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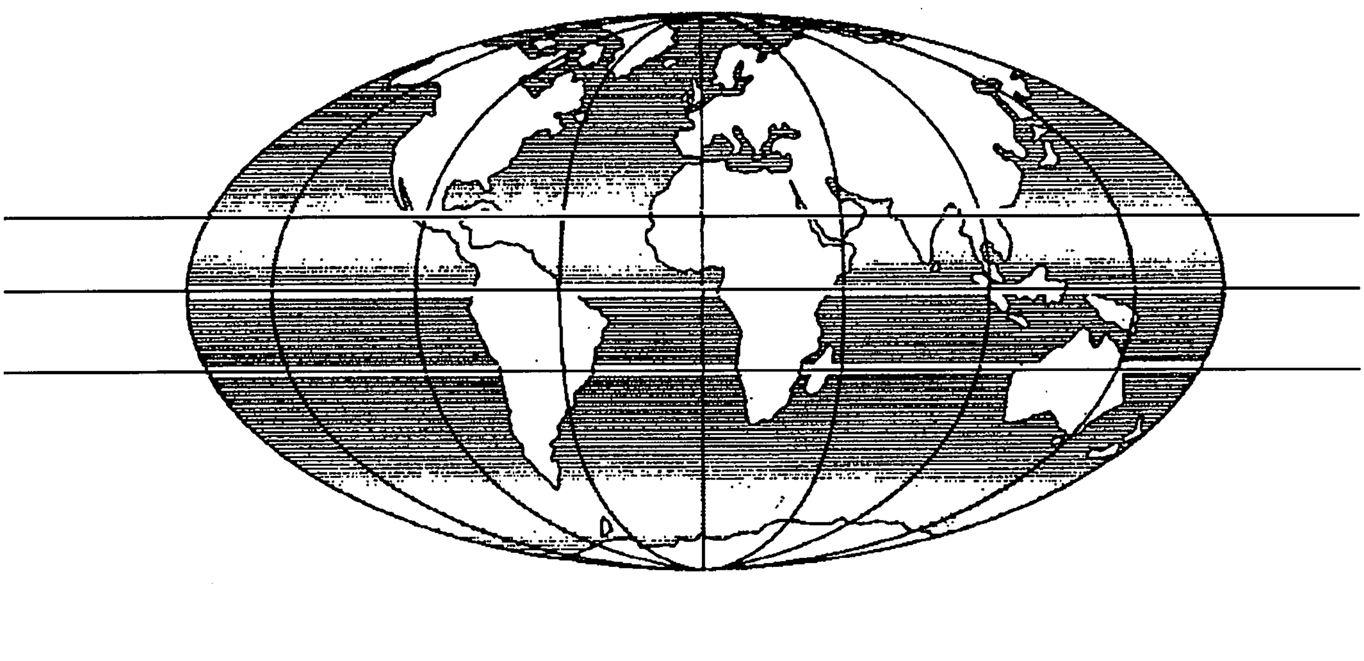
TITLE The urban travel behaviour and constraints of low income households and females in Pune, India

by A Astrop, C Palmer, D Maunder and D M Babu



Overseas Centre
Transport Research Laboratory
Crowthorne Berkshire United Kingdom

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The urban travel behaviour and constraints of low income households and females in Pune, India

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by Angela Astrop, Christian Palmer, David Maunder and D M Babu (CIRT, Pune)

THE URBAN TRAVEL BEHAVIOUR AND CONSTRAINTS OF LOW INCOME HOUSEHOLDS AND FEMALES IN PUNE, INDIA

1. INTRODUCTION

In many cities in developing countries rapid population growth has meant that housing has developed in areas inadequately served by public transport services. This can have an effect on the quality of life of the residents of these areas in terms of access to employment, shopping and medical facilities.

Before resources are allocated to increasing public transport provision in areas inhabited by the urban poor, it is necessary to discover what improvements need to be made to the network. This can be achieved by undertaking surveys of residents on travel demand using a questionnaire to obtain data on frequency and mode of travel, problems incurred when making journeys etc. In addition, it is also necessary to obtain background information on the area studied and the culture of the society being examined, as these factors can have a major influence on travel behaviour.

As part of an Overseas Development Administration funded Technology Development and Research (TDR) programme, the Transport Research Laboratory is undertaking studies of urban travel behaviour in three developing country cities: Accra in Ghana, Medellín in Columbia and Pune in India. Pune was selected as a case study for this project as a large number of residents presently use motorised two wheelers, e.g motorcycles and motorscooters and historically used cycles. In addition, as public transport services comprise suburban rail, stage bus, taxi and autorickshaws it was thought that the residents would have a wide choice of travel mode from journeying on foot to train services. During the 1980's as well, a cycle network was established to encourage the use of cycles within the urban agglomeration. The network was planned to consist of lanes where cycles would be segregated from motor vehicles. Therefore the low income groups of Pune have access to a wide range of public transport services as well as traffic lanes dedicated to cycles should they own and operate one.

The aim of the research is to discover which factors influence travel demand in low income households. In addition, particular emphasis has been placed on understanding the travel behaviour of women, as women are often more disadvantaged than men in terms of access to transport services and infrastructure. The results of the research will provide policy makers with an improved understanding of travel constraints, and will therefore enable them to formulate better transport developmental projects which will in turn, provide improved accessibility to the transport network for low income households (and particularly women) in developing countries.

2. RESEARCH METHODOLOGY

In order to obtain a complete picture of the travel demand and behaviour of household members in Pune, six questionnaire surveys were carried out during May 1996. Firstly a household travel survey was undertaken in nine neighbourhoods. All household members aged sixteen years and over were interviewed in respect of their travel behaviour; the head of the household also answered a series of questions relating to the travel behaviour of any persons under sixteen years of age.

Market trading is a major source of employment for women in India and therefore female market traders were interviewed to ascertain whether their ability to travel to markets with goods was affected by the type of transport available. In addition to these two surveys, interviews of female users of motorised two wheelers (mopeds, motor scooters and motorcycles), female cyclists and women using public transport were also conducted. A number of interviews of male public transport users were undertaken to enable a comparison of public transport usage between men and women.

Both motorcyclists and cyclists were stopped during their journey and interviewed at the roadside. The public transport users (both bus and rail users) were interviewed either on-board the vehicle whilst travelling, or while waiting at the bus stop or station.

In summary, the six surveys composed:

	Sample Size
• Household survey [number of households]	328 (comprising 1005 residents)
• Female Traders	199
• Female Cyclists	204
• Female motorised 2 wheelers users	587
• Female public transport users	788
• Male public transport users	227

3. PUNE METROPOLITAN REGION

Pune is an important regional centre of the State of Maharashtra and is situated 177 km south east of Bombay and covers around 810 square km. The population is now around 2.5 million, compared to 800,000 in 1971, representing an increase of over 200 per cent over the twenty-five year period.

The importance of Pune as an industrial centre has grown rapidly since the 1960's when industrial expansion in Bombay was banned. Consequently Pune has become a major centre in the state, having attracted heavy engineering industry such as motor vehicle manufacturing plants (buses, cars and motorcycles). In addition to this, a number of multi-national companies such as Phillips have manufacturing bases within the city. The industrial expansion of Pune was further aided by the Maharashtra Industrial Development Corporation who offered incentives to encourage industrial growth. Much of the local industry is concentrated along the main Pune-Bombay highway, enabling manufactured goods to be dispatched and supplies given to the factories without having to access the more congested centre of Pune.

Rural to urban drift and the immigration of people from other regions of India has occurred because of the employment opportunities created by rapid industrialisation; this has also led to an acute housing shortage and an increase in slum settlements which are poorly served by transport infrastructure and services. There has been a dramatic increase in the number of educational establishments in Pune over the last 25 years. The corresponding rise in the number of students has placed additional demand on public transport services and the transport system.

4. TRANSPORT PROVISION

4.1 PUBLIC TRANSPORT

Rapid population growth and industrial expansion have placed heavy demands both on the transport infrastructure and public transport services, so that the present transport infrastructure in the city is struggles to keep pace with the increasing population and their travel demands.

Bus services are supplied by Pune Municipal Transport (PMT) and Pimpri-Chinchwad Municipal Transport (PCMT). PMT currently operates 818 buses operating 63,400,000 km of route and transports approximately 227,500,000 passengers per annum; the corresponding figures for PCMT are 248 buses operating 15,500,000 km, and carrying 48,000,000 passengers. Bus fares are charged on the basis of km travelled, and range from the minimum fare of 140 paise for 2 km to 1485 paise for a journey of 60 km.

