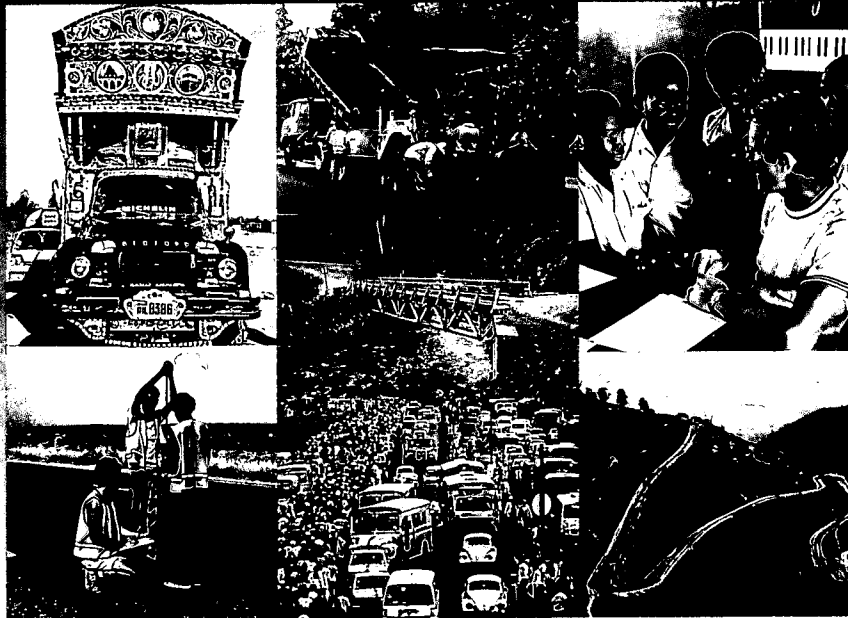


Transport Research Laboratory

Library LOAN COPY (3)



**Constraints, attitudes and travel
behaviour of low income
households in two developing cities**

by C J Palmer, A J Astrop and D A C Maunder

The Transport Research Laboratory is the largest and most comprehensive centre for the study of road transport in the United Kingdom. For more than 60 years it has provided information that has helped frame transport policy, set standards and save lives.

TRL provides research-based technical help which enables its Government Customers to set standards for highway and vehicle design, formulate policies on road safety, transport and the environment, and encourage good traffic engineering practice.

As a national research laboratory TRL has developed close working links with many other international transport centres.

It also sells its services to other customers in the UK and overseas, providing fundamental and applied research, working as a contractor, consultant or providing facilities and staff. TRL's customers include local and regional authorities, major civil engineering contractors, transport consultants, industry, foreign governments and international aid agencies.

TRL employs around 300 technical specialists - among them mathematicians, physicists, psychologists, engineers, geologists, computer experts, statisticians - most of whom are based at Crowthorne, Berkshire. Facilities include a state of the art driving simulator, a new indoor impact test facility, a 3.8km test track, a separate self-contained road network, a structures hall, an indoor facility that can dynamically test roads and advanced computer programs which are used to develop sophisticated traffic control systems.

TRL also has a facility in Scotland, based in Edinburgh, that looks after the special needs of road transport in Scotland.

The laboratory's primary objective is to carry out commissioned research, investigations, studies and tests to the highest levels of quality, reliability and impartiality. TRL carries out its work in such a way as to ensure that customers receive results that not only meet the project specification or requirement but are also geared to rapid and effective implementation. In doing this, TRL recognises the need of the customer to be able to generate maximum value from the investment it has placed with the laboratory.

TRL covers all major aspects of road transport, and is able to offer a wide range of expertise ranging from detailed specialist analysis to complex multi-disciplinary programmes and from basic research to advanced consultancy.

TRL with its breadth of expertise and facilities can provide customers with a research and consultancy capability matched to the complex problems arising across the whole transport field. Areas such as safety, congestion, environment and the infrastructure require a multi-disciplinary approach and TRL is ideally structured to deliver effective solutions.

TRL prides itself on its record for delivering projects that meet customers' quality, delivery and cost targets. The laboratory has, however, instigated a programme of continuous improvement and continually reviews customers satisfaction to ensure that its performance stays in line with the increasing expectations of its customers.

TRL operates a quality management system which is certificated as complying with BS EN 9001.



Transport Research Foundation Group of Companies

Transport Research Foundation (a company limited by guarantee) trading as Transport Research Laboratory.
Registered in England, Number 3011746. TRL Limited. Registered in England, Number 3142272.
Registered Office: Old Wokingham Road, Crowthorne, Berkshire. RG45 6AU



Transport Research Laboratory
Old Wokingham Road
Crowthorne, Berkshire, RG45 6AU

Overseas Development Administration
94 Victoria Street
London, SW1E 5JL

TRL REPORT 263

CONSTRAINTS, ATTITUDES AND TRAVEL BEHAVIOUR OF LOW INCOME HOUSEHOLDS IN TWO DEVELOPING CITIES

by C J Palmer, A J Astrop and D A C Maunder

Subsector:	Urbanisation and transport
Theme:	Urban transport
Project title:	Planning for women and transport
Project reference:	R6019

Copyright Transport Research Laboratory 1997. All rights reserved.

This document is an output from a project funded by the UK Overseas Development Administration (ODA) for the benefit of developing countries. The views expressed are not necessarily those of the ODA.

Transport Research Foundation Group of Companies

Transport Research Foundation (a company limited by guarantee) trading as Transport Research Laboratory. Registered in England, Number 3011746.
TRL Limited. Registered in England, Number 3142272. Registered Offices: Old Wokingham Road, Crowthorne, Berkshire, RG45 6AU.

First Published 1997
ISSN 0968-4107

CONTENTS

	Page
Executive Summary	1
Abstract	3
1. Introduction	3
2. The cities	4
2.1 Pune	4
2.2 Accra	4
3. Transport provision	4
3.1 Pune	4
3.2 Accra	5
4. Research methodology	5
5. General travel survey	5
5.1 The samples	5
5.2 Vehicle ownership	6
5.3 General trip characteristics	7
5.4 Work trips	9
5.5 Shopping trips	11
5.6 Education trips	13
5.7 Attitudes regarding personal vehicles	14
5.8 Attitudes regarding public transport	15
5.8.1 Bus services	15
5.8.2 Rail services	15
6. Discussion and conclusions	17
7. Acknowledgements	18
8. References	18

EXECUTIVE SUMMARY

In a number of cities of the developing world the rapid rise in population, coupled with increasing costs of fuel and limited financial resources available for investment in urban infrastructure has generated severe transport problems. These are exacerbated by the tendency to locate the low income on city fringes far from employment opportunities, thereby causing considerable difficulties both for the residents of such areas in terms of mobility and accessibility, and for transport operators in terms of the need to provide low cost public transport services.

Sustainable urban development requires continuous investment in infrastructure to ensure basic services for urban residents and investment in transport infrastructure and services is no exception. In the near future, as a result of financial constraints, an improved public transport system is likely to be the only solution to the problem of increasing traffic congestion and chaos in most cities of the developing world. Furthermore 'it is unlikely that the communities concerned can (or even should) afford to build a road network needed to accommodate unrestrained travel by private car' (Jacobs & Fouracre, 1976).

As part of an Overseas Development Administration funded Technology Development Research (TDR) programme the Transport Research Laboratory (TRL) undertook studies of urban travel behaviour in two representative cities of the developing world namely Pune in India and Accra in Ghana. The cities were chosen because they are representative of a range of cities (with a population of approximately two million) in the developing world in terms of public transport provision, growth rates and socio-economic aspects. Geographical location and the diverse range of cultures represented in their respective populations also ensures that they are representative of today's Third World cities.

The aim of the research was to discover which factors influence travel behaviour and demand in low income households, how demand is met, perceived travel constraints, and how public transport services can be improved. In addition, particular emphasis was placed on understanding the travel behaviour of women, as females are often more disadvantaged than men in terms of access to transport services and personal travel modes. It is hoped that the results of the research will provide policy makers with an improved understanding of travel behaviour and constraints and will therefore enable the formulation of better transport development projects in the future. This will lead to improved mobility and accessibility to the entire transport network for low income households and particularly women in the developing world.

The principle conclusion is that public transport provision in the two cities is unable to meet demand. This is perhaps best demonstrated by the tendency of large manufacturing companies to provide their own vehicles to transport personnel to ensure staff arrive on time. The more affluent sections of society have more access to personal motorised vehicles, and thus rely less on public transport services. It is therefore the urban poor who are most affected by the lack of provision.

