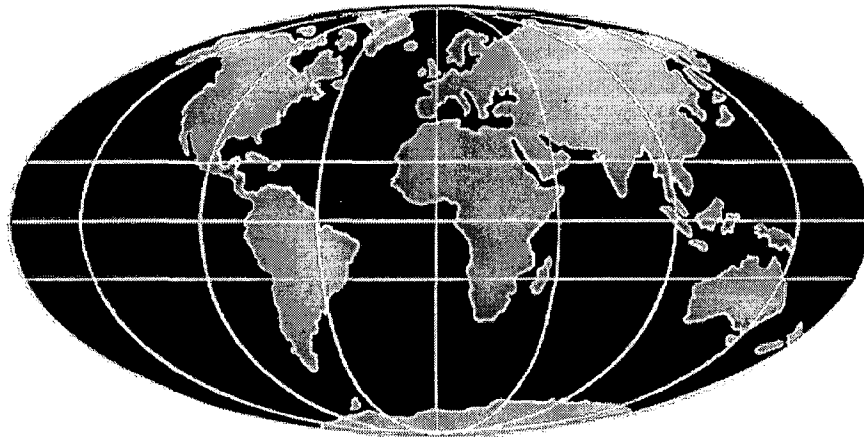# DFID
Department For
International
Development

TRL

TITLE: Public Transport Needs of the Urban Poor in Delhi, India

by: D A C Maunder

PA1162/86, MAUNDER, D A C, (1986). **Public transport needs of the urban poor in Delhi, India.** *CODATU. Third Conference on Urban Transport in Developing countries, Cairo, 20 - 23 January 1986. Paris: Conferences sur le Developpment et l'Amenagement des Transports Urbaines dans les Pays on Developpement.*

Public Transport Needs Of The Urban Poor in
Delhi, India

D A C Maunder
Senior Scientific
Officer
Overseas Unit
Transport & Road
Research Laboratory
United Kingdom

SUMMARY

Settlement of the low income community to distant city fringes has become an all
too frequent occurrence in the Third World at the present time. Yet this
policy decision has far reaching and lasting implications for both the urban
poor community and operators of public transport services.

The paper discusses the transport implications of an enforced relocation
settlement policy in Delhi, India where the travel demands of relocated low
income communities are contrasted and compared with higher income groups.
Effects of income and residential location on trip rates and travel patterns
are highlighted.

Basic modelling procedures suggest that travel demand (especially for public
transport services) could be considerably reduced by more prudent resettlement
policies and land use development.

RESUME

L'établissement des communautés économiquement faibles en bordure éloignée
des villes est devenu un fait qui n'est que trop fréquent à présent dans le
Tiers Monde. Et pourtant, cette décision politique a des implications durables
de grande portée en ce qui concerne les communautés urbaines pauvres et les
entreprises de transports publics.

Cette communication discute les implications pour les transports d'une politique
de replacement obligatoire des habitations à Delhi, dans l'Inde, où l'on compare
et fait ressortir le contraste entre les demandes de transport des communautés
économiquement faibles replacées avec celles des groupes à revenu plus élevé.
On souligne les effets du revenu et de l'emplacement résidentiel sur le taux
des déplacements et la répartition des voyages.

Les techniques de modélisation fondamentales suggèrent que la demande de
transport (particulièrement les services de transports publics) pourrait être
considérablement réduite grâce à des politiques plus prudentes de transfert de
population et grâce au développement de l'utilisation du sol.

Public Transport of the Urban Poor
in Delhi, India

D A C Maunder
Senior Scientific Officer
Overseas Unit
Transport & Road Research
Laboratory
United Kingdom

1. INTRODUCTION

It has been estimated that by the year 2000 approximately 50 per cent of the world's population will be living in urban areas. Over two thirds of this urban population will be living in cities of the Third World that presently experience great difficulty in feeding, housing and transporting the millions that already live there. The urban population explosion taking place in the Third World (and projected for the future) is the result of high birth rates, falling death rates, improved medical facilities and migration from rural areas. In India the present average annual urban growth rate of 3.8 per cent is more than twice that of rural areas.