In more developed countries, bus travel is increasingly viewed as a way of easing congestion in town and city centres, and therefore there has been an increase in the number and variety of bus priority measures in use. However, in Pune, little thought has been given to bus priority measures, and due to the present road layout and driving behaviour, implementation of such measures would be problematic. Financial constraints have made it difficult for the bus companies to expand their fleets, to replace ageing vehicles and to generally provide an efficient service. Bus operations are further hindered by congestion, shortage of road space and a lack of road discipline.

In response to a lack of public transport provision, a number of major manufacturing companies have begun providing commuter bus services for the sole use of their employees thereby guaranteeing that their workforce arrive on time for their shifts. There are around 4000 company buses in Pune, which is over four times the number of public buses, and therefore suggests that there is considerable under-provision in the public sector service at the present time.

In addition to local bus services, there are also a number of inter-city bus routes which offer services between Pune and other major cities such as Bombay, Bangalore and Hyderabad. A number of different standards of service are on offer, ranging from express air conditioned buses to stopping services; the price of the journey is reflected in the quality of the service.

Since 1977 there has been an airport at Pune. As well as daily flights to Bombay (where connections can be made to both domestic and international flights) there are less frequent flights to other destinations in India. The local airport has recently been refurbished to offer a higher quality to aid passenger comfort.

Pune is connected by rail to Bombay, Hyderabad, Madras and Miraj-Kolhapur. Many people use these services to commute daily either to or from Pune. There are currently 2515 taxis in Pune (of which 1900 are tourist cars); these taxis tend not to provide services within Pune; rather they serve inter-city routes from Pune to Bombay, Thane, Nasik, Ahmednagar, Kolhapur and Aurangabad.

Autorickshaws have replaced horse drawn tongas as the major form of intermediate public transport in Pune. They operate anywhere within Pune and are the major operator of taxi services within the city. Autorickshaws tend to serve areas with poor bus service provision and offer a relatively cheap source of transport; for example, they are used to transport groups of children to school. The growth in the number of auto rickshaws along with other vehicles is shown in Table 1. The data illustrates the dramatic increase in the number of auto rickshaws which has occurred over the last 25 years.

Table 1 Growth in the number of registered mechanised vehicles

	1960	1970	1980	1994
Public Bus			434	994
Truck	1590	3628	8302	21008
L.C.V.	18	333	2506	5432
Car, jeep, taxi	2658	7565	13962	37208
Autorickshaw	207	2560	11038	22093
Two-wheeler	1315	15048	72040	295008
Other	185	844	1753	2341

4.2 PRIVATE TRANSPORT

Historically, Pune was known as the "cycle city of India", however cycling has decreased in popularity as the ownership and use of motorised two-wheelers has increased. There has been rapid growth in the number of motorised two wheeled vehicles so that there are currently around 118 motorised two wheelers per 1000 population compared to 5.0 in 1965. The growth in motorised two wheelers is shown in Table 1. As a result of this growth, lanes dedicated for cycle users are now mainly used by motorised two wheeler users.

The growth in private car ownership has been slow due to the high purchasing and operating costs. In 1975 there were 7.2 cars per 1,000 population, by 1994 this had approximately doubled to 14. This contrasts with 337 cars per 1000 population in Great Britain in 1995 (Dept of Transport Statistical Services). Clearly, the motorised two-wheeler is the 'motor car' of the middle income of India.

5. HOUSEHOLD SURVEY

5.1 INTRODUCTION

The aim of the household survey was to obtain information about individuals' travel patterns and attitudes and relate them to various household variables such as income, structure and location with respect to the central business district (CBD). Two research tools were developed specifically for this task, both taking the form of an interviewer-administered questionnaire. The first questionnaire (general travel survey) concentrated on information about individuals, the second (head of household survey) sought information about the household.

For the purposes of the study a team of interviewers were employed who were able to speak English, Hindi (the language of Northern India) and Maharati (the local language). This ensured ease of communication between survey supervisors and the survey team, and between the survey team and interviewees.

The survey teams visited households in pairs; one would ask the questions whilst the other recorded the responses. Such a design allowed the interview to flow without the need for pauses, and gave the process a more 'natural' feel. The team were instructed to administer the first questionnaire individually to all members of the household who were present, over the age of 16 years. When this had been completed the team were then required to administer the second questionnaire to the head of the household, or where this person was unavailable, to the most senior member present.

5.1.2 DESIGN AND SUBJECTS

Household income and distance from the home to the CBD are two variables of particular importance to the study. The 328 households (taken from over 100 housing areas) approached were therefore classified in terms of a measure of per capita income and distance from the CBD. The criteria used for classification are as follows:

	Per capita income	**Distance from CBD**
Low/near	Rs 0 - 1250	0 - 3 Km
Mid	Rs 1251-2500	3 - 9 Km
High/far	Rs 2501 or more	more than 9 Km

The number of households and individuals interviewed in each segment of the matrix are given in Table 2.

Table 2: Number of households and individuals interviewed

	HOUSEHOLDS				INDIVIDUALS			
	Income				Income			
DISTANCE	Low	Mid	High	Total	Low	Mid	High	Total
Near	46	23	15	84	174	73	68	315
Mid	55	62	29	146	179	174	76	429
Far	25	52	21	98	73	142	46	261
TOTAL	126	137	65	328	426	389	190	1005

5.2 RESULTS

5.2.1 INTRODUCTION

Whilst in effect there are eighteen experimental groups (three by three matrix by sex), it was decided that for the purposes of analysis, comparisons between all possible group pairs would be too complicated as well as unnecessary (because the emphasis of the study is on the behaviour of the urban poor). Accordingly the analysis has been completed on two levels. In Section 5.2.2 the distance grouping have been collapsed, allowing income groups to be compared whilst, section 5.2.3 looks at the low income group, but compares male and female respondents.

5.2.2 DIFFERENCES BETWEEN INCOME GROUPS

5.2.2.1 Demographic differences

Table 3 shows the means for a number of demographic and household variables. It should be remembered that households were assigned to groups on the basis of measured per capita income, defined as income per person over the age of 16 years (<u>not</u> income divided by household size).

Table 3: Demographic and household variables

	Income Group		
	Low	**Mid**	**High**
Percentage of male respondents	58%	60%	58%
Mean age of respondent	35.8	36.0	36.9
Percentage of male household heads	95%	90%	81%
Age of head of household	45	43	43
Household size **	6.3	4.7	4.3
Household income (Rs) **	3211	5956	18389
Per capita income (Rs)**	742	1755	5801
Transport expense (Rs)**	446	815	2031
Transport expense as % of household income	15.5%	14.0%	13.5%

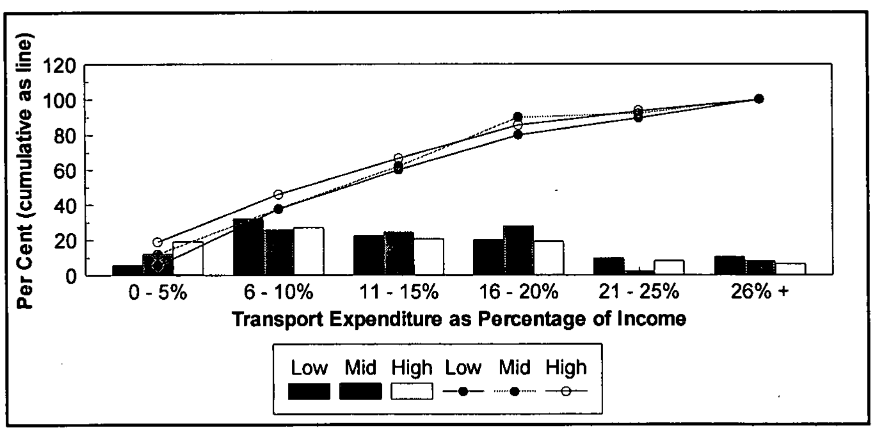
** indicates significance better than 0.1%

Household size decreases from low through mid to high income households. This is as one would expect in the developing world. It is interesting that there is a higher percentage of female household heads in the high income group than in the low income group. This could be related to either household size or household income. Large households are perhaps more likely to be able to provide a suitable male replacement in the event of death or other absence. In relation to the latter, having significant wealth is likely to allow a female rather more independence or respect, and thus the ability to run the household without the need to find a male replacement.

Whilst it is not statistically significant, the final statistic - percentage of household income spent on transport - is interesting and is consistent with the findings of a number of other studies of households in India (e.g Maunder, 1984). It should be noted that these figures have been calculated using data pairs (income and expenditure) for individual households, rather than using group means. Figure 1 further illuminates the expenditure data, and shows frequency values for the three income groups for grouped percentage expenditure.. The line corresponds to cumulative frequency. The graph demonstrates the reason for the non-significance of the result, namely the large spread of figures with respect to the magnitude of the mean.