The bicycle represents a low-cost alternative to public transport, and there is increasing ownership and use of these vehicles among the low income male residents of Pune. In Accra, however, negative cultural attitudes have a stronger influence than economics on bicycle use, and ownership levels are still extremely low. Since even bicycles are not affordable to many low income residents, many trips are undertaken on foot. Pedestrians represent an extremely vulnerable group of road users in all cities. They are particularly vulnerable in cities where footpaths are of a poor quality. Investment in the building of proper pavements and the introduction of signalised pedestrian crossings would significantly benefit pedestrians, especially the many individuals (often female) employed as porters in and around markets.

Limitations of cycling and walking mean that the travel needs of poor urban residents will continue to be met by public transport for the foreseeable future. There is therefore a requirement for services to be reliable, inexpensive, frequent, and must also operate throughout low income residential areas. Interviewees complained of inadequate and unreliable services, which affect their employment opportunities and thus have an impact on household income.

The public bus companies are at present unable to increase their resources to meet demand, and are often unable to maintain their fleet in a roadworthy condition, thereby limiting the number of vehicles available for service on any one day. Resources should therefore be targeted at improving public transport vehicle availability. In Pune, bus companies are faced with a dilemma; either to increase fares and thereby enable an expansion of the bus fleet, or to continue to operate at existing fares, but be unable to meet peak demand and maintain the road worthiness of the fleet. In Accra no scheduling system operates, and tro-tros leave termini as and when they are full.

Local urban rail services are provided in Pune, however users thought that these services could be improved, although this too will require financial investment. An alter-

native to heavy rail services being considered by a number of cities is metro, or light rapid transport systems. However, urban planners need to carefully review the benefits such systems will afford the urban poor. Expansion or improvement of the road and bus network may well be a more appropriate investment.

Another major finding is that females are more disadvantaged than males in terms of personal mobility. Females are generally more reliant on public transport, which does not always provide adequate services. Females have less access to vehicles belonging to the household. Females generally are more negative about bus services, possibly because they experience sexual harassment on overcrowded buses.

In summary, it is apparent that there are constraints in respect of personal accessibility and mobility that are common to all cities. But, importantly, there are also differences that have arisen as a product of culture and the existing transport infrastructure. Planners need to be aware of this cultural specificity and acknowledge that a solution for one city may not be a solution for all. Care must be taken that more resources are allocated in such a way as to meet the travel demands of the entire urban population and not just the more affluent sections of society. It is the urban poor, particularly females, which are the most vulnerable in society, and thus it is essential that their travel needs are addressed for the sustainability of the household to be ensured.

CONSTRAINTS, ATTITUDES AND TRAVEL BEHAVIOUR OF LOW INCOME HOUSEHOLDS IN TWO DEVELOPING CITIES

ABSTRACT

In many cities of the developing world rapid population growth coupled with limited financial resources available for investment in urban infrastructure has led to severe transport and mobility constraints. These problems are exacerbated by locating many of the urban poor on city fringes, where land is available but employment opportunities are scarce, thereby generating substantial demand for low cost travel to workplaces and other amenities. However, low income housing has frequently developed in areas which are inadequately served by public transport services. Almost inevitably this lack of transport has an effect on the quality of life of these residents in terms of access to employment, education, shopping and medical facilities; factors which are essential for sustainable economic and social development.

This report documents the findings of travel surveys carried out in two representative cities of the developing world, namely Pune (India) and Accra (Ghana). The influence of household income and gender were investigated in terms of modal choice, trip frequency, and attitudes to public transport and personal vehicles. It is hoped that the results will provide transport policy makers with an improved understanding of travel constraints and thereby enable the formulation of better transport development projects in the future. The results point to a number of policy issues that need to be considered, for example that women are often the most affected by inadequate transport provision and that the acquisition and use of personal vehicles is determined as much by culture as by economic considerations.

1. INTRODUCTION

In a number of cities of the developing world the rapid rise in population, coupled with increasing costs of fuel and limited financial resources available for investment in urban infrastructure has generated severe transport problems. These are exacerbated by the tendency to locate the low income on city fringes far from employment opportunities, thereby causing considerable difficulties both for the residents of such areas in terms of mobility and accessibility, and for transport operators in terms of the need to provide low cost public transport services.

Sustainable urban development requires continuous investment in infrastructure to ensure basic services for urban residents and investment in transport infrastructure and

services is no exception. In the near future, as a result of financial constraints, an improved public transport system is likely to be the only solution to the problem of increasing traffic congestion and chaos in most cities of the developing world. Furthermore 'it is unlikely that the communities concerned can (or even should) afford to build a road network needed to accommodate unrestrained travel by private car' (Jacobs & Fouracre, 1976).

Before resources are allocated to improving transport infrastructure and increasing public transport provision in all urban areas - but especially those inhabited by the low income - it is necessary to identify what improvements (if any) need to be made to the transport network in order to meet the basic travel needs of residents. One means of obtaining this information is by undertaking surveys on travel demand and behaviour throughout the city to gather data on frequency and mode of travel, problems and constraints when making journeys, vehicle ownership and use etc. In addition, it is necessary to obtain background information on the study area in terms of public transport provision, standard of road network and even take account of the culture of the society being examined as all these factors can have a major influence on travel behaviour.

As part of an Overseas Development Administration funded Technology Development Research (TDR) programme the Transport Research Laboratory (TRL) undertook studies of urban travel behaviour in two cities of the developing world namely Pune in India and Accra in Ghana. The cities were chosen because they are representative of a range of cities (with a population of approximately two million) in the developing world in terms of public transport provision, growth rates and socio-economic aspects. Geographical location and the diverse range of cultures represented in their respective populations also ensures that they are representative of today's Third World cities.

The availability of public transport and ownership and usage of personal travel modes varies greatly between the two cities. Pune has historically been referred to as 'the bicycle city of India', although in recent years the ownership of motorised two wheelers (motorcycles and scooters) has grown significantly. The growth has been so great that nowadays both bicycles and motorised two wheelers share the segregated network of tracks originally planned for cyclists. Stage bus services in Pune are operated by two publicly owned Municipal companies. In contrast, the culture in Accra is such that cycling is regarded as socially unacceptable to the majority of the city's residents (Grieco *et al.*, 1994) and public transport (bus) services are provided by the private sector using small capacity vehicles.

The aim of the research was to discover which factors influence travel behaviour and demand in low income households, how demand is met, perceived travel constraints, and how public transport services can be improved. In addition, particular emphasis was placed on understanding the travel behaviour of women, as females are often more disadvantaged than men in terms of access to transport services and personal travel modes. It is hoped that the results of the research will provide policy makers with an improved understanding of travel behaviour and constraints and will therefore enable the formulation of better transport development projects in the future. This will lead to improved mobility and accessibility to the entire transport network for low income households and particularly women in the developing world.

2. THE CITIES

2.1 PUNE

The location of Pune is shown in Figure 1. Pune has a population of approximately two-and-half million. Since constraints were placed on the industrial growth of Bombay, Pune has expanded rapidly as an industrial centre having attracted heavy engineering industry such as motor vehicle manufacturing plants (buses, cars and motorcycles). In addition a number of multi-national companies have manufacturing bases within the city. Pune's industrial expansion was further aided by the Maharashtra State Industrial Development Corporation who offered incentives to encourage industrial growth. Much of the industry is concentrated along the main Pune-Bombay highway, probably because this enables manufactured goods to be dispatched and supplies delivered to the factories without having to access the more congested centre of Pune.

Rural to urban drift and the migration of people from other regions of India have occurred because of the employment

opportunities created by rapid industrialisation. This has led to an acute housing shortage and an increase in slum settlements which are poorly served by the existing transport infrastructure and public transport services.

2.2 ACCRA

Accra is the capital city and seat of Government of Ghana, with a population of around two million. Its location is also shown in Figure 1. Though on the coast, Accra does not have a port of its own. A new port, about 20 km to the east of the city has been developed in the town of Tema, which forms part of the Greater Accra Metropolitan Area (GAMA). Tema has become the nation's primary port, surpassing the older port at Takoradi, near the Ghana-Côte d'Ivoire border.

Much of the industry in GAMA is located at Tema, with Accra relying on commerce, service and light industries for its employment opportunities. There is considerable commuting in both directions between Accra and Tema.

Accra is growing rapidly along the main East, West and North axes to Tema, Winneba and Kumasi respectively. New developments like those at McCarthy Hills, Ammassaman, Madina, Adenta and Sakuman are putting considerable strain on service provision and transport infrastructure.