As the urban population increases, most of the additional population will be from the poorest sections of the community who will become an ever increasing proportion of the urban community. Many who live as squatters on pavements, roadsides, river and railway banks etc are often moved out to the periphery of cities into resettlement areas. Similarly those migrating to the city mainly from rural areas are usually confined to similar locations. Public transport services then have to be provided at a cost that they can afford which generally leads to high levels of fare subsidies. By the relocation of low income groups to sites distant from the city centre, transport mobility and accessibility are reduced, travel times and distances increased and additional expenditure incurred to meet basic travel needs (even when public transport fares are heavily subsidised). This contrasts with life within the city centre as squatters in close walking proximity to most amenities and work places. It is unlikely that factors such as reduced mobility/accessibility of low income communities or the added burden of providing additional public transport services (in addition to other infrastructural services) are seriously considered by city administrators when relocating squatters to areas distant from the city centre. For example, during 1975/77 thousands of squatters/migrants living in the central areas of Delhi, India were moved to resettlement camps located between 15-30 kilometres from the city centre. As a consequence these low income communities became institutionalised and at present, 34 resettlement camps/colonies now contain over 1.5 million residents representing about 20 per cent of the total population of the city. Gradually basic services such as water, sanitation, street lighting and domestic electricity have been supplied. Public transport services had to be provided immediately in order to move the residents to and from the city centre giving the Delhi Transport Corporation (DTC), who provide services throughout the city, considerable problems.

This paper presents results of surveys conducted in Delhi, during 1979/82 into the travel patterns of different socio-economic groups and the way in which their travel needs are provided.(1,2,3) The findings are used to determine how residential location, household income and both private and public transport provision affect trip rates, travel patterns and modal choice. Results of the surveys have been used to derive basic models so that both public transport

operators and planners have a clearer understanding of the travel needs and requirements of a cross section of the population of Delhi but particularly those of the low income community living considerable distances from the city centre. The general insights provided should be of interest to urban transport and land use planners and other professionals concerned with mobility, accessibility and planning in cities in the developing world.

2. SURVEY AREAS OF DELHI

Delhi, with a population of 6.1 million, is one of the largest cities in India. It is the capital of India and the seat of government and is situated within the northern plain beside the river Jamuna.

Detailed home interviews were conducted in Delhi in six different residential areas or colonies; information was collected on trip rates, travel patterns and basic socio economic characteristics of the households. The six areas surveyed were two low income resettlement colonies, (Nand Nagri and Dakshin Puri), three upper-middle income colonies, (West Patel Nagar, Saket and Janakpuri) and one lower-middle income unauthorised colony, (Shakarpur). All six areas differ in terms of distance from the central area and household income of residents (see Table 1). In addition to these six areas, squatters located in and around the city centre were studied to extend the data base to include centrally located low-income housing groups.

TABLE 1

Distance from city centre and household income of study areas: Delhi

Average monthly household income*	Road distance from city centre		
	'near' (between 6 and 7 km)	'middle' (14-15 km)	'far' (22-24 km)
Low (less than Rs 500/600)	(Squatters)	Dakshin Puri	Nand Nagri
Lower-middle (Rs 501-1000/1100)	Shakarpur	–	–
Upper-middle (Rs 1001-2500/3000)	West Patel Nagar	Saket	Janakpuri

*Note: In April 1982 the £ sterling was equivalent to 17 Rupees.

3. PUBLIC TRANSPORT SUPPLY

Transport services consist of conventional stage buses operated by the Delhi Transport Corporation (DTC), taxis, auto and cycle rickshaws, horse drawn tongas, motorcycle 'phut phuts' and privately owned and operated charter buses. The DTC (a Central Government Undertaking) provides a network of bus services to all areas of the city. The privately operated transport services tend to be operated only to and from higher income residential areas where there is sufficient demand for such services. This is shown in Table 2.