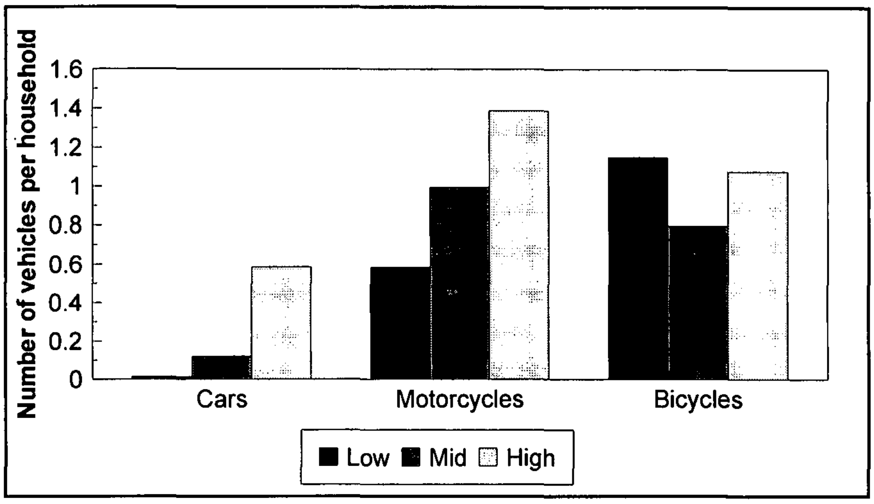
Vehicle ownership varies greatly between groups. This can be seen in Figure 2 which shows the mean ownership rates for cars, motorcycles and bicycles for households in the three income bands.

Figure 1: Relationship between income group and transport expenditure



All three groups have a level of bicycle ownership at around one per household. Ownership of both cars and motorised two-wheelers follows the predicted relationship with rising household income; these are expensive item to own and operate.

Figure 2: Vehicle ownership levels



5.2.2.2 General trip characteristics

Respondents were asked a number of questions about the journeys that they make. These questions were posed in two different ways: First respondents were asked about the journeys that they make regularly; secondly they were asked about journeys for specific purposes.

Before commencing detailed analysis of the data it is worth discussing general differences between the income groups. Table 4 shows the mean number of (return) trips made each day by individuals from the three income bands. It can be seen that the three groups are remarkably similar. To find differences in trip rates one must investigate trips for specific purposes (see Sections 5.2.2.3 to 5.2.2.5).

Table 4: Daily per capita trip rates

	Income Group		
	Low	**Mid**	**High**
Number of return trips per day	1.03	1.04	1.02

Modal choice is a variable of considerable interest, since it is likely to be highly affected by income levels. Figure 3 shows the proportion of trips made by the income groups using different modes. There are obvious differences between the groups in modal choice. For instance, the use of motor cars increases with income. The same is true of motorised two-wheelers, although in all three groups a significant number of trips are made by this mode.

The modes incurring little or no cost are favoured by the low-income group which is predictable. Interestingly, a higher proportion of trips are made by autorickshaw by the lower income group than by the higher income group, despite being expensive (compared to the bus). It could be that the higher income groups simply do not like to travel by autorickshaw, and the decision is not financial. An alternative explanation - supported by the finding that the high income group also make less journeys by bus - is that high income individuals do not need to use these modes because of their high levels of motorised vehicle ownership.

Figure 3: Modal choice by income group; all trips

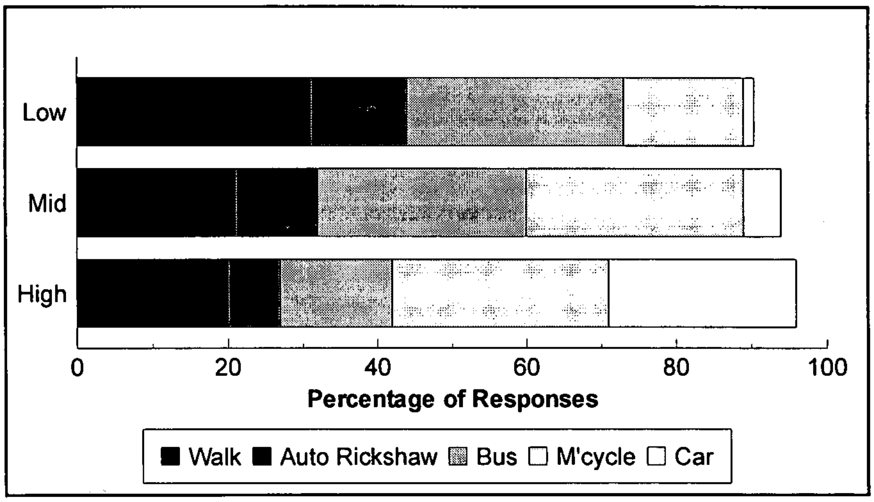


Table 5 shows the mean journey distance by mode for the income groups. As one might expect, the low income group travel further using cheaper, more effortful modes (walk and bicycle) than the higher income groups, although for cycling the difference is only marginal.. The high income group travel further by car, motorcycle and bus than the low income group. This difference is reflected in differences in mean journey distance for all modes.

Table 5: Mean journey distance, by mode (km)

	Income Group		
	Low	**Mid**	**High**
Private car	3.5	8.0	11.2
M'cycle/scooter	6.9	8.0	8.1
Bicycle	4.3	3.9	4.2
Public Bus	7.9	9.5	10.5
Auto rickshaw	4.0	5.1	3.3
Walk	2.0	1.3	0.9
All modes	5.4	7.2	7.1

5.2.2.3 Work trips

The frequency of work trips was more or less uniform across the whole population, with most people working five days per week or more. Table 6 gives details about work trip frequency.

It should be noted that this Table, and all similar Tables for specific journeys in this report, only includes those respondents who responded that they do make trips for this purpose, and excludes all 'negative' responses. For work trips 48 per cent of the low, 53 per cent of the mid and 47 per cent of the high income groups reported making at least some trips for work purposes.

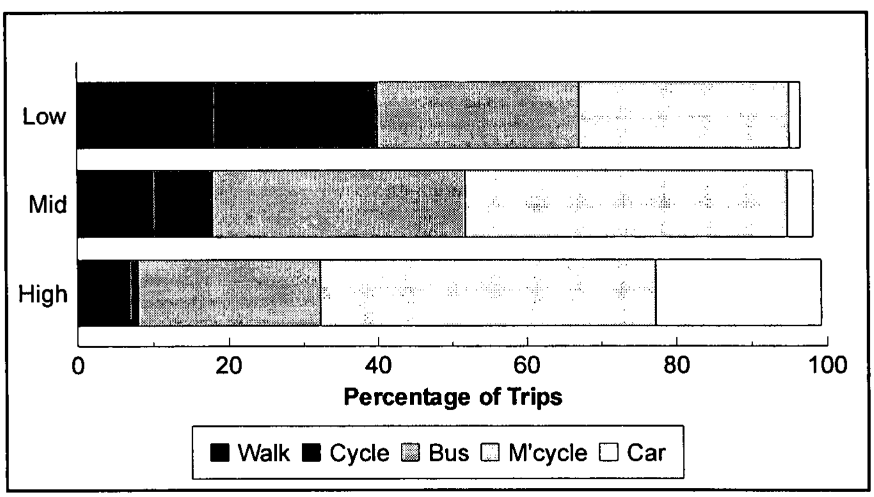
Table 6: Frequency of work trips

	Income Group		
	Low	**Mid**	**High**
5 times per week or more	92%	96%	90%
2-4 times per week	2%	2%	6%
Once a week or less	6%	2%	4%

Figure 4 shows inter-group differences in modal choice for work trips. It can be seen that walking as a mode of transport is more highly favoured by individuals from low income households. Cycling also follows a similar pattern. The opposite trend clearly occurs in relation to travel by car, and to a lesser extent to travel by motorcycle/scooter. It is interesting to note that the most common mode of transport (the modal mode) for all three groups is the motorised two-wheeler (motorcycle), reflecting the rise in ownership of these vehicles.

The percentage of trips made by personal motorised vehicles equates to 30 per cent, 47 per cent and 67 per cent for low, mid and high income individuals respectively. For personal non-motorised travel (walk and cycle) the figures are 40 per cent, 18 per cent and 8 per cent respectively. This relationship is probably related not only to income but also to the distance that the three groups tend to travel for work journeys (6.2 km, 9.7 km and 11.0 km respectively)

Figure 4: Modal choice by income group; work trips



Buses, both public and company owned, are utilised for a considerable percentage of work journeys: 27%, 34% and 25% respectively. Therefore, even though utilisation of local trains and auto rickshaws for work trips appears to be low, public transport carries a significant number of people to work, regardless of income group.

5.2.2.4 Shopping trips

Table 7 illustrates the frequency of travel of individuals for shopping purposes. A much higher proportion of the low income group (80 per cent) reported making shopping trips than either the mid (53 per cent) or the high (47 per cent) income groups. This suggests that in low income households there is more sharing of household duties between members.