3 TRANSPORT PROVISION

3.1 PUNE

In Pune, two main bus companies operate around 1,060 buses between them. However, this is insufficient to meet demand at peak times and in response to this, a number of major manufacturing companies operate their own buses to ensure their employees are able to travel to work without

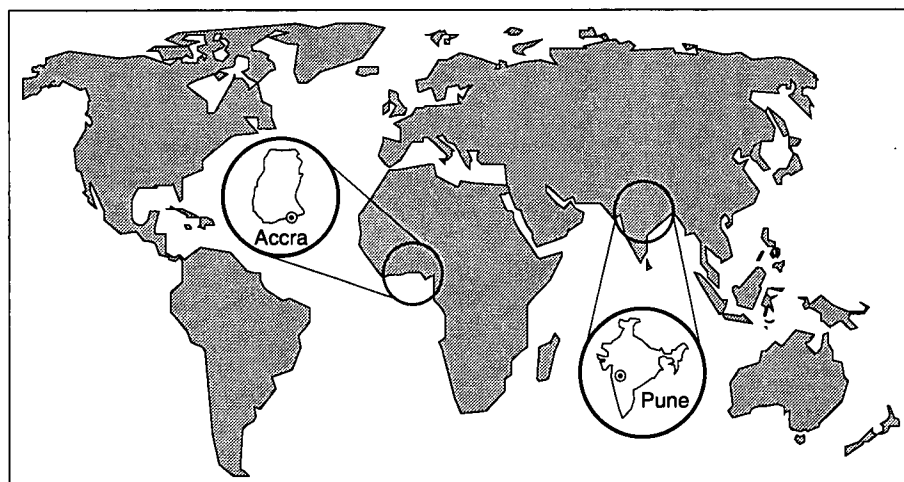


Fig. 1 Map showing location of Pune and Accra

difficulty; these buses currently number around 4,000. In addition to local transport services there are also a number of inter-city bus routes offering travel to major cities such as Bombay and Delhi. Pune is connected by rail to Bombay, Hyderabad, Madras and Miraj-Kolhapur, and many people make use of these services to commute considerable distances to and from Pune. Local train services are also available for intra-regional journeys.

There are currently 2,500 taxis based in Pune; of these 1,900 are tourist cars, which tend not to provide services within Pune but serve inter-city routes from Pune to Bombay, Thane, Nashik, Ahmednagar, Kolhapur and Aurangabad.

Autorickshaws (covered tricycles powered by a small engine) have replaced horse-drawn tongas and cycle rickshaws as the major form of intermediate public transport in Pune. They operate anywhere within Pune and are the major provider of taxi-type services within the city. Autorickshaws tend to serve areas with poor bus service provision and offer a relatively cheap source of transport for the type of service offered.

3.2 ACCRA

In Accra the types of public transport available are varied. The most common mode is the tro-tro or urvan. These are mini-buses/mini-vans which form the mainstay of the public transport system. Taxis are also available. Larger passenger carrying buses do operate, but these are used either for inter-urban travel, or by industrial and service companies solely for transporting their own personnel to and from the workplace.

Tro-tros are route specific, but do not run to a scheduled service. They tend to leave termini only when they are full, and thus on less popular routes, or in the inter-peak periods, passengers can wait a considerable amount of time before departure.

The taxi system in Accra has three distance operating practices: dropping, chartering and joining. In 'dropping' a passenger asks the driver to take him or her to a specific destination. 'Chartering' is the same as dropping, only the journey is arranged in advance. Under these two types of arrangement the taxi driver is prohibited from running as a shared taxi. Under a 'joining' agreement passengers pay for a point-to-point service but additionally other passengers may be picked up. These passengers may stay for the remainder of the journey or may be dropped off on route. The vehicle acts as a shared taxi, and is thus less expensive.

Journey cost is negotiable and, in addition to journey length, depends on factors such as the possibility of obtaining a fare at the destination, and the age and road-worthiness of the vehicle.

There were approximately 9,000 tro-tros and 13,000 taxis

in operation in 1993 (Fouracre, 1996). Their average age in 1993 was ten years and because of a lack of maintenance they were, and continue to be, in a poor operational and mechanical condition.

4. RESEARCH METHODOLOGY

A research tool was developed specifically for the tasks at hand, and took the form of an interviewer-administered questionnaire. This questionnaire asked individuals about the journeys they frequently make, the modes they choose to use, and how often they travel for specific purposes. Also included were questions about attitudes towards various types of vehicles and the problems experienced in the use of public transport. The second part of the questionnaire asked for information on various household variables such as income, household structure, and vehicle ownership, this section being completed by the household head (or most senior person available at the time).

The survey teams in each of the two cities were local residents with good English ability. In this way the team could comprehend instructions in English and then conduct the survey in either English or the local language, depending on the characteristics of each household. Having been briefed, the survey team visited households either individually or in pairs. There they administered the questionnaire to all available household members aged 16 years or above. Respondents were simply required to respond orally to the questions posed by the survey team, who read the questions aloud and recorded the responses. Once finished, the questions in the second section of the questionnaire (household variables) were answered by the household head alone.

5. GENERAL TRAVEL SURVEY

5.1 THE SAMPLES

There are many variables which have a causal effect on travel behaviour, for example, researchers have examined the effects of household head gender, household structure (Turner *et al.*, 1995a) and household location with respect to the central business district (Maunder, 1984). In addition a number of other factors (vehicle ownership, employment rate and household size) can all play a part in the determination of travel needs, and thus of travel behaviour. It is therefore a valid exercise to define 'experimental' groups based on any one of these variables, and to compare travel behaviour between these groups.

Many of these variables are, however, to some extent dependent on household income. For example, household

TABLE 1

Demographic profile of the subject groups

	<i>Accra</i>		<i>Pune</i>	
	Low	High	Low	High
Male:female ratio	55:45	55:45	58:42	58:42
Mean age (years)	34	37	36	37
N (sample size)	134	74	126	65
Mean household size	9.5	5.9	6.3	4.3
Mean household income (£ per month)	93.4	225.4	60.0	360.0
Mean income per person aged 16 plus (£ per month)	9.9	38.1	9.5	83.7
	Male	Female	Male	Female
Mean age (years)	36	32	35	39
N	73	60	247	180

income can have an influence on residence location and vehicle ownership. Comparisons between income groups will therefore encompass comparisons between other factors and will consequently provide a comprehensive overview of travel behaviour. Accordingly, the samples from Pune and Accra were split in terms of household income.

In Pune this was undertaken on the basis of reported income per household member aged 16 years and above. Households were selected from a wide range of housing areas to give a representative spread of income (unofficial squatter areas were excluded from the survey). The distribution of per capita income was split into three groups of equal size; the group at the top end of the distribution was defined as 'high income', that at the bottom end as 'low income'. On this basis, low income households were those with a per capita income of less than 1,251 Rupees per month, and high income as those with a per capita income of 2,501 Rupees or more per month (in May 1996 the Pound Sterling equated to 51 Rupees). In Ghana, the sample were allocated to income groups on the basis of household location. That is, areas were selected on the basis that they were assessed by the local survey team to be low or high income. As for Pune, unofficial squatter areas were excluded from the survey.

The assignment of individuals to groups based on their household's (per capita) income will not, however, reveal differences in travel behaviour between males and females. As such comparisons are important to this study, the low-income groups were split by gender and the data reanalysed.

The demographic profile of individuals and households in each of the income bands in each of the cities is given in

Table 1. Information is also given about males and females within the low income banding.

In simple demographic terms, the samples from Pune and Accra are very similar. The male/ female ratio and mean age of respondents are fairly constant for both income groups in both cities. This similarity is essential if comparisons are to be made between income groups and cities.

Low income households tend to have more members than higher income households in both Pune and Accra, which is consistent with findings from other developing cities (Mauder, 1984).

5.2 VEHICLE OWNERSHIP

Table 2 gives vehicle ownership rates for high and low income households in Accra and Pune.

Ownership rates for all vehicle types are different between the cities. On the one hand, there are more cars per household in Accra than in Pune, and this relationship holds for both high and low income households. Indeed, the car ownership rates in Accra are higher than perhaps one would expect, this possibly being due to an availability of (relatively) inexpensive, second-hand cars from Europe which boosts ownership rates. These are typically of very low quality and thus high ownership rates represent a potential road safety problem.

On the other hand, households in Pune own more motorised two wheelers and bicycles than households in Accra. It can also be seen that high income households own more motorised vehicles than low income households.

TABLE 2

Mean vehicle ownership rates (per household)

	Accra			Pune		
	Low	High	(High/Low ratio)	Low	High	(High/Low ratio)
Cars	0.24	1.13	(4.7)	0.16	0.58	(3.6)
Motorised two-wheelers	0.013	0.23	(17.7)	0.58	1.38	(2.38)
Bicycles	0.12	0.12	(1.0)	1.15	1.08	(0.94)

The low levels of two wheeler ownership in Accra demonstrate the powerful effect that society and culture can have on behaviour and attitudes. Areas of Accra inhabited by the indigenous Ga population are strongly opposed to the use of bicycles, as their use is seen as akin to delinquency. In areas which are populated by migrant workers from Northern Ghana however, young males are actively encouraged to cycle; the situation for young females is not so clear (Grieco, *et al.*, 1994; Turner *et al.*, 1995b). It is cultural factors and not economic factors which govern travel behaviour in this instance, and it is therefore important to comprehend these cultural issues at the transport planning stage and to fail to do so may well result in poor transport investments being made.