In the two low income resettlement colonies only a few privately operated modes exist; these are cycle rickshaws, horsedrawn tongas and autorickshaws. In all four middle income colonies cycle rickshaws, autorickshaws, taxis and

TABLE 2

Privately operated public transport provision: all survey areas

Mode (income)	Nand Nagri (low)	Dakshin Puri (low)	Shakarpur (lower middle)	Janakpuri (upper middle)	West Patel Nagar (upper middle)	Saket (upper middle)
Autorickshaws	-	12	10	50	30	15
Cycle rickshaws	few	few	20	75-100	-	few
Tongas	50	few	10	few	-	-
Taxis	-	-	6	25	20	28
Charter buses	-	-	2-5	100+	15-20	10

charter bus services are operated both within the colonies and to/from other locations in Delhi. Charter buses are contracted by groups of local residents to provide services to and from the central business area during peak travel times. Thus higher income communities appear to enjoy a higher level of privately operated public transport provision.

The DTC provides conventional stage bus services to all six colonies; Table 3 summarises the different levels of supply.

TABLE 3

DTC conventional stage bus service provision: all survey areas

Service provision	Nand Nagri	Dakshin Puri	Shakarpur	Janakpuri	West Patel Nagar	Saket
Routes operated	7	14	19	23	44	9
Routes per 1,000 population	0.1	0.2	0.5	0.2	0.7	0.2
Buses scheduled	41	85	110	140	261	50
Buses per 1,000 population	0.8	1.3	2.7	1.4	4.3	1.4

Not all routes service colonies directly; many routes, especially to Shakarpur and West Patel Nagar, provide services along boundary roads 'en route' to other parts of Delhi. These two colonies have a comparatively high level of service provision compared with the other colonies because they are centrally located and sited along major travel corridors.

In terms of conventional stage buses there does appear to be a relationship between distance from the central area and service provision ie less public transport as distance from the central area increases. In addition, the number of actual buses operated does tend to be less to lower income colonies than to similarly located middle income colonies even though low income residents are likely to be more dependent on the bus service than middle income residents who have (as seen above) a wider and more varied choice of public transport.

It is worth noting that the DTC revenue cost ratio has deteriorated rapidly over the total route network from 0.76:1 in 1979 to 0.39:1 in 1984. The ratio for the routes servicing the six study areas has similarly declined. The DTC incurs marginally heavier losses on routes to low income communities than to similarly located middle income residential areas.

4. SOCIO-ECONOMIC CHARACTERISTICS OF HOUSEHOLDS

Household size varies little between the six colonies, the averages being between 4.4 and 5.4 persons. The average number of students per household ranges from zero for squatters (their life style does not encourage schooling) to 1.9 for Shakarpur households. The number of employed persons ranges from 1.4 in Saket, Dakshin Puri and Shakarpur households to 1.8 in squatter households. Appendix 1 shows the distribution of monthly household income observed in the sample of households interviewed.

Household monthly incomes range from £18 in squatter households to £150 in upper middle income colonies. Over one third of squatter households had less than Rs 200 a month (£11.75) on which to exist and in other low income colonies up to 6 per cent of households also existed on this amount of income.

Household heads were asked to estimate how much the household spent per month on transport. Figure 1 shows the distribution of reported transport expenditure (all modes) by income category for all six survey areas. At low incomes (less than Rs 600 and representing between 3 to 81 per cent of households interviewed in the four colonies of Nand Nagri, Shakarpur, Dakshin Puri and Saket) the level of expenditure is considerable, ranging between 27-37 per cent of household income: the rate quickly declines, however, to around 5 to 15 per cent over the income range of Rs 600-4,000. In West Patel Nagar and Janakpuri a more even relationship is observed ranging from 17 per cent at low income levels to 8-10 per cent at incomes of Rs 4,000. Thus, in all areas above a certain income level tranpsort expenditures are broadly similar in percentage terms irrespective of household income, suggesting the existence of a constant or near-constant travel budget (once a threshold income of about Rs 600 is reached).