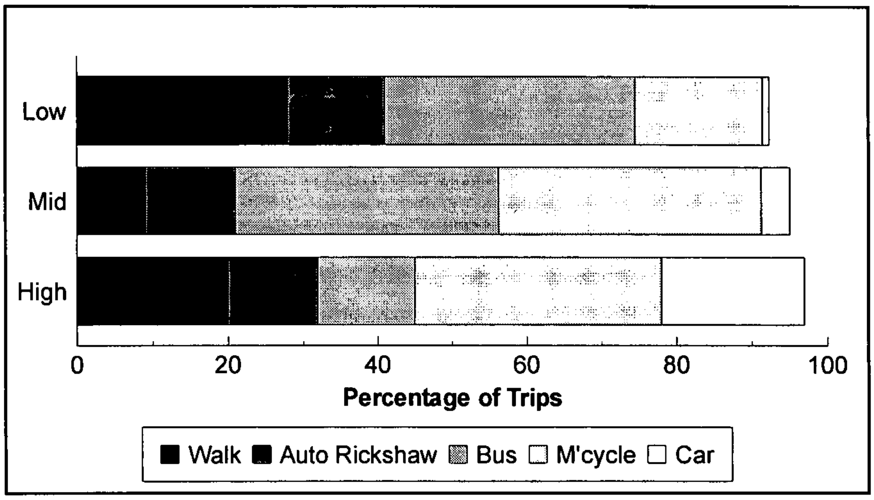
Table 7: Frequency of shopping trips

	Income Group		
	Low	**Mid**	**High**
5 times per week or more	11%	2%	6%
2-4 times per week	12%	13%	16%
Once a week	42%	38%	44%
Once a fortnight	7%	9%	12%
Once a month or less	23%	34%	19%
As required	5%	5%	4%

For all three groups the modal frequency response was 'once per week'. The pattern of responses for three groups are similar. However, individuals from low income families are much more likely to shop five times per week or more, compared to the mid and high income groups. Since many low wage jobs are in the informal sector they are usually paid daily, and thus it is often impossible to purchase more than one days supplies.

The pattern of modal choice for shopping trips differs from that for employment purposes, and is shown in Figure 5.

Figure 5: Modal choice by income group; shopping trips



The relationship between modal choice and income is not so distinct, especially for less costly modes. For example, both low and high income groups make a higher percentage of walk trips than the mid-income group. This is likely to be a result of differences in mean journey length, which is 4.5 km, 6.0 km and 3.8 km for low, mid and high income groups respectively.

For high-cost modes - cars and motorcycles - the expected pattern is found; usage increases with income. The percentage of trips made by personal motorised vehicles is 18%, 39%, and 52% respectively for the three groups. The percentage of trips made by personal non-motorised modes are 36 per cent, 13 per cent and 22 per cent respectively. Public transport, in the form of buses and auto rickshaws, is used by many individuals from all three groups, being utilised for 46 per cent, 47 per cent and 25 per cent of journeys respectively.

For shopping trips the three groups differ in terms of the modal mode. For the low income group it is the bus which is most frequently used (32% of journeys); for mid and high income groups it is the motorcycle/scooter (35% and 33% respectively).

5.2.2.5 Education trips

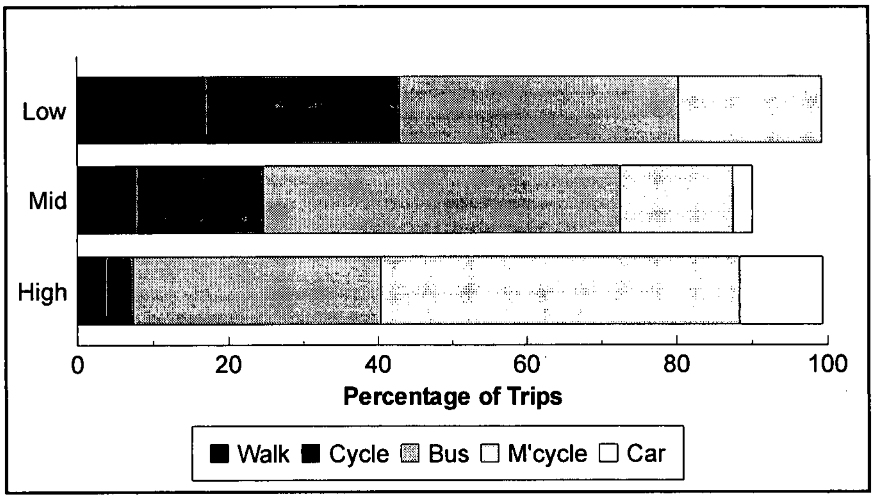
Many of the people interviewed were students (23 per cent, 20 per cent and 17 per cent of the groups respectively reported making trips for education purposes) and therefore information about journeys to education establishments was obtained. Table 8 shows the trip frequency for the three groups. As would be expected a vast majority individuals travel at least five times per week. Only the high income group has a notable number of individuals who travel less frequently for education purposes. The mean age of the high income group is slightly higher than that for the other groups. This fact, combined with the likelihood of this group having more disposable income, could suggest that a higher number of the high income group attend night school, which involves expense, and is unlikely to involve travel more than twice per week.

Table 8: Frequency of education trips

	Income Group		
	Low	**Mid**	**High**
5 times per week or more	80%	81%	69%
2-4 times per week	3%	3%	10%
Once a week	5%	4%	10%
Less than once a week	12%	12%	11%

Modal choice for education trips is shown in Figure 6. The distribution of modes is similar to that found for work trips.

Figure 6: Modal choice by income group; education trips



A considerable number (59 per cent) of trips are undertaken by personal motor vehicle by the high income group, presumably a result of parents giving a lift to other young adults. The bus is a popular mode with all three groups, but especially the low and mid income groups. The bicycle is predominantly used by the low income group. Mean journey distances are 6.7 km, 7.3 km and 10.5 km respectively.

5.2.3 LOW INCOME HOUSEHOLDS: GENDER DIFFERENCES

The results from the household survey suggest that females are not often in a strong bargaining position when it comes to the utilisation of vehicles owned by the household. In addition, public opinion, tends to be against women using two-wheelers - the fastest growing transport mode (although these opinions are changing). Therefore one would expect the travel behaviour of men and women to differ.

5.2.3.1 Demographic differences

Table 9 shows the sex split of the low income group and shows mean age. It can be seen that more males than females were interviewed, but enough females responded to have confidence in the data. The men were, on average, slightly younger than the women, but this difference is not significant.

Table 9: Number and mean age of respondents

	Male	Female
Number of respondents	103	74
Mean age	34.6	37.8

5.2.3.2 General trip characteristics

Table 10 shows the mean trip rates for men and women. Men make significantly more return trips than women. The explanation is likely to be that more men report making trips for work than women (see Section 5.2.4.3) and thus many make an extra five return journeys per week.

Table 10: Daily per capita trip rates

	Male	Female
Number of return trips per day	1.21	0.79

Figure 7 shows the modal choice (all trips) for men and women. Obvious differences exist; far fewer women ride motorised two-wheelers and bicycles than men. Instead women make a higher proportion of trips by walking and by bus. Possible explanations for this are given in the subsequent sections.

Figure 7: Modal choice by sex; all trips

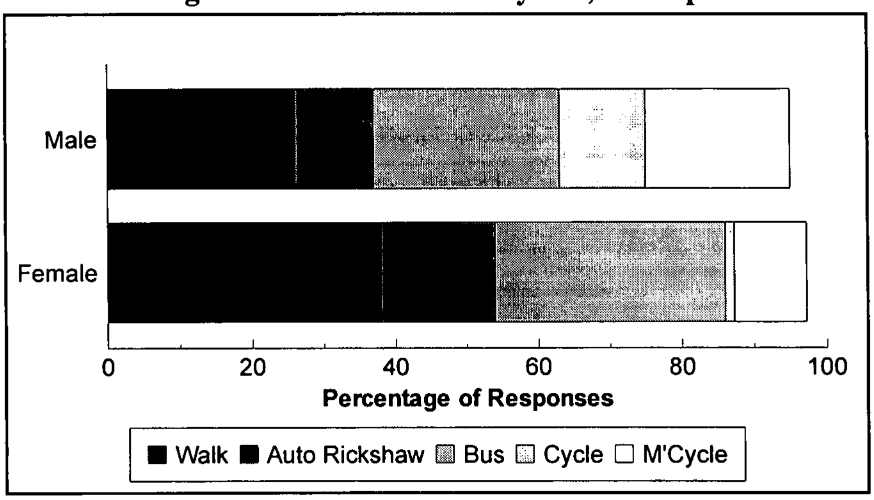


Table 11 gives the mean journey length by mode for the sexes. Men on average have marginally longer journeys than women by 0.5 km. This is mainly due to larger distances travelled by bus. For the other modes the two groups are fairly comparable.