5.3 GENERAL TRIP CHARACTERISTICS

Respondents were asked about all the regular journeys they make. Studies have already shown that household income and location may affect an individual's daily trip rate (e.g. Maunder, 1984). The results from the present survey are shown in Table 3. Although the data from this survey fail to show an influence of income on trip rate, there is a difference between the cities. In addition, detailed analyses reveal that there are trip frequency differences in terms of distance from the Central Business District (CBD) in both

cities, with households located further from the CBD generating more trips (Astrop *et al.*, 1996; Palmer, 1996; Palmer *et al.*, 1996a; 1996b).

It is interesting to note that in Accra, low income males and females make the same number of trips, whereas in Pune females make fewer trips than males.

One would expect modal choice to be highly dependent on income. It has already been demonstrated that income influences vehicle ownership (and this must in turn exert an influence on modal choice). In addition income can have an effect on the extent to which low income individuals are able to utilise public transport services.

Figure 2 shows modal choice for all journeys by income group and by gender in Accra and Pune. Because the types of public transport available in these cities is markedly different, all types have been amalgamated under the heading of 'public transport'. In Accra this includes buses, taxis and tro-tros. In Pune this encompasses bus services, autorickshaws, taxis and local trains.

Note that totals do not always add up to 100 per cent. In such cases, the remainder accounts for 'other' modes.

It is clear that private cars are used for more trips in Accra than in Pune, a result to be expected from ownership levels

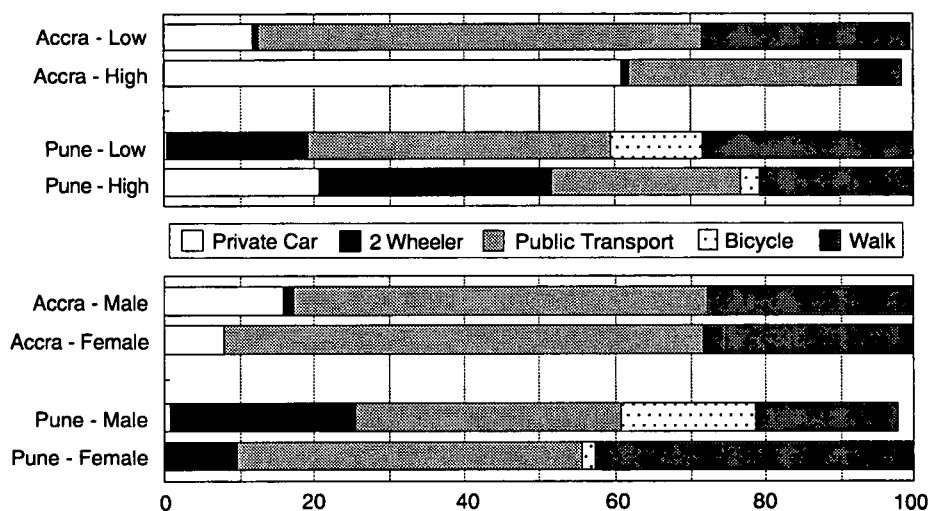


Fig. 2 Modal choice by income and sex: all trips

TABLE 3

Mean daily per capita return trip rates

	<i>Accra</i>		<i>Pune</i>	
	Low	High	Low	High
Daily per capita - return trip rate	1.2	1.3	1.0	1.0
	Male	Female	Male	Female
Daily per capita - return trip rate	1.2	1.2	1.2	0.8

(see Table 3). In Pune both high and low income groups make a significant number of trips by motorised two wheeler, a mode hardly utilised in Accra (again this is to be expected from ownership levels). As might be predicted, public transport in both cities is used more by the low income than the high income group; although more than one quarter of all trips are made using some form of public transport by even the high income groups.

In both cities there are a number of problems facing the users of public transport. In Accra, tro-tros do not operate in accordance with a timetable, and leave termini as and when they are full. In the inter-peak periods this can often involve a two hour wait (Turner, 1996). In Pune there are timetables, but the perception of the users is that there are too few buses running on too few routes (see Section 5.8).

Typically, the transport infrastructure is such that walking is inherently dangerous. Pavements are generally of a very poor quality, as is the ability and behaviour of drivers. In Accra there are many women working in the informal sector as head-loaders, known locally as 'kayayoos' (Agarwal *et al.*, 1994). This practice increases the dangers of walking in that head loads make it extremely difficult to check for traffic before crossing the road, and also restrict the ability to physically react to dangerous situations.

Personal (motorised and non-motorised) vehicle trips account for 13 per cent of trips by low income individuals and 62 per cent of trips by high income individuals in Accra; the figures for Pune are 32 per cent and 54 per cent respectively.

Figure 2 also illustrates modal choice for all trips split between males and females from only the low income groups. In both cities the data show that males make more use of personal motorised vehicles than females. This finding is of interest and demonstrates that vehicle ownership levels in isolation fail to entirely explain patterns of modal choice, since access to household assets such as personal vehicles is not necessarily uniform across all household members. Turner and Fouracre (1995) reported that personal vehicles are often reserved for journeys which are directly associated with income generation. In addition they identified a threefold commonality in the roles which societies assign to women:

- Production - as workers
- Reproduction - responsible for child care and managing the household
- Community management - responsible for maintaining community and social networks

Many of the trips made by women are in the roles of reproducers and community managers and thus are only indirectly associated with earnings (without these trips the household, and thus wage earners, could not survive). Women, therefore, often find themselves in a poor bargaining position in negotiations over the use of personal vehicles. There is also some degree of circularity, in that the less access women have to personal vehicles the less likely they are to become proficient in their use.

For both males and females there is a heavy reliance on public transport. This dependence aggravates any problems associated with the use of such modes. In Accra the problems are associated with the lack of a scheduled timetable for tro-tro services. Typically they leave termini as and when they are full and thus passengers often have to wait considerable time periods before the vehicle departs (Turner, 1996).

A significant proportion of trips are made on foot. Almost half the trips made by low income females in Pune are walk trips. For males the figure is approximately 20 per cent, and for both males and females in Accra the proportion of walk trips is almost 30 per cent. This reliance on walking, coupled with the considerable distance of some of these trips (see Table 5) suggests that the public transport system either cannot provide the required services at a reasonable fare, or that the problems experienced in the use of these services outweigh the problems and dangers associated with walking.

Table 4 shows two ratios associated with the willingness or ability to pay for trips. A 'trip' is defined as a one-way journey which is made on a regular basis. The first ratio is the number of public transport trips divided by the number of walk trips. The second is the number of trips incurring costs (those by private car, motorised two wheeler and

TABLE 4

Modal choice ratios

	<i>Accra</i>		<i>Pune</i>	
	Low	High	Low	High
PT trips/walk trips	2.1	8.1	1.4	1.2
Paying trips/free trips	2.5	12.3	1.5	3.3
	Male	Female	Male	Female
PT trips/walk trips	2.0	2.2	1.8	1.1
Paying trips/free trips	2.6	2.5	1.6	1.3

public transport) to trips which have no tangible costs attached (walk, cycle).

The first analysis demonstrates that when a personal vehicle (motorised or unmotorised) is not used, individuals in Accra are rather more willing to pay for public transport (instead of walking) than individuals in Pune. Whilst this is a valid finding it results entirely from the lack of bicycle usage in Accra. Bicycles offer a (largely) free means of travelling distances which cannot sensibly be covered by foot, and thus are an alternative to public transport. In Accra the ratio of public transport trips to walk trip is similar for males and females. In Pune, however, given no access to personal vehicles, a higher proportion of females walk compared to males.

It is possible that differences between Accra and Pune as discussed above originate in differences in relative wealth. Unfortunately such comparisons are highly complicated (if, indeed, they are possible) since conversion of local currencies into dollars (for example) ignores differences in terms of the cost of living. In addition, cost of living differences do not apply evenly across all commodities.

As one would expect, in both cities the high income groups pay for a higher proportion of trips than the low income groups, however the data also show that individuals in Pune pay for a smaller proportion of trips than individuals in Accra. Again this is probably because there is considerable bicycle use in Pune.

Table 5 shows the mean trip distance by the various modes. Differences between the cities in terms of gross journey length (i.e. in kilometres) must be to some degree attributable to differences in city size, layout and land use. Therefore inter-city comparisons can only be in terms of trends. Intra-city comparisons, however, are meaningful. Predictably, trips by personal motor vehicles and by public transport are the longest, and walk trips are the shortest. The results clearly show that in India the bicycle is used for trips of intermediate length. In Accra such trips have to be made either on public transport or on foot and thus may cost more in terms of time and/or money.

