es Salaam's 85 percent were on the higher side. However, the survey methods were not similar.

The results confirm the importance of non-motorised and public transport in all the case study cities including Cape Town where income and car ownership level is higher than Dar es Salaam and Nairobi. However, the share of NMT for the school trip is higher for Nairobi than Dar es Salaam although their income is higher because in Nairobi city schools are located within walking distance whereas this is not the case in Dar es Salaam. Thus in addition to income and population characteristics, urban form is an important factor influencing travel behaviour.

#### **4 CONCLUSION**

The aim of the paper was to report on a comparison of the results of travel survey carried out in Cape Town, Dar es Salaam and Nairobi during approximately the same time, using similar questionnaire and field teams trained and coordinated by one firm.

The comparison of travel behaviour in terms of mode choice for different trip purposes and trip rates between the three cities revealed similarities and differences that can be accounted for by demographics, culture, urban form and transport policies. NMT and public transport play a critical role in all the three cities. Policies to encourage use of NMT and public transport are recommended for the case of Cape Town while Dar es Salaam and Nairobi authorities need to consider how to provide for the high demand for these modes. In addition, the City of Dar es Salaam should address planning issues causing the low proportion of NMT mode usage for the trip to school.

#### **ACKNOWLEDGEMENT**

The authors are grateful to the Volvo Research and Educational Foundations who funded the research through the African Centre of Excellence for Studies in Public and Non-motorised Transport (ACET).

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