Although relative transport expenditures are fairly similar over a wide income range the level of mobility and modal choice differ widely due to such factors as personal vehicle ownership, access to public transport service provision and level of trip making activity. Table 4 shows the level of personal vehicle ownership in each colony and the categorisation of households by actual vehicle owned (though some households obviously possess more than one vehicle or type of vehicle).

TABLE 4

Household vehicle ownership levels

Per-centage of house-holds owning: (income)	Nand Nagri (low)	Dakshin Puri (low)	Shakarpur (lower middle)	Janakpuri (upper middle)	West Patel Nagar (upper middle)	Saket (upper middle)
any vehicle	29	62	59	62	59	77
cycle	28.5	59	49	34	30	18
motorcycle	0.5	2	18	38	35	51
car	-	1	3	5	6	29

In five of the survey areas over 50 per cent of households have some form of vehicle, but only 29 per cent of households in Nand Nagri and less than 10 per cent of squatter households have a vehicle. Not surprisingly the type of vehicle owned varies substantially between different communities. For example, almost all personal vehicles owned by low income households are cycles, whereas

in Saket personal vehicles tend to be motorcycles and cars. This suggests a correlation between vehicle type, ownership and household income, with low income households being more likely to possess cycles and middle income households a motorised vehicle. Figure 2 illustrates this relationship and curves having been generated by combining the vehicle ownership figures for each colony.

5. HOUSEHOLD TRAVEL DEMAND

5.1 Trip Rates

Details of all trips undertaken daily by household members were obtained by personal interview, and trips were categorised into the following purposes: (i) educational, (ii) employment and (iii) 'other' including social/leisure trips and trips by housewives.* Figure 3 shows that the majority of trips in all areas were for employment and educational purposes, particularly in low income households. In higher income areas however, almost 20 per cent of trips were for 'other' activities, mainly social/leisure pursuits.

The overall average daily trip rate per household in the six areas ranges from 5.1 to 8.5 with the trip rate for squatter households being 4.0. The trip rate per capita (see Figure 4) ranges from 1.0 in Nand Nagri to 1.6 in both Saket and Shakapur; the rate is 0.8 for squatter households. There is thus evidence that residents of low income colonies make fewer trips than those in middle income colonies. Furthermore, location also appears to have an effect on trip making, residents in colonies located at the periphery of the city tending to make fewer trips than those (of similar income) living close to the city centre. Figure 5 illustrates the distribution of daily trip rate per capita by income category. In general the figure shows an upward trend in trip rates as household income increases. This income effect on trip making seems to be associated largely with increased educational and other activities in more affluent communities as shown in Figure 3.

In order to determine further the effect of location on the level of trip making, trip rates were combined for residential colonies located similar distances from the city centre. Thus a composite trip rate was obtained for each distance category by income and the results are shown in Figure 6. The combined 'far' locations of Nand Nagri and Janakpuri have considerably lower trip rates for given income levels than the more centralised locations. There is little difference observed between the 'near' and 'mid' locations except at the extremes of income level.

Figure 6 implies that households in colonies more than 15 kilometres from the city centre are likely to have trip rates which are up to 30 per cent lower than those closer to the city centre. From Figure 6 it is possible to make some estimates of trip rate elasticities with respect to income. The shape of the curves in both Figures 5 and 6 suggest that the elasticity is likely to be higher for low income households in all six colonies than for higher income households. Table 5 shows estimated values of trip rate elasticities for three income groupings.

---

* Note, housewives in India do not escort their children to school to any significant extent. This would not necessarily be the case in other parts of the developing world.