It can be seen that the mean distance for walk trips is more than one kilometre for all groups. This suggests that many walk trips are considerably longer than this, indicating that the public transport system is ignoring the needs of some residents, either in terms of cost, or in route/service availability.

Males typically travel further than females. This is in part due to males making more trips by car and two-wheeler, and these trips are among the longest. Males also travel further by public transport. This is likely to be a result of males making more trips for work purposes (see Section 5.4); such trips may cost more, but also allow income to be generated, and thus transport expenditure can be seen as an investment generating a return.

5.4 WORK TRIPS

As well as being questioned about their general travel behaviour, respondents were required to answer questions about travel for specific purposes. The trips which were of particular interest, and which are critical to the sustainable development of most households, are those for employment, shopping, and education.

Table 6 shows the frequency with which the various groups make trips for employment purposes. It should be noted that in this Table, and subsequent Tables relating to the frequency of shopping and education trips, negative responses have been excluded. In Accra a larger proportion of the high income group make work trips than the low income group. In Pune, however, the two groups are similar. More males make trips than females, but the difference in Accra is marginal. The very low percentage of females making work trips in Pune may reflect a low employment rate, or may be the result of women working from home and thus not needing to travel for employment purposes. Of those individuals making work trips, the only group with a significant number of respondents travelling less frequently than 'daily' is females in Pune. This again may reflect casual or part-time employment.

Table 7 shows the mean distance travelled by the groups for

TABLE 5

Distance covered by mode (km)

	<i>Accra</i>		<i>Pune</i>	
	Low	High	Low	High
Car	8.1	12.1	3.5 ^a	11.2
Two wheeler	8.3 ^a	2.0 ^a	7.0	8.1
Public transport	8.6	8.0	7.7	8.7
Bicycle	-	-	4.2	4.2
Walk	1.2	1.2	2.0	0.8
All modes	6.4	8.0	4.9	7.1
	Male	Female	Male	Female
Private car	8.6	6.7	3.5 ^a	-
Two wheeler	8.3 ^a	-	6.9	7.2
Public transport	8.8	8.1	8.2	6.7
Bicycle	-	-	4.4	3.5
Walk	1.3	1.1	2.6	1.7
All modes	6.7	6.0	6.1	4.7

^a These means are calculated from very few trips**TABLE 6**

Work trip frequency (%)

	<i>Accra</i>		<i>Pune</i>	
	Low	High	Low	High
Daily	97	97	92	90
Other	3	3	8	10
(Proportion of sample making trips)	(60)	(78)	(48)	(47)
	Male	Female	Male	Female
Daily	100	91	93	83
Other	-	9	7	17
(Proportion of sample making trips)	(61)	(57)	(68)	(19)

TABLE 7

Mean work trip distance (Km)

	<i>Accra</i>		<i>Pune</i>	
	Low	High	Low	High
Mean distance	9.0	9.7	6.1	10.0
	Male	Female	Male	Female
Mean distance	9.5	8.2	6.4	4.4

Note: Zero length trips (i.e. those made by people working from home) are excluded from these means.

work purposes. As discussed above, inter-city differences in trip length are not meaningful (because of differences in city size and layout), although intra-city differences are. In both cities the high income group travel further than the low income. Since they own more private vehicles (and these are likely to be owned - and therefore used - by income earners) individuals from higher income groups are more able to travel either out of the CBD into the suburbs to find work, or from the suburbs into the CBD. Low income groups are constrained to either working in their local environs or in locations readily accessible by public transport.

Males on average travel further than females for work purposes. Modal choice data (see Figure 3) shows that males also make more trips using personal motor vehicles. Their access to such vehicles allows males to make longer journeys within the time constraints typically imposed by employment. The reliance of the high income groups on personal vehicles is shown by the modal choice data in Figure 3.

Cars and motorised two wheelers account for approximately 60 per cent of work trips for high income residents of Accra, and 67 per cent of those in Pune. This compares with 15 per cent and 30 per cent for the respective low income groups.

The various public transport modes are utilised by a sizeable proportion of all groups. It is, however, the low income individuals in Accra who make most use of these modes; 76 per cent of their work trips are made using public transport services. For both males and females in Accra, public transport is the modal mode for employment travel. In Pune public transport is also important, but so too are motorised two wheelers and bicycles. Public transport is therefore generally essential for the employment of the low income groups. Long mean journey distances for work purposes tend to preclude walk trips.

The exception to this is females in Pune, of whom more than half travel to work on foot. A major reason for this may be that in their experience, public transport can be intimidating and humiliating, since buses are crowded and sexual harassment (known locally as 'Eve teasing') is rife. A subsidiary reason is likely to be a lack of access to personal vehicles combined with an historical cultural resistance to women's use of two wheelers. Attitudes are, however, slowly changing and females are increasingly travelling by such modes.

5.5 SHOPPING TRIPS

Table 8 shows the frequency with which shopping trips are undertaken by the various groups. The modal frequency for all the income groups is 'between one and four times per week'. Shopping trip frequency is similar for both males and females in Pune, suggesting that shopping activities are shared between the sexes (although the data do not account for the amount purchased per trip, or the nature of the goods). In Accra, however, shopping is predominantly undertaken by women and thus a lower proportion of men make shopping trips; even those men who do undertake such trips, make them less frequently than women.

The mean distance travelled for shopping purposes is shown in Table 9.

Mean distance is typically longer in Accra. The need to travel further to obtain any required goods (and the associated increase in cost and/or time) would generally suggest less frequent shopping trips, especially for low income groups who have little access to personal motorised vehicles. This is supported by the data in Table 8; only 2 per cent of low income residents of Accra shop daily compared to 11 per cent of Pune's low income residents.

In both Pune and Accra, males travel further than females

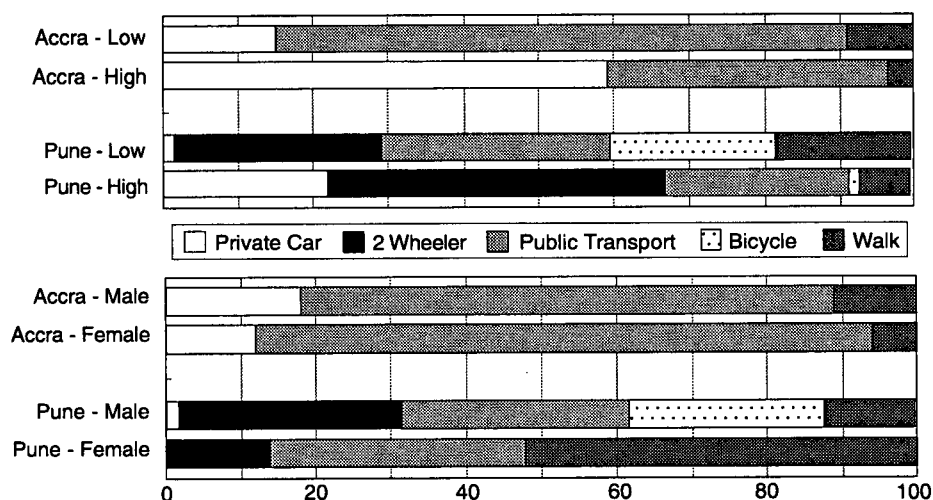


Fig. 3 Modal choice by income and sex: work trips

TABLE 8

Individuals' shopping trip frequencies (%)

	<i>Accra</i>		<i>Pune</i>	
	Low	High	Low	High
Daily	2.0	6.9	11	6.2
One to four times per week	62	50	56	60
Less than once per week	36	43	33	34
(Proportion of sample making trips)	(75)	(78)	(80)	(47)
	Male	Female	Male	Female
Daily	-	3.8	9.0	11
One to four times per week	44	79	52	57
Less than once per week	66	17	39	32
(Proportion of sample making trips)	(66)	(88)	(76)	(79)

TABLE 9

Mean shopping trip distance (km)

	<i>Accra</i>		<i>Pune</i>	
	Low	High	Low	High
Mean distance	7.9	9.8	4.8	4.9
	Male	Female	Male	Female
Mean distance	8.5	7.6	5.6	4.1

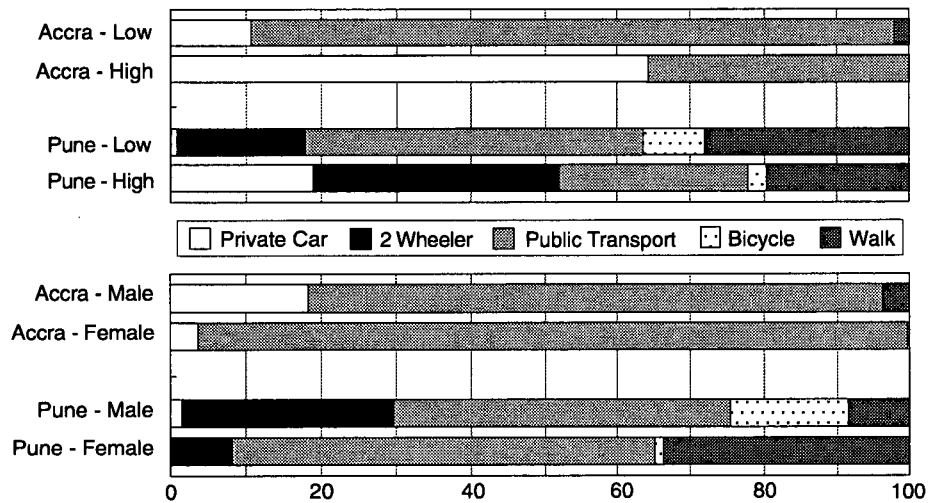


Fig. 4 Modal choice by income and sex: shopping trips

for shopping purposes. This pattern is the same as for work trips, and the same explanation - access to personal motor vehicles - is supported by modal choice data (see Figure 4).