Table 11: Mean journey length by mode

	Male	Female
Motorcycle/scooter	4.2	4.7
Bicycle	2.1	1.0
Public bus	8.4	7.2
Auto rickshaw	3.0	3.3
Walk	2.4	2.4
All modes	4.2	3.7

5.2.3.3 Work trips

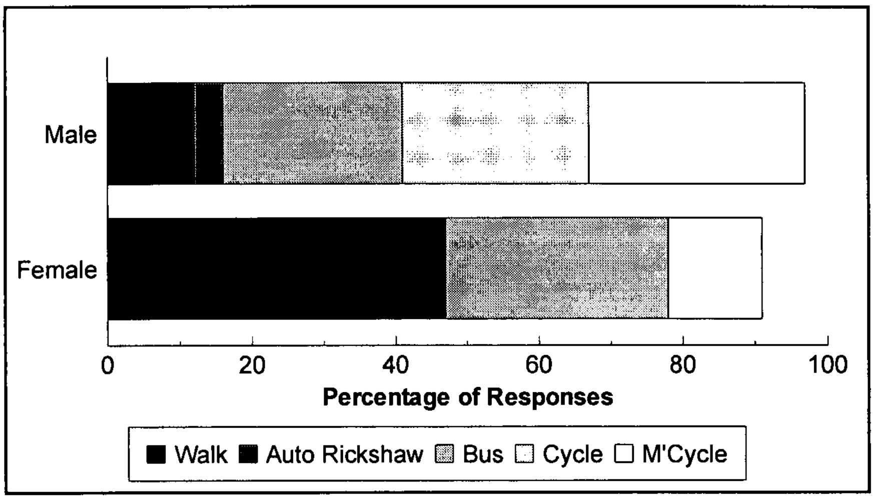
Frequency of making work trips is shown in Table 12. As one would expect the modal response for both males and females is working 'at least five times per week'. It is interesting to note that it is more common for women to work less than five times per week than men, which implies that more women are employed on a part-time basis. A much higher proportion of men than women make work trips: 68 per cent compared to 19 per cent. Thus from the sample it is evident that far fewer women than men are employed and so need to travel for such a purpose.

Table 12: Frequency of making work trips

	Male	Female
Five times or more	93%	83%
2-4 times per week	2%	3%
Once a week or less	5%	14%

Figure 8 illustrates considerable differences between the sexes in terms of modal choice.

Figure 8: Modal choice by sex; work trips



The modal mode for women is walking, whereas for men it is the motorcycle or scooter. This difference may be explained in part by the fact that the mean home to work journey is shorter for women than men (4.6 km compared to 6.5 km). However, there are obviously many women who travel considerable distances to work (the *mean* is 4.6km). It would appear that these women take the bus rather than use a bicycle or motorised two-wheeler.

The difference is likely to be for two reasons. Firstly, women tend not to have the same degree of access to family-owned vehicles as men. Secondly, women's perceptions of the safety of bicycles and two-wheelers tend to be lower than those of men (see Section 5.2.3.6). Therefore, even when a woman has access to such modes she may prefer to walk or catch a bus (although this may not be the case for affluent females).

5.2.3.4 Shopping trips

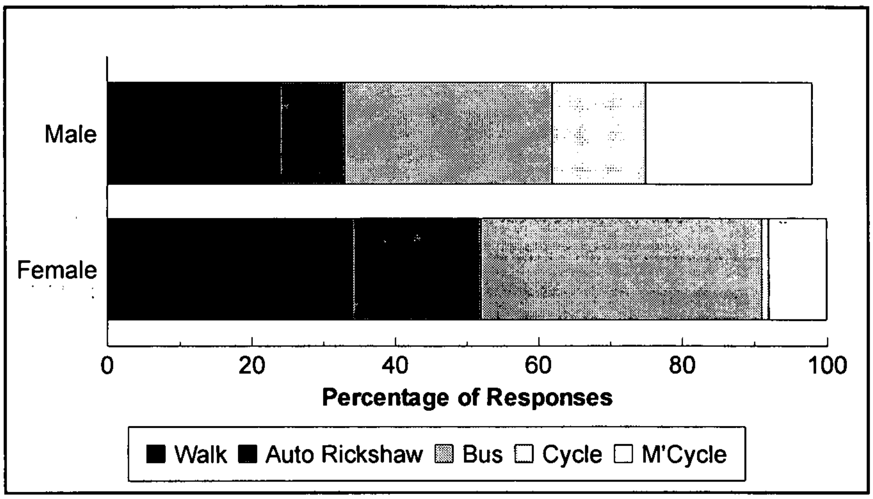
Frequency of making shopping trips is shown in Table 13. As for work trips, the two sexes demonstrate similar frequency patterns, although women do tend to shop slightly more frequently. Similar proportions of the two groups reported ever making shopping trips: 76 per cent for males and 79 per cent for females.

Table 13: Frequency of making shopping trips

	Male	Female
Five times or more	9%	11%
2-4 times per week	11%	14%
Once a week	41%	43%
Once a fortnight or less	39%	32%

Figure 9 shows modal choice for the two sexes. As with work trips, there are differences in modal choice.

Figure 9: Modal choice by sex; shopping trips



Unlike work trips, males and females have the same modal mode for shopping trips, namely the bus. Other than this, however, the patterns are largely the same as for work trips; more women than men travel by foot whereas men more frequently use a motorcycle/scooter.

Both sexes make more use of the autorickshaw for shopping than they do for either work or education trips. This is likely to be due to a trade off between cost and frequency, and the convenience offered by the mode needing to carry a heavy load. Males and females travel approximately the same distance for shopping trips, i.e. males 5.0 km and females 4.3 km.

5.2.3.5 Education trips

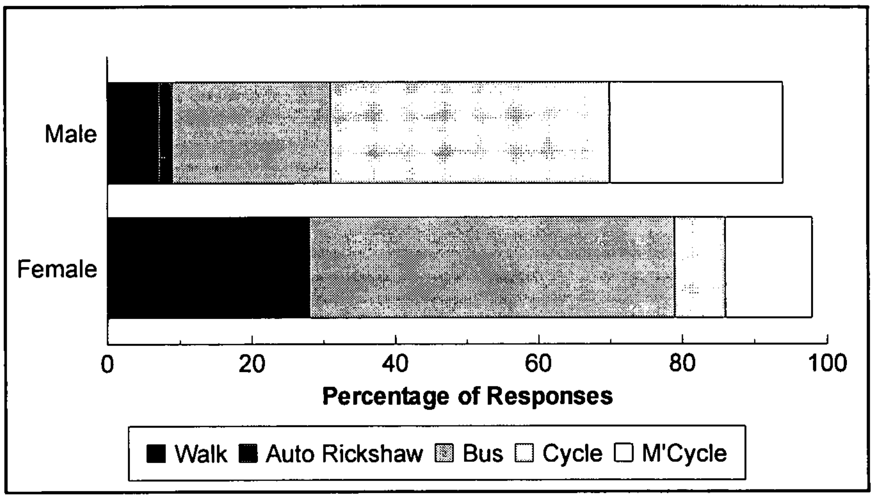
The frequency of making education trips is shown in Table 14. For males 21 per cent reported making education trips; for females 23 per cent.

Table 14: Frequency of making education trips

	Male	Female
Five times or more	82%	76%
2-4 times per week	4%	2%
Once a week or less	14%	12%

The pattern for the two sexes is similar. As with work and shopping trips, however, the pattern of modal choice differs. See Figure 10.

Figure 10: Modal choice by sex; education trips



The modal mode for females is the bus, whereas for men it is the bicycle. Few women (19 per cent) use either a bicycle or a motorised two-wheeler, whereas 63 per cent of men use one of these two modes. This reflects the pattern previously found, i.e. two-wheelers being less frequently used by women and more frequently used by men.

For education trips, males tend to travel slightly further than women (7.4 km compared to 6.0 km).

5.2.3.6 Attitudes towards private vehicles

Figure 11 shows the affirmative responses of males and females in relation to bicycles. Considerably more men than women ever make a journey by bicycle. In addition, men rate bicycles as being significantly safer and more comfortable than women. Quite which of these factors causes the other is impossible to discern.