TABLE 5

Trip rate elasticities with respect to household income

Income range	Residential locations less than 15 kms from the CBD	Residential locations greater than 15 kms from the CBD
< Rs 1,000	0.09	0.37
Rs 1,000-2,000	0.08	0.22
> Rs 2,000	0.19	negligible

The values shown suggest that households near the CBD have very little suppressed demand and can make virtually all the trips they desire because of the wide modal choice (including walk) available to them. This is not the case in more distant colonies where only essential trips are made.

6.   HOUSEHOLD TRAVEL PATTERNS

6.1 General observations

The modal choice for all trip purposes in the six areas is shown in Table 6.

TABLE 6

Modal split for all trips undertaken daily

Mode	Nand Nagri	Dakshin Puri	Shakarpur	Janakpuri	West Patel Nagar	Saket
Walk	42	58	43	25	36	26
DTC bus services	52	26	40	36	35	27
School bus services	1	-	4	12	9	18
Charter bus services	-	-	1	14	3	7
Cycle	3	14	5	5	3	1
Scooter/motorcar	-	1	2	5	10	19
Other	2	1	5	3	4	2
TOTAL	100	100	100	100	100	100

The use of a particular mode of transport depends on factors such as the level, variety and provision of public transport services, trip purpose, distance travelled, time available for travel and access to the various modes including personal vehicles.

In all six areas the two dominant travel modes are DTC stage bus services and walk, both being particularly important in low and lower middle income areas. A considerable proportion of journeys are undertaken on foot in all colonies particularly by students. In the three upper middle income colonies where special school bus services are common the walk mode is less significant.

DTC bus services are used in the different colonies for approximately 25 to 50 per cent of all trips made, being the highest in the 'far' low income colony of Nand Nagri and the lowest in the middle distance locations of Saket and Dakshin Puri. Location is clearly a factor in modal choice and the bus (be it DTC or charter bus) is used most extensively by persons furthest from the centre. The more central locations rely less on bus services and more on walking and the use of personal modes. Although ownership of personal vehicles has an effect on

modal choice, location may have a stronger influence. Thus cycle ownership is reasonably high in Nand Nagri and yet the cycle is not used significantly presumably because trip distances are long whereas in Dakshin Puri which is located much more centrally, the cycle is used more often because trip distances are relatively short.

Charter buses tend to be important as a travel mode only in Janakpuri; possibly the use of charter buses is low in more centralised locations because the benefits of the charter bus service are not so significant for relatively short travel distances.

In Delhi the choice of mode is largely influenced by income and location. In order to establish more clearly the relationships involved, Figure 7 presents composite curves which distinguish between low and high income residents (as groups) for the journey to work. The Figure emphasises the limited choice available to low income residents who travel long distances to work. It also demonstrates the importance of motorised personal vehicles to higher income groups and shows that lower income residents, in general, walk further than higher income residents.

7.   CONCLUSIONS AND DISCUSSION

These studies have shown that both residential location and household income have an effect on travel characteristics such as trip rates, modal choice and transport expenditure. The effect of income on trip rate is, as might be expected, positive. Increasing income is associated with marginally higher trip making. The rate of increase in trip making with respect to income is dependent on location or distance of the household from the city centre; furthermore, trip making tends to decline with increasing distance from the city centre. There is a difference in trip making patterns between households with similar incomes at long and short distances from the city centre whereas there is little difference observed for households at short and medium distances.

The provision of public transport (and hence access to it) is seemingly related to location and general income of the area; areas more distant from the centre are less well served than those close to the centre, though this must be qualified by the fact that higher income areas tend to attract better services, not least because private operators (of public transport) find profitable markets in these communities. Consequently the level of public transport service is inevitably correlated with the level of trip making.

Modal choice is also significantly affected by income and residential location. As expected, higher incomes are associated with use of personal motorised vehicles and buses. Low incomes are associated more with use of DTC stage bus services, cycle and walking. Location clearly has an effect on choice in that long distance trips (for example over 15 km) are unsuitable for cycling and walking. In this case the DTC bus service is virtually the only option left for low income travellers. For those with higher incomes making similar trips, other, more expensive options, like the charter bus, taxi and auto rickshaws are readily available.