For low income groups in both Accra and Pune, personal motorised vehicles are used for a lower percentage of shopping trips than work trips. This is likely to be the result of the lack of power by individuals undertaking shopping trips (which are by definition not associated with earning, but spending, money) to dictate vehicle usage, as discussed in Section 5.4. For high income groups the proportions of work and shopping trips made using personal motorised vehicles are similar.

As discussed in relation to mean trip distance, males make more use of personal motor vehicles than do females. Access to such vehicles makes it possible to travel longer distances, and thus males on average make longer trips for shopping.

Public transport is the modal mode for both sexes in both cities. However, whilst in Accra public transport accounts for a vast majority of shopping trips, in Pune many individuals travel by other means. About one third of females walk; more than a third of males use either a motorised two wheeler or a bicycle.

5.6 EDUCATION TRIPS

The final specific journeys about which respondents were asked were those for education purposes. Trip frequencies are shown in Table 10. As outlined in Section 4, only individuals aged 16 years and above were interviewed. Thus the individuals appearing in the following analyses should be regarded as students, rather than as school children.

It can be seen that in both Pune and Accra, individuals undertaking educational activities from low income households make trips every day. Whilst this is also true for a majority of the high income groups, there remains a sizeable proportion who make education trips less frequently. The implication is that they are studying part time (perhaps at evening classes) or at a university where attendance is only required when a relevant lecture is being given.

Table 11 shows the mean distance travelled by the various groups for educational purposes. In Accra low and high income groups travel comparable distances. In Pune, however, high income students travel much further than the low income group.

In Accra females travel further than males for educational purposes, whereas in Pune males travel further than females.

TABLE 10

Education trip frequency (%)

	<i>Accra</i>		<i>Pune</i>	
	Low	High	Low	High
Daily	90	62	80	69
One to four times per week	10	38	8.6	20
Other	-	-	11	11
(Proportion of sample making trips)	(23)	(15)	(23)	(15)
	Male	Female	Male	Female
Daily	83	100	82	76
One to four times per week	17	-	8	10
Other	-	-	10	14
(Proportion of sample making trips)	(25)	(22)	(21)	(26)

TABLE 11

Mean education trip distance (km)

	<i>Accra</i>		<i>Pune</i>	
	Low	High	Low	High
Mean distance	7.1	6.8	6.4	10.7
	Male	Female	Male	Female
Mean distance	6.5	7.5	6.8	5.8

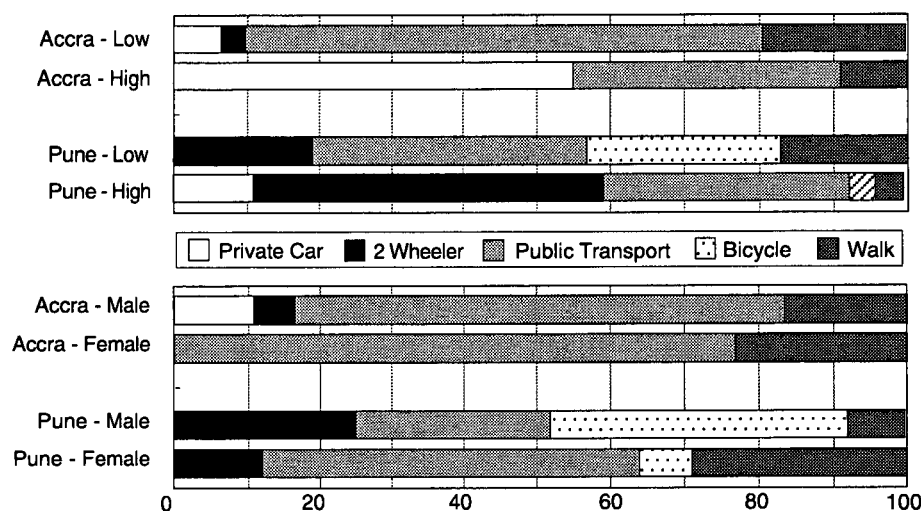


Fig. 5 Modal choice by income and sex: education trips

Modal choice for education trips is shown in Figure 5.

The pattern of use of personal motor vehicles is similar to that for work journeys (although the absolute numbers are lower for education trips), suggesting that students who travel by these means are obtaining a lift from a working member of the household.

Students typically are not wage earners, and are thus less able to afford personal vehicles. Nevertheless approximately half the students from both income groups in Pune use a two wheeler to make education trips. The type of two wheeler (motorised or bicycle) is, of course, affected by income group. There is also a heavy reliance on public transport, and approximately one fifth of the low income groups travel on foot.

In general, males make more use of personal motor vehicles than women, and many males in Pune use bicycles. Women on the other hand rely heavily on public transport and walking. The large number of walk trips suggests that public transport services are failing to meet the specific needs of these users, i.e. the need for low cost services for short distances.

5.7 ATTITUDES REGARDING PERSONAL VEHICLES

It has been demonstrated that modal choice is not simply a function of personal or household economics. Whilst the decision by a household to purchase a vehicle involves economic considerations, other factors also play their part. For example, in Accra generally, and for females in Pune, the low rate of cycle ownership can be partially attributed to cultural values.

The survey included a small section dealing with attitudes towards two modes of personal transport: motorised two wheelers and bicycles. The respondents were asked whether

they regarded each of these modes as safe or unsafe, acceptable or unacceptable, and comfortable or uncomfortable.

Figure 6 shows the opinions of the two income groups in Accra and Pune with respect to bicycles. The Figure shows the proportion of respondents giving the replies 'safe', 'acceptable', and 'comfortable'.

Considerably more individuals from Pune than Accra regard the bicycle as 'safe'. Whilst a similar proportion of individuals from both cities regard the bicycle as an 'acceptable' mode of transport, more Pune residents think of bicycles as 'comfortable'. In both cities, more men than women are positive about the 'safety', 'acceptability' and 'comfort' of bicycles.

As discussed earlier there are differences in attitudes towards bicycles between the majority indigenous population of Accra and migrant workers from Northern Ghana (see Section 5.2) (Grieco, *et al.*, 1994; Turner, *et al.*, 1995b). It is somewhat surprising to find such a high proportion of the Accra sample reporting that they believe bicycles to be 'acceptable'. Attitudes towards the 'safety' and 'comfort' of bicycles are, however, much more negative than those from the Pune sample, and go some way towards explaining the relative level of bicycle usage between the cities.

The pattern of responses with respect to motorised two wheelers (not displayed here) is the same as that for bicycles; however the proportion of all groups rating the motorised two wheeler as 'safe', 'acceptable' and 'comfortable' is higher.

Use of motorised two wheelers is to a large degree mediated by the use of bicycles; people tend to graduate from bicycle to motorcycle/scooter ownership and usage. Thus, whatever the attitudes towards motorised two wheelers one would not expect high usage of this mode in Accra.