Figure 11: Attitudes towards bicycles

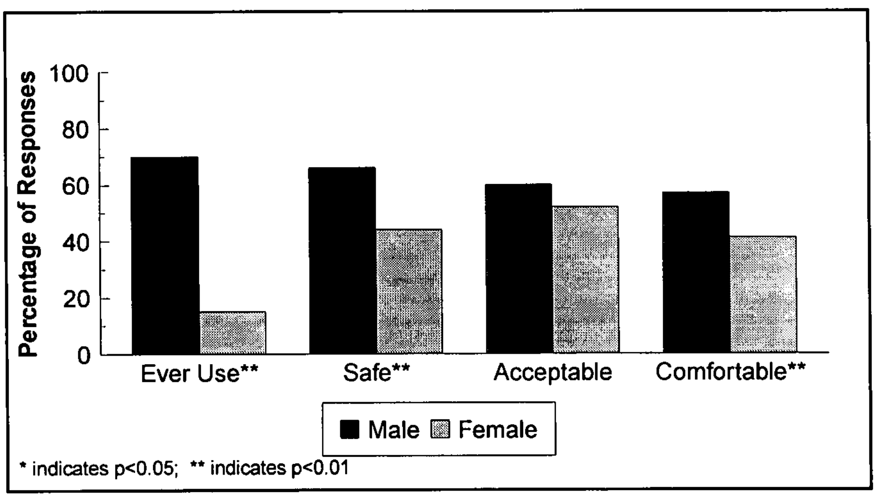
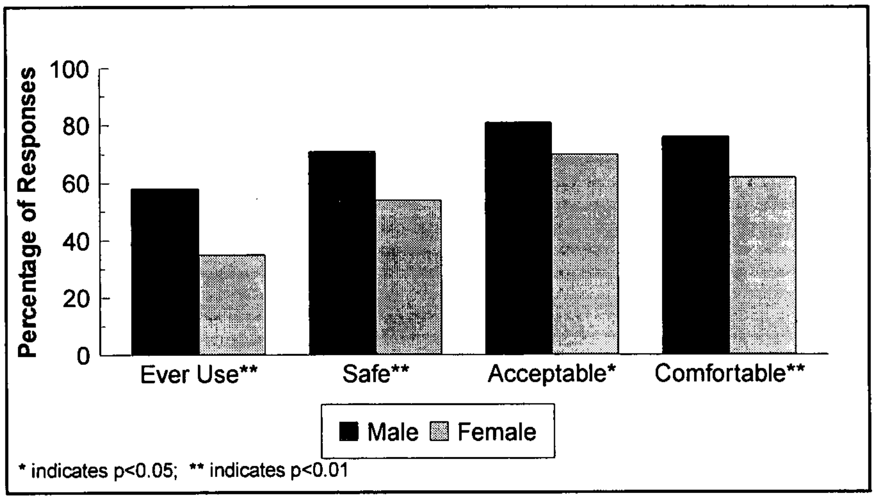


Figure 12 shows the responses for motorcycles/scooters. Fewer men ride a motorised two-wheeler than ride a bicycle, whereas the opposite is true for women. Nevertheless, significantly more men ride a motorised two-wheeler than women. As previously mentioned, public opinion has been against women riding two-wheelers, which may in part explain the finding. However, public opinion has been changing over time, and so in future one would expect an increase in the number of female two-wheeler users. Section 6 deals exclusively with women and two-wheeled transport.

Figure 12: Attitudes towards motorcycles/scooters



Similar patterns exist for the other questions. Whilst women rate motorcycles/scooters more highly than they rate bicycles, men remain significantly more positive.

5.2.3.7 Attitudes towards public transport

Table 15 shows the complaints that males and females have about the use of public transport. The most interesting finding is that a higher proportion of women rate overcrowding as a problem. This is understandable since sexual harassment (known as 'Eve-teasing') is common on public transport vehicles.

Table 15: Problems of using public transport

	Male	Female
Overcrowding	28%	41%
Rude/cheating staff	5%	6%
Too expensive	1%	3%
Not enough buses/routes	14%	8%
Have to wait too long	25%	18%
Irregular	15%	19%
Other	12%	5%

As previously found, suggested improvements (see Table 16) are linked to perceived problems. It is of interest to note however that very few women want to see the introduction of female-only buses (as opposed to the very popular women-only carriages on trains). Instead of single-sex buses, women would like to simply see more buses operating, and thereby reducing the overcrowding which is so evident at times.

Table 16: Suggested improvements to public transport

	Male	Female
Improve regularity	45%	39%
Better staff behaviour	3%	5%
More buses	21%	32%
Improve punctuality	13%	11%
Make cheaper	3%	5%
Introduce female-only buses	-	2%
Other	15%	6%

6. WOMEN AND TWO WHEELED VEHICLES

6.1 INTRODUCTION

In many developing countries, bicycles have grown in popularity as a means of personal transport as they offer a relatively cheap form of travel once they have been purchased. As income levels rise however, cycles tend to be replaced by motorised two wheelers such as motorscooters, mopeds and motorcycles, particularly among middle income groups.

6.2.2 MARITAL STATUS

In both surveys, a large proportion of the respondents were single, though a higher proportion of motorscooter users were married (see Table 18) probably due to the fact that a larger percentage of the cyclists were below the current marriageable age of 18 years for females, though in practice this legal restriction is not always conformed to.

Table 18: Marital Status

	Cyclists	Moped/Motorscooter users
Single	63.6%	46.8%
Married	36.4%	52.7%
Widowed	-	0.5%
Divorced/separated	-	-

6.2.3 INCOME, EMPLOYMENT AND EDUCATION

The respondents were asked their occupation and salary. The results are shown in Table 19. Only 20 percent of the sample of cyclists were in paid employment compared to 60 percent of the motorscooter users (as stated previously, a large proportion of the cyclists were students). The income levels for the cyclists are relatively low suggesting that maybe a large number are in some form of part-time employment, possibly fitting in with their educational commitments. The mean monthly income of the cyclists was one third of that of the motorscooter users.

TABLE 19: Occupation and monthly income

	Cyclists	Moped/Motorscooter users
Student	68.9%	35.3%
Housewife	9.8%	4.4%
Clerical/admin.	2.9%	9.1%
Tertiary	17.8	43.9%
Professional	-	6.4%
Other	0.6%	0.9%
Mean monthly income	Rs 1505	Rs 4540

The mean cost of purchasing a vehicle was Rs 1275 for a bicycle and Rs 20115 for a Moped/motorscooter. In general, female motorscooter users are more highly qualified than female cyclists and mean monthly income tends to reflect this.

6.2.4 ACCESS TO VEHICLES AND VEHICLE OWNERSHIP

Vehicle ownership is shown in Table 20. A larger proportion of the moped/motorscooters users than cyclists personally owned their vehicle. Also a much higher percentage of motorscooters than cycles were owned by the respondents' husbands (although, as stated previously, more motorscooter users were married than cyclists).

Table 20: Vehicle ownership

	Cyclists	Moped/Motorscooter users
Respondent	32.1%	38.8%
Husband	5.7%	21.1%
Family	62.2%	39.1%
Other	-	1.0%

Despite the fact that around two thirds of both samples replied that their vehicle was owned by husbands and other family members, over 90 percent of cyclists and 80 percent of the motorscooter users stated that they had access to the vehicle whenever they wanted it (see Table 21). Thus, the vehicles were only used by other family members when they were not required by the respondent. This appears to contradict the findings of section 5.2.3, which suggests that women take the bus or walk because the men use the motorcycle/scooter. It is important to remember, however, that the two populations are different; Section 5.2.3 looked at all low-income members, whereas the present section concentrates on women who *actually ride* two-wheelers and thus are not subject to the same constraints. Other key users of the household owned vehicles include husbands, parents and brothers/sisters.

Table 21: Access to vehicle

	Cyclists	Motorscooter/Moped users
Whenever want it	28.2%	31.2%
Most of the time	63.0%	49.0%
Sometimes	6.6%	18.0%
Rarely	2.2%	1.8%

Table 22 shows that around 60 percent of respondents in both samples had purchased the vehicle themselves. A greater proportion of cyclists than motorscooter users purchased their vehicle using their own funds, but around four times as many motorscooter users as cyclists obtained loans to purchase their vehicle - presumably due to the relatively high purchase cost of the vehicle.

Table 22: How the vehicle was purchased

	Cyclists	Moped/Motorscooter users
Own funds	40.2%	34.6%
Loan/ Hire Purchase	5.9%	21.0%
Gifts	13.2%	3.6%
Other	0.5%	1.2%
Vehicle not purchased by respondent	40.2%	39.7%

Table 23 shows other personal vehicles available to the household. The motorscooter users generally have more vehicles available within the household than the cyclists interviewed. They also have around double the number of motorised two wheelers and four times as many cars. This obviously reflects a greater degree of affluence of motorscooter users as illustrated in Table 19.

Table 23: Additional vehicles available to the household

Vehicle	Cyclists	Moped/Motorscooter users
Car	4.9%	21.5%
Other bicycle	46.6%	42.1%
Other motorised two wheeler	38.7%	63.5%

Note: Percentages add up to more than one hundred percent in the motorcycle users column because some households have access to more than one additional vehicle.