Household transport expenditure patterns for the various colonies show a marked consistency. Expressed as a percentage of household income, transport expenditures are high in all areas where the household income is less than Rs 600 per month. Beyond this level the expenditure on transport levels off to between 5 and 15 per cent of household income. This suggests the possibility of a constant transport expenditure budget over a wide income range once an initial threshold of Rs 600 is reached despite marked differences in trip rates, travel patterns, vehicle ownership etc.

It is evident that locational differences and to a lesser extent income differences have an important effect both on the relative level of travel demand and modal choice. The quantitative effects can be assessed using the survey findings by rudimentary modelling procedures. Though the models are basic they do illustrate the kind of analysis and forecasting of travel demand that can be achieved by the collection of household travel data. They also show how the results can be of practical use to transport and physical planners. For example, by studying the present travel patterns and demand in Nand Nagri and Dakshin Puri it is possible to estimate the likely effects on travel demand of locating low income people closer to the city centre. Estimates in mode choice of such a location change for the work journey are given in Table 7. There would undoubtedly be a large shift to both walk and cycle modes through relocation (to a more central area) at the expense of trips by DTC bus services.

TABLE 7

Effect on modal choice for the journey to work of locating low income
residents closer to the city centre

	Actual location	More central location (hypothetical)	Per cent change
Distance from centre	24 km	14 km	- 42
Daily work trips, of which by:	31,000	31,000	-
DT bus	24,900	17,700	- 29
cycle	3,500	7,800	+123
walk	2,600	5,500	+112

The reduction in demand for DTC services would be even greater if average journey length is taken into account. Passenger kilometres travelled by DTC bus services would be reduced by 56 per cent whilst cycle and walk kilometres would increase by 44 and 200 per cent respectively.

The effects of changes in land use, for example bringing employment opportunities closer to a residential area located more than 20 km from the city centre, are likely to be similar to those described above. Thus dependence upon DTC bus services would decline considerably whilst use of walk and cycle modes would increase. The long-term effects of such land use changes on travel patterns would be considerable for not only would the modal choice differ but so too would the actual person/passenger km travelled. Changes in kilometrage travelled by the modes are shown in Table 8.

Total passenger kilometrage by DTC bus services would be reduced by an estimated 86 per cent whilst for both cycle and walk modes there would be significant increases. The DTC could adapt to such changes in travel demand by either reducing their present service levels to such areas or by providing a better, perhaps more frequent service between residential areas and employment centres for the shorter route distances involved.

It was shown that travel costs for the low income households (less than Rs 600 per month) are a heavy burden on the household budget and households with monthly incomes of only Rs 250 per month (representing up to 20 per cent of households in low income colonies and 50 per cent of squatter households) spend up to 37 per cent of income on travel and up to 70 per cent of disposable income for 'essential' travel for employment/education purposes. This is mainly undertaken by DTC bus services at heavily subsidised fares and yet transport expenditure is still disproportionate for these people. The present policy of indirect subsidies in the form of non repayable loans to the DTC ensures that all passen-

TABLE 8

Effects of a change in land use on travel demand for the journey
to work by residents of Nand Nagri

	Actual location	Closer to employment centre (hypothetical)	Per cent change
Average distance from workplace	17 km	5 km	- 70
Person/passenger kms (000) by:			
DTC bus	453	65	- 86
cycle	41	60	+ 46
walk	4	20	+400