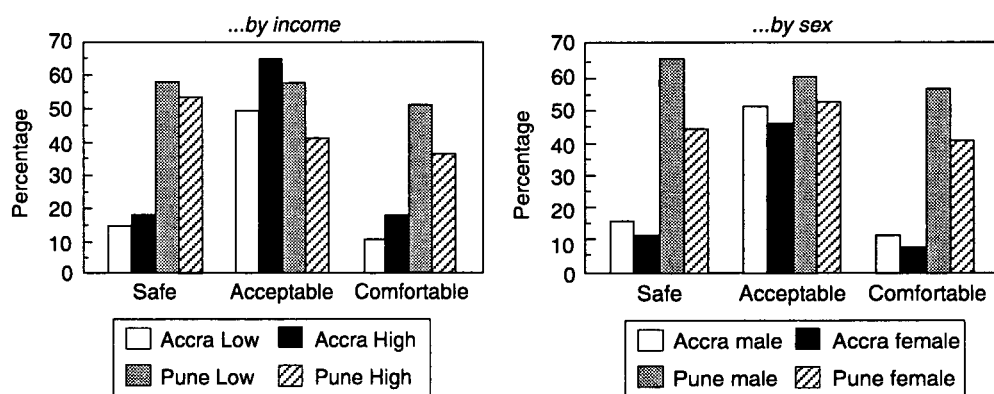


Fig. 6 Attitudes towards bicycles

5.8 ATTITUDES REGARDING PUBLIC TRANSPORT

5.8.1 BUS SERVICES

Both male and female respondents in both cities stated that problems exist in accessing public transport during peak periods. In both cities, respondents thought the capacity at peak periods was inadequate, and suggested that there was a need for increased service frequency, to meet demand. As discussed in Section 3, manufacturing companies in both cities operate their own bus services to enable their workforces to arrive on time. The fact that companies need to operate their own bus services to transport employees serves to illustrate that existing public transport provision is inadequate.

Table 12 shows the problems in using public transport, as perceived by users. It is interesting to note that in both Accra and Pune the respondents were not particularly concerned about the cost of public transport, this maybe because the journeys the respondents were making were deemed necessary (e.g. a work trip), and therefore cost was not such a consideration. Overcrowding is a particular problem in Pune, and this is clearly related to the inadequate service provision, as suggested by approximately 50 per cent of the Pune sample.

The condition of the vehicles used for public transport is a problem only for users in Accra. Being informal, tro-tro service operators frequently disregard regulations, and hence the vehicles are regularly overloaded with both passengers and goods to increase profit margins. This form of abuse over many years (the mean age of the vehicles is ten years; Fouracre, 1996) leads to structural and mechanical problems. In Pune, although problems do exist in maintaining buses in a roadworthy condition, facilities are more available for servicing and maintaining vehicles; the condition of the bus fleet is therefore less of a concern to the passengers.

Respondents were asked which measures they would like to see implemented in order that the public transport system

be improved. Inevitably, suggested improvements are linked to perceived problems.

In Pune, a large proportion of females stated that overcrowding was a problem. This may be because sexual harassment known as 'Eve teasing' is prevalent on public transport. However, very few women (2 per cent) 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 (32 per cent), and improve service regularity (39 per cent), thereby reducing the overcrowding which is so evident at times.

Males in Pune also want to see an improvement in regularity (45 per cent) and more buses operating (21 per cent). Therefore both males and females are in unison in their approach to improving public transport in Pune.

In Accra the modal improvement for both males and females was 'to build more roads' (26 per cent and 22 per cent respectively). The next most frequent response was 'to provide more or bigger vehicles' (17 per cent for both groups), which would reduce overcrowding and allow service frequency to improve. If vehicles with a larger capacity were operated then the current demand-response practices (i.e. leave when full) would be unworkable, and perhaps some form of timetable could be introduced.

5.8.2 RAIL SERVICES

Pune has heavy rail facilities and services. Respondents travelling within suburban Pune can therefore choose to travel either by bus or by local rail services along the major corridors of the city. This section reports the attitudes of users to the local rail passenger facility. Users were asked to rate their responses on a five point scale ranging from 'very good' to 'very poor'. The results are shown in Table 13.

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

TABLE 12

Problems perceived in the use of public transport (%)

	<i>Accra</i>		<i>Pune</i>	
	Male	Female	Male	Female
Overcrowding	6	9	28	41
Too expensive	8	10	1	3
Inadequate frequency/not enough buses	35	36	54	45
Old/dangerous vehicles	14	14	-	-
Rude staff	10	8	5	6
Other	27	23	12	5

TABLE 13

Attitudes to train services in Pune (%)

	<i>Very Good</i>		<i>Good</i>		<i>Average</i>		<i>Poor</i>		<i>Very Poor</i>	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Reliability	17.1	21.5	17.1	37.1	19.7	19.9	46.1	17.3	-	4.2
Comfort and convenience	3.9	21.7	29.0	52.3	52.6	22.8	14.5	3.2	-	-
Connection availability	1.3	9.7	21.1	60.0	32.9	19.5	44.7	10.3	-	0.5
Behaviour of drivers and conductors	10.0	-	50.0	44.7	20.0	10.7	20.0	28.5	-	16.1
Behaviour of other passengers	-	10.9	13.5	28.9	32.4	23.0	52.7	18.6	1.4	18.6
Safety of boarding and alighting	-	12.0	77.7	38.9	19.7	29.7	1.3	17.7	1.3	1.7
Fares charged	3.9	16.3	47.4	50.0	38.2	31.1	10.5	2.1	-	0.5
Overall rating	-	12.0	1.3	43.5	60.6	38.2	36.8	6.3	1.3	-

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. The latter generally felt rail services were unsatisfactory, this being illustrated in that 97 per cent of males classified the services as 'average' or 'poor' compared to 44 per cent of females. Only 1 per cent of males stated that overall the train services were either 'very good' or 'good', compared to 55 per cent of females.

Again, the suggested improvements to the train service was higher frequency and improved reliability.

In many developed countries metro and Light Rapid Transit (LRT) schemes are being built to make public transport more attractive and effective. In developing countries these schemes are often viewed as status symbols and indicators of development (Gardener *et al.*, 1994). A recent study in

Medellín, Colombia (Astrop and Palmer, 1996) utilised the findings from a household survey of low income residents to assess the potential patronage by the low income of the metro system which was opened in late 1995 (the survey being implemented prior to the opening of the metro). Astrop and Palmer (1996) concluded that the system would be of little benefit to the urban poor, mainly because the points of access to the metro are far from the low income residential areas. The low income residents would have preferred that a small percentage of the huge metro investment had been spent expanding the road and bus route network, and hence bus service frequency, thereby ensuring direct access and services to their neighbourhoods. At present many of the neighbourhoods perched on the sides of the Medellín valley are not served directly by roads, and hence residents have to walk considerable distances to access the public transport network. Even if they could afford to use the metro, they would have to walk and catch a bus to travel to the metro station, thus negating any potential time savings. Thus metros and LRTs are not always appropriate forms of transport development in cities in the developing world which are populated mainly by the low income.

6. DISCUSSION AND CONCLUSIONS

This report has demonstrated that the provision of public transport services in the two cities of Accra and Pune (which are assumed to be representative of a large number of cities in the developing world) is not always able to meet the needs of residents of low income areas. For a majority of the residents motorised personal transport is unavailable, and high purchase and maintenance costs suggest that it is unlikely that ownership of motorised vehicles by the low income groups will grow significantly in the foreseeable future. It is possible that the use and ownership of bicycles among these groups will rise; bicycles are, however, not suitable for long journeys and also their use (or lack of) may be biased by cultural influences.

In Accra, the cultural bias against cycling manifests itself in beliefs about the dangers and lack of comfort inherent in cycling. To some extent these beliefs are self-fulfilling; since there are so few cyclists no special provision is made for them in terms of infrastructure, and other road users are not given the opportunity to learn to make special allowances. There are plans to introduce separate cycle lanes into Accra, which should help users in terms of comfort and safety. This may consequently provide an opportunity to raise the profile of bicycle usage. However, the bias against cycling is cultural, and as such is not necessarily based upon objective judgements of safety and comfort. It is likely that the maximum benefit will be gained from cycle lanes in Accra only if their installation coincides with imaginative marketing. In Pune, it is becoming more socially acceptable for females to use two wheelers, and females from high income households are increasingly observed travelling by motorised modes such as mopeds and scooters.

Pedestrians in Accra can be considered to be in a more fortunate road safety position than cyclists since, despite the generally poor condition of pavements, the sheer number of pedestrians ensures that drivers account for their presence. However, pedestrians in all countries continue to represent an extremely vulnerable road user group, and future resources need to be targeted to address their specific needs. Measures such as the building of proper pavements, and the introduction of signalised pedestrian crossings could be of significant benefit. Such installations would be of particular benefit to head loaders, who are particularly at risk since their ability to look for vehicles before crossing and to physically react to dangerous situations is severely restricted.

Because of the limitations of cycling and walking in terms of distance it appears that the travel needs of poor urban residents are likely to be met by public transport for the foreseeable future. There is a requirement for services to be reliable, inexpensive, frequent, and must also operate

throughout low income residential areas. Many interviewees complained about inadequate and unreliable services which can affect the ability to travel to work and therefore have an impact on household income.

In both Accra and Pune residents of low income urban areas tend to make considerable use of informal public transport (tro-tros and autorickshaws respectively) as these vehicles operate in areas not covered by formal public transport. In Pune autorickshaws can also be used as a feeder service to provide access to the formal public transport sector.