6.3 PUBLIC TRANSPORT USAGE

Around 75 percent of the female cyclists interviewed and 98 percent of motorscooter users also use public transport services to make journeys. The frequency with which these respondents use public transport is illustrated in Table 24. The motorscooter users tend to use public transport services "as required". This can cover a number of responses ranging from using public transport daily to once a year, but does suggest usage on a non-regular basis. This also suggests a greater degree of affluence among the motorscooter users as they can make use of public transport when they choose to do so. It is also possible that the respondents live in areas better served by public transport.

Table 24: Frequency of use of Public Transport

	Cyclists	Moped/Motorscooter users
Five times a week or more	-	2.8%
Two - four times a week	24.1%	7.1%
Once per week	22.7%	10.8%
Once per fortnight	12.1%	5.9%
Once per month	7.1%	8.0%
Less than once a month/occasionally	11.3%	5.9%
As required	22.7%	59.5%

Note: These are responses given by the cyclists and motorscooter users who stated that they used public transport to make journeys, and it includes trips by bus, train and auto rickshaw.

6.4 JOURNEY PURPOSE

When interviewed the main journey purpose for female motorscooter users was 'travelling to or from work', and for the cyclists it was for 'educational purposes'. A relatively small proportion of journeys being made at the time of interview for both samples was for 'shopping purposes', but Table 25 shows that for both sets of respondents, shopping trips account for a large proportion of 'other' journey purposes (25 and 60 percent for cyclists and motorscooter users respectively). The higher percentage of shopping trips undertaken by the motorscooter users may be accounted for by the fact that a larger proportion of these respondents are married and therefore the responsibility for buying food for the household is more likely to lie with them than in cases where the respondents are unmarried. In addition, the higher income of the motorscooter users may mean that they are more likely to undertake shopping as a leisure activity. Other activities using the two wheelers include social, medical and educational activities, the latter mainly by cyclists (see Table 26).

Table 25: Purpose of the trip being made

	Cyclists	Moped/Motorscooter users
Travelling to/from work	30.8%	46.5%
Shopping	8.7%	14.7%
Social	3.1%	2.6%
Medical	1.5%	3.9%
Education	48.2%	29.6%
Other	7.7%	2.7%

Table 26: Additional journeys made using the vehicle

	Cyclists	Moped/Motorscooter users
Travelling to/from work	14.2%	6.8%
Shopping	25.0%	60.0%
Social	25.5%	10.7%
Medical	10.8%	4.3%
Education	33.8%	5.8%
Other	7.8%	4.9%

Note: the columns add up to more than 100 percent because some respondents made additional journeys for more than one purpose.

The benefits that the respondents perceive from using their vehicle rather than public transport are shown in Table 27. For female cyclists, the modal response was that it was cheaper. However, for the female motorscooter users the modal response was that "by using their vehicle they would save time", or "arrive at their destination on time." As stated previously, a large proportion of motorscooter users were making work journeys and therefore ensuring that they arrive on time is obviously important. Cost is clearly of marginal importance to motorcycle owners as opposed to comfort and convenience which are far more important.

Table 27: Benefits of using the vehicle (percent)

	Cyclists	Moped/ Motorscooter users
Time saving/arrive on time	9.8	51.4
Cost saving	51.6	6.5
Comfortable/easy to ride	17.4	24.0
Exercise	12.1	
Convenient	9.1	18.1
TOTAL PERCENT	100	100
TOTAL RESPONSES	132	691*

*Some respondents gave more than one answer to this question.

Although there are a number of benefits to using cycles and motorscooters, the respondents also reported a number of disadvantages. These are shown in Table 28.

Table 28: Disbenefits of using the vehicle (percent)

	Cyclists	Moped/Motorscooter users
Unsafe	23.9	15.1
Not useful for long journeys	18.3	2.9
Tiring	18.3	
Time consuming	7.0	0.3
Uncomfortable	28.3	
Expensive to buy/operate and maintain		61.9
Traffic/parking problems		12.5
Other	4.2	7.3
Total percent	100	100
Total responses	142	344

Both sets of respondents thought that their own safety when using the vehicle was a major problem, but other than this cyclists and motorscooter users have very different concerns. For the motorscooter users, the costs of buying, operating and maintaining the vehicle is a major issue, however, for the cyclists, this is not a reason for concern. Parking motorcycleS is a major problem in central area of Pune. The major concern of cyclists was that cycles are uncomfortable, tiring to operate and not particularly suitable for long journeys.

Although there are a number of disbenefits to using both cycles and motorscooters, the benefits must outweigh the disadvantages of making the journey by another mode of transport. Table 29 shows why the respondents chose to use their vehicle rather than public transport for the particular journey they were making when interviewed.

As Table 29 shows convenience is a major factor influencing the respondents decision to use their own vehicle. Comfort and savings in time are also key reasons for motorcycle owners.

Table 29: Reasons for not using public transport for this journey (percent)

	Cyclists	Moped/Motorscooter users
Own vehicle is convenient	30.5	29.1
PT expensive/cheaper to use own vehicle	22.4	4.3
PT offers irregular services/inconvenient	17.2	5.0
Own transport readily available	4.6	0.9
No waiting with own vehicle/saves time/ lengthy wait for PT	20.1	23.8
Easy to drive own vehicle	4.0	8.3
Comfortable	0.6	24.3
Safe	0.6	4.3
Total percentage	100	100
Total responses	174	703*

*Some respondents gave more than one answer to this question.

7. SURVEY OF FEMALE TRADERS

7.1 INTRODUCTION

Within many developing countries there are a growing number of female traders, particularly in the informal trading sector such as at urban markets and roadside locations. The revenue generated by these female traders can play a valuable contribution to the family income.

A one day survey of female traders was carried out as part of the field surveys. In total, 199 were questioned on a number of issues regarding their travel and purchasing arrangements. This section of the report analyses the results of the questionnaire.

7.2 TRADING

The respondents were asked about their trading arrangements. In response to the question "how often do you trade here", 93 per cent of the respondents stated that they traded on five or more days a week. In order to determine why the particular markets were attractive to the respondents, they were questioned as to why they chose the particular market location. The results of this are shown in Table 30.

Table 30: Reasons for trading in the particular market

	Number of responses
Convenient	52
Easy to sell goods/good profits	37
Nearby/saves travel costs	65
Large number of customers	12
Central place in Pune/good market	22
In front of road	4
Frequent market	11
Other	10

Note: the numbers add up to more than the sample size as some respondents gave more than one reason for choosing the particular market.

Distance to the point of trading and convenience are the main considerations for the sample of traders; the market being 'nearby' was the modal response to this question. Obviously, a consideration in deciding where to trade is the amount of potential custom and location. In total, 71 persons responded that it is "easy to sell goods" at the location, that there are a "large number of customers" or that "the market is central in Pune."

Around 18 per cent of the respondents also trade in other markets. Thus it appears that female traders have a main market for trading purposes, and for those who do trade at other locations, they probably visit these markets when their main market is closed.

7.2.1 TRAVELLING TIME TO THE TRADING POINT AND DISTANCE TRAVELLED TO PURCHASE STOCK

The mean travelling time to the trading point was 16.3 minutes and the mean distance travelled 4.6km, illustrating that the respondents tend to trade within local areas and travel short distances, i.e. generally less than 10 km. However, almost 17 per cent had travelling times in excess of 30 minutes. This may be for a number of reasons, i.e they may live further away from trading places, they may trade in specific goods or the return they receive outweighs the disbenefits of longer travelling times and higher transportation costs.

7.2.2 MODE OF TRAVEL

The most frequently used mode for both the outward and return journey to the marketplace was foot (58 and 67 per cent for outward and return respectively). A higher percentage used auto rickshaws and trucks for the journey to the marketplace than for the return home. This is probably because at the end of the days trading there are fewer goods to transport home, and there is no time constraint. In addition, a number of traders store goods in a lock-up at the point of trading or may have arrangements with suppliers on a sale or return basis.

Eighty-four per cent of the sample carried their goods to the marketplace, which is possibly because of the short distances travelled.

7.2.3 COST OF TRAVELLING

The cost of travelling to and from the place of trading is shown in Table 31. Around 58 per cent of the sample did not respond to the question. In view of the distances and modes to the marketplace, it is not unreasonable to suppose that these respondents did not incur any travel costs. Therefore two mean values have been calculated, i.e the mean for the sample of respondents who answered this question, and a mean to include those for whom the cost was assumed to be zero.

As distances travelled are generally short, travel costs reflect this and are relatively low. The mean fare for the return journey is less than that of the outward, reflecting the fact that more traders return by foot compared to the outward, and therefore do not incur any travel costs.