gers receive the same benefit rather than specific groups of the community.
Even though the present flat fare system ensures that more centrally located
residents pay a higher fare per km than long distance travellers, travel costs
are excessive and financial losses greater for the services to the distant low
income communities. There is therefore a need to redirect the policy of indir-
ect subsidy so that it is more clearly seen to help those who have low incomes
and are totally dependent on the DTC for their mobility needs. It would also
help the DTC in requesting financial assistance and fare changes by identifying
these routes/services that the DTC are obliged to provide as opposed to those
that it would wish to provide taking market factors into consideration. The
present subsidy could be redirected to all these routes/services servicing low
income resettlement areas or by subsidising individuals who earn a minimum
amount by means of concessionary travel passes (similar to those granted to
students at the present time). This would ensure that the low income community
are provided with services that they can afford more easily and those on higher
incomes pay the actual market cost (or as near as possible) in providing the
service. Failing that, a dual type system could be operated, ie an inexpensive
basic service provided for those that wish to travel in high density vehicles
and a higher cost 'seating only' service to those that wish to travel in comfort
and have the guarantee of a seat. Since the completion of the research the DTC
have introduced such a system on many routes in Delhi.

One of the main side-effects of the resettlement of squatters in Delhi has
been to create a captive market for cheap public transport services which can
provide high capacity over long journey distances (by urban standards). Many
travellers have no choice of tranpsort, their low income and residential loca-
tion restricting their modal choice to DTC bus services which are obliged as far
as possible to satisfy their needs. The DTC incurs losses on all its routes
though it is apparent that losses tend to be greater on routes servicing low
income areas. Despite the high level of demand generated at peak periods in
some of these distant suburbs, the low fare structure imposed on the DTC by the
central government and the heavy investment required to cope with the heavy
demand and long trip lengths contribute substantially to this loss.

Location is particularly important because proximity to the city centre
brings modal choice ie DTC services, cycle or walking even to the low income
groups. Clearly, transport demand could be managed to advantage by judicious
resettlement policies and land use development. It is likely that planners
throughout the Third World will continue to develop (as in Delhi) cheap peripheral
land for low income residential location at the cost of having to provide and
subsidise a cheap mass transit system. However, before such planning decisions
are taken and replicated throughout the developing world, the long term impli-

cations of such a policy need to be considered in the context of a continuing growth in urban population, city area, and demand for public transport in total. The results of the present study tend to suggest that other options need to be considered by planners to reduce the demand for public transport in total and by the low income in particular. For those members of the community with low incomes it is essential.

8.   ACKNOWLEDGEMENTS

The work described in this paper forms part of the research programme of the Overseas Unit (Unit Head: J S Yerrell) of the Transport and Road Research Laboratory and the paper is published by permission of the Director.

9.   REFERENCES

1.   MAUNDER, D A C (1984). Trip rates and travel patterns in Delhi, India. Department of the Environment Department of Transport, TRRL Research Report 1. Crowthorne (Transport and Road Research Laboratory).

2.   MAUNDER, D A C (1983). Public transport in relation to the travel needs of the urban poor in cities of developing countries. PhD thesis. University of Leicester.

3.   MAUNDER, D A C and G D JACOBS (1983). Public transport and the travel needs of the urban poor in Delhi, India. PTRC Summer Annual Meeting. University of Brighton (PTRC).

APPENDIX

TABLE 1

Distribution of total household monthly income: all survey areas

Monthly income range (Rs)	Squatters	Nand Nagri	Dakshin Puri	Shakarpur	Janakpuri	West Patel Nagar	Saket
0- 200	34	6	1	1	-	-	-
201- 400	41	51	29	8	1	4	1
401- 600	25	24	38	17	5	8	2
601- 800	-	11	14	20	8	10	3
801-1000	-	5	8	16	15	16	2
1001-2000	-	3	9	28	47	36	26
2001-3000	-	-	1	7	18	16	31
3001-4000	-	-	-	2	5	6	18
4000+	-	-	-	1	1	4	17
TOTAL	100	100	100	100	100	100	100
Average household income (Rs)	314[1]	446[1]	585[3]	1047[2]	1594[1]	1617[2]	2619[3]
Income status	'low'	'low'	'low'	lower middle	upper middle	upper middle	upper middle

Notes: (1) 1979 survey data
(2) 1981 survey data
(3) 1982 survey data