The public bus companies are at present unable to increase their resources to meet demand, and are often unable to maintain their fleet in a roadworthy condition, thereby limiting the number of vehicles available for service on any one day. Resources should therefore be targeted at improving public transport vehicle availability. In Pune, bus companies are faced with a dilemma; either to increase fares and thereby enable an expansion of the bus fleet, or to continue to operate at existing fares, but be unable to meet peak demand and maintain the road worthiness of the fleet.

In Accra no scheduling system operates, and tro-tros leave termini as and when they are full. Surveys in Accra have recorded waiting times of up to two hours in the inter-peak periods. It appears there is need for some form of control whereby tro-tros are scheduled to operate at specified times. It is probable that in order to encourage operators to manage their services in accordance with a scheduled timetable some form of incentive would be required.

Regarding urban train services, users in Pune thought that generally these services could be improved, although this too will require financial investment. An alternative to rail services being considered by a number of cities is metro or light rapid transit systems, but following the findings in Medellín, urban planners in these cities need to carefully review the benefits such systems will afford the urban poor. Expansion or improvement of the road and bus network may be a more appropriate investment. Possibilities include bus segregation and bus priority measures. These low-cost approaches to transport improvement have in London resulted in increased productivity for the bus companies and allow improved service frequencies without increasing fleet size (Astrop and Balcombe, 1995). There is merit in applying these principles to the needs of cities in developing countries.

The research has shown that females are somewhat disadvantaged compared to males in terms of personal mobility. Females are generally more reliant on public transport which as this study has shown, does not provide adequate services. Even females in vehicle-owning households are disadvantaged, since vehicle usage is often restricted to journeys which are directly associated with the highest income-generation. Women often therefore are in a relatively poor bargaining position in usage negotiations.

In Pune the surveys demonstrated that females were generally more dissatisfied with bus services than males. This could be a result of sexual harassment. This hypothesis is supported by the finding that females were more satisfied than males in respect of train services, where female only carriages are provided. Females do not, however, want to see segregation introduced into buses; this may be the result of past experience with such a system. Female-only buses are perhaps an option, an alternative option being higher service frequencies which would reduce the number of passengers in crush situations.

In Accra both sexes appear to experience similar problems with the use of public transport services, suggesting that both males and females are disadvantaged equally.

In summary it is apparent that there are constraints in respect of personal accessibility and mobility that are common to all cities. But, importantly, there are also differences that have arisen as a product of culture and the existing transport infrastructure. Planners need to be aware of this cultural specificity and acknowledge that a solution for one city may not be a solution for all. Care must be taken that more resources are allocated in such a way as to meet the travel demands of the entire urban population and not just the more affluent sections of society. It is the urban poor, particularly females, which are the most vulnerable in society, and thus it is essential that their travel needs are addressed for the sustainability of the household to be ensured.

7. ACKNOWLEDGEMENTS

The work presented in this Report was carried out in the Overseas Centre of the Transport Research Laboratory (Programme Director: Dr John Rolt) under the Technology Development Research Programme of the Engineering Division, Overseas Development Administration.

The authors are grateful for the assistance given by the local collaborators in each of the cities: Dr S Padam (Director) and the Faculty of the Central Institute of Road Transport, Pune; Mr J Amegashie (Executive Director) of the Ghana National Road Safety Committee, Accra.

8. REFERENCES

AGARWAL S., M. ATTAH, N. APT, M.S. GRIECO, E.A. KWAKYE, and J. TURNER (1994). Bearing the weight: The kayayoo, Ghana's working girl child. UNICEF Conference on the Girl Child. Ahmedabad, India.

ASTROP A.J. and R. J. BALCOMBE (1995). Performance of bus priority measures in Shepherd's Bush. *TRL Report 140*. Crowthorne: Transport Research Laboratory.

ASTROP A.J. and C.J. PALMER (1996). Understanding the travel behaviour and constraints of low income households in Medellín, Colombia. *TRL Project Report PR/OSC/092/96*. Crowthorne: Transport Research Laboratory. Unpublished. (Available on written request.)

ASTROP A.J., C.J. PALMER, D.A.C. MAUNDER and M. BABU (1996). The urban travel behaviour and constraints of low income households and females in Pune, India. Paper presented at the National Conference on Women's Travel Issues. Baltimore, 23-26 October, 1996.

FOURACRE P.R. (1996). Urban transport: Key statistics and performance indicators. *TRL Project Report PR/OSC/105/96*. Crowthorne: Transport Research Laboratory. Unpublished. (Available on written request.)

GARDNER G., J. RUTTER and F. KUHN (1994). The performance and potential of light rail transit in developing cities. *TRL Project Report PR/OSC/069/94*. Crowthorne: Transport Research Laboratory. Unpublished. (Available on written request.)

GRIECO M.S., J. TURNER and E.A. KWAKYE (1994). A tale of two cultures: Ethnicity and cycling behaviour in urban Ghana. Seventy Third Annual Meeting of the Transportation Research Board. Washington D.C., January 1994.

JACOBS G.D. and P.R. FOURACRE (1976). Intermediate forms of urban public transport in developing countries. *Traffic Engineering and Control*, Vol 17, No 3.

MAUNDER D.A.C. (1984). Trip rates and travel patterns in Delhi, India. *TRRL Research Report 1*. Crowthorne: Transport Research Laboratory.

PALMER C.J. (1996). Understanding the urban travel behaviour and constraints of low income households in Accra, Ghana. *TRL Project Report PR/OSC/111/96*. Crowthorne: Transport Research Laboratory. Unpublished. (Available on written request.)

PALMER C.J., A.J. ASTROP, M. BABU and D.A.C. MAUNDER (1996a). Understanding the urban travel behaviour and constraints of low income households in Pune, India. *TRL Project Report PR/OSC/109/96*. Crowthorne: Transport Research Laboratory. Unpublished. (Available on written request.)

PALMER C.J., A.J. ASTROP, M. BABU and D.A.C. MAUNDER (1996b). The travel behaviour of households in Pune. Paper presented at the International Symposium on Infrastructure of the Future. Bangalore, 25-29 November, 1996.

TURNER J. (1996). Trading and the tro-tro: A description of the informal public transport sector of Accra. In Grieco M.S., N. Apt and J. Turner (Eds), *At Christmas and on Rainy Days: Transport, Travel and the Female Traders of Accra*. Aldershot: Avebury.

TURNER J. and P.R. FOURACRE (1995). Women and transport in developing countries. *Transport Reviews*, Vol 15, No 1, pp 77-96.

TURNER J., M.S. GRIECO and E.A. KWAKYE (1995a). Understanding the travel behaviour of low-income households in Accra, Ghana. *TRL Project Report PR/OSC/082/95*. Crowthorne: Transport Research Laboratory. Unpublished. (Available on written request.)

TURNER J., M.S. GRIECO and E.A. KWAKYE (1995b). Subverting sustainability? Infrastructural and cultural barriers to cycle use in Accra. The Seventh World Conference on Transport Research. Sydney, 16-21 July, 1995.

MORE INFORMATION

The Transport Research Laboratory has published the following other reports on this area of research:

- RR 1 Trip rates and travel patterns in Delhi, India. D A C Maunder. Price code OS_A.
SR 767 Household and travel characteristics in two suburban residential areas of Delhi, India.
D A C Maunder. Price code OS_A.
SR 709 Characteristics of public transport demand in Indian cities. D A C Maunder, P R Fouracre,
M G Pathak and C H Rao. Price code OS_A.

If you would like copies, photocopy and fill in the slip below. Enquiries to Overseas Centre,
Telephone: 01344 770551 or 770187, Fax: 01344 770719.

.....
To: Overseas Centre, Old Wokingham Road, Crowthorne, Berkshire, RG45 6AU.
Please send me the following Transport Research Laboratory reports (state report Nos and
quantity)

.....
.....
.....
.....
Name

Address

.....
.....
.....
.....
Postcode

Telephone

USE OUR EXPERTISE



The Transport Research Laboratory's researchers and facilities are available at competitive rates.

Our 330 scientists and engineers include many world-class experts on highways design and maintenance, transport structures, traffic systems, vehicle safety, road safety and the environment.

The Transport Research Laboratory facilities include a 3.8 km test track, a fully interactive driving simulator, an all weather facility for impact testing of vehicles, large structures test halls for static and fatigue testing, dynamic pavement test facility, dynamic and low cost impact test rigs, a pedestrian impact test facility, as well as advanced computer systems and a large specialist library with online access to worldwide information.

If you are planning a project where we may be able to help, contact the Transport Research Laboratory's Business Directorate at Crowthorne, Berkshire RG45 6AU, telephone 01344 770004, fax 01344 770356.