Table 31: Cost of travel to and from market place

Rupees	Travel to Marketplace	Travel from Marketplace
0-5	9.5%	9.5%
6-10	12.5%	8.0%
11-15	6.0%	4.0%
16-20	3.5%	3.0%
21-30	4.0%	4.0%
30+	6.0%	3.5%
Not applicable	58.5%	68.0%
Mean cost (Rs)	16.1	14.3
Mean (all respondents)	6.9	4.8

7.2.4 INCOME

The monthly income generated by the traders is shown in Table 32. In 1994 GNP per capita in India was US$ 310 per year (World Bank Atlas 1996), which equates to around Rupees (Rs) 10,500. The average annual earnings of the market traders assuming that they work for 11 months of the year would be Rs 21 000.

However, the results of the analysis should be treated with some degree of caution. Firstly, these figures equate to gross earnings, from which the cost of goods and travel must be subtracted, and secondly, as trading does not offer a fixed salary income levels can fluctuate considerably. Despite this, female traders can clearly generate significant income to augment the household budget.

Table 32: Monthly income

Rupees	Percent
Less than 1000	13.7%
1001-1500	42.6%
1501-2000	19.8%
2001-3000	10.6%
3001+	13.3%
Mean income	1914 Rupees

8 PUBLIC TRANSPORT PASSENGER SURVEY

8.1 INTRODUCTION

Due to the relatively low levels of personal transport ownership in developing countries, public transport is a major mode of travel for urban residents, but especially for the urban poor and females. In order to assess how effective public transport is in terms of meeting users' travel needs, questionnaire surveys were conducted of users of local stage bus and train services. These interviews were conducted either on board the bus/train or at bus stops/train stations. To ascertain whether males and females have different attitudes, needs and problems regarding public transport use, a sample of male and female passengers were interviewed and their responses are compared in this Section.

8.2 USER PROFILES

8.2.1 AGE

On average, the bus passengers were older than train passengers; the mean age for the male and female sample of bus users being 30.7 and 31.5 respectively, compared to 28.1 and 26.2 for the train users.There were a much higher proportion of train users in the 21-30 age group compared to the bus users, and a much higher percentage of bus users in the 40 plus category.

8.2.2 EMPLOYMENT AND INCOME

A much higher proportion of train users are in paid employment (see Table 33) compared to the bus users; around 64 per cent of female bus users are either students or housewives/housepersons compared to around 44 per cent of train users. Thirty-one per cent of male bus passengers and 15 per cent of train passengers were either housepersons or students.

Table 33: Occupation

	Bus Passengers		Train Passengers	
	Male	**Female**	**Male**	**Female**
Student	26.4%	18.6%	14.9%	33.2%
Housewife/houseperson	4.2%	45.7%	-	12.4%
Clerical/admin.	2.1%	0.3%	-	-
Tertiary	56.8%	29.5%	85.1%	44.9%
Professional	2.8%	2.9%	-	1.1%
Secondary	2.8%	-	-	8.4%
Retired	4.9%	0.2%	-	-
Other	-	2.8%	-	-
Mean monthly income	Rs3109	Rs3384	Rs2569	Rs2293

Bus passengers have a higher mean income than train passengers. Trains are often used to make longer journeys, and in developing countries the urban poor tend to live a considerable distance from the city centre and therefore have to travel long distances into the centre. This may account for the lower mean income of train passengers compared to bus passengers.

Female bus users have a higher mean income than males. This may be because males with higher income levels are able to afford some form of motorised personal transport and therefore travel using their own vehicle. For females, issues such as safety are a consideration, and there maybe some constraint due to public opinion (though the strength of this seems to be decreasing). Conversely, the mean income of the male train users is higher than that of the females. This is presumably because a much higher proportion of male than female train users were in paid employment.

Table 34 shows the purpose of the journey being made when the respondent was interviewed. The main journey purpose for all users was for employment. However, a higher proportion of males were making work journeys compared to females; around a third more male train passengers were making work journeys than females, and almost twice as many male bus passengers compared to females.

A large proportion of female bus passengers were housewives/housepersons. This probably accounts for the high percentage of female bus users making shopping trips.

Table 34: Journey purpose

	Bus Passengers		Train Passengers	
	Male	**Female**	**Male**	**Female**
Work	52.0%	28.1%	64.5%	46.9%
Shopping	7.3%	17.6%	0.0	8.9%
School	20.7%	13.6%	18.4%	29.6%
Social	4.0%	9.6%	-	1.6%
Recreation	3.3%	4.2%	-	0.5%
Hospital	4.7%	4.0%	-	1.6%
Religious	3.3%	7.6%	17.1%	3.6%
Other	4.7%	15.3%	-	7.3%

8.3 USER ATTITUDES TO BUS AND TRAIN SERVICES

The respondents were asked questions regarding their attitudes to a number of different features of public transport. They were asked to rate their responses on a 5 point scale ranging from "very good" to "very poor".

Male bus users were more inclined to give bus services a higher rating than females. For example, 32 per cent of male respondents stated that reliability was very good compared to 10 per cent of the female sample. Less than one per cent of females stated that overall the bus services were 'very good' compared to 9 per cent of males.

These ratings highlight the fact that the female respondents perceive or experience more problems using bus services than the male respondents. The women were particularly concerned by the behaviour of drivers/conductors and other passengers.

The attitudes of the female train passengers were similar to those of their bus counterparts in that they were concerned about the behaviour of drivers and other passengers. However, in contrast to female bus passengers, 40 per cent of the train users interviewed rated the behaviour of other passengers as 'very good' or 'good' (the corresponding figure for the bus users was around 31 percent). This may be because on certain local train services females have access to female-only carriages, and are therefore segregated from males.

Female train users also rated the 'comfort' and 'convenience' of train services and the 'availability of connecting services' more highly than male respondents.

Overall, the female train users rated the service more highly than males. For example 55 per cent of females stated that overall, the train service was either 'very good' or 'good' compared to 1 per cent of male respondents. In contrast 97 per cent of males classified the service as being 'average' or 'poor' compared with 44 per cent of females.

9. SUMMARY AND CONCLUSIONS

The rapid development of Pune has led to substantial demand for travel both within the CBD and between residential areas and manufacturing centres. Despite a considerable expansion of public transport services, the fleet has not kept abreast of demand. In response to this many of the leading manufacturers in Pune now operate large fleets of buses (both chartered and privately owned) to ensure their workforce arrive on time and thus production is not interrupted.

With rising affluence, ownership of motorised two-wheelers has quadrupled in the last 15 years and as a consequence cycle usage has declined. The cycle network established during the 1980's is therefore shared by cyclists and riders of motorised two-wheelers. The bicycle however continues to be an important mode for students from the low- and mid-income households.

The survey findings illustrate that considerable differences exist between males and females in terms of access to and the use of the various travel modes on offer. Females are much more likely to walk or take the bus, and this may be linked to the types of journeys they make, e.g. local shopping trips and escorting children to school. Although such trips are essential for the 'survival' of the household, they are not wage earning, and thus are afforded less priority in terms of access to private vehicles.

In higher income households which own a number of vehicles, such constraints do not appear to exist. There has been a growth in the number of women riding two wheeled vehicles, usually motorscooters and mopeds. This suggests that attitudes and traditions are beginning to change. Social and economic changes are therefore making it both increasingly acceptable and increasingly affordable for females to have a greater degree of personal mobility and independence.

Women perceive the bus service in Pune to be inferior to the local train service in terms of convenience, comfort and safety. This is largely due to the existence of female-only carriages on the trains. Interestingly, however, women appear disinterested in the idea of female-only buses (perhaps due to earlier unhappy experiences when sections of buses were caged for female security) and would prefer to see the provision of more buses. A higher service frequency would as a consequence create a less crowded and safer environment in which all, but especially females can travel in comfort.

Distances travelled throughout Pune are comparatively short, hence the high percentage of trips undertaken on foot. Even a large percentage of female market traders walk to the market despite having to carry their goods. Although for most this journey is short, around 15 per cent of the respondents who walked to their trading point walked in excess of 30 minutes. This may be a result of inadequate public transport facilities, or may be a financial constraint. However, some of the more successful market traders are able to afford to travel by autorickshaw.

Clearly, looking to the future, the public transport system needs to be developed and the fleet increased to keep pace with the ever-growing size and travel needs of the population. Women appear to favour the train over the bus. Restrictions in rail-route planning make it unlikely that the rail network will expand, and thus it is the bus fleet and route network which needs to be expanded.

As incomes rise and attitudes change females are increasingly able to travel by moped or motorscooter. Thus the motorised two wheeler fleet in Pune is likely to grow substantially in the coming years. The road network needs to be planned accordingly.

The low income communities will continue to rely on inexpensive public transport services and travel on foot to meet their mobility requirements. The bicycle will continue be an important means of personal transport for low income households for a number of years to come, though in low income households, females do not generally have access to the household bicycle.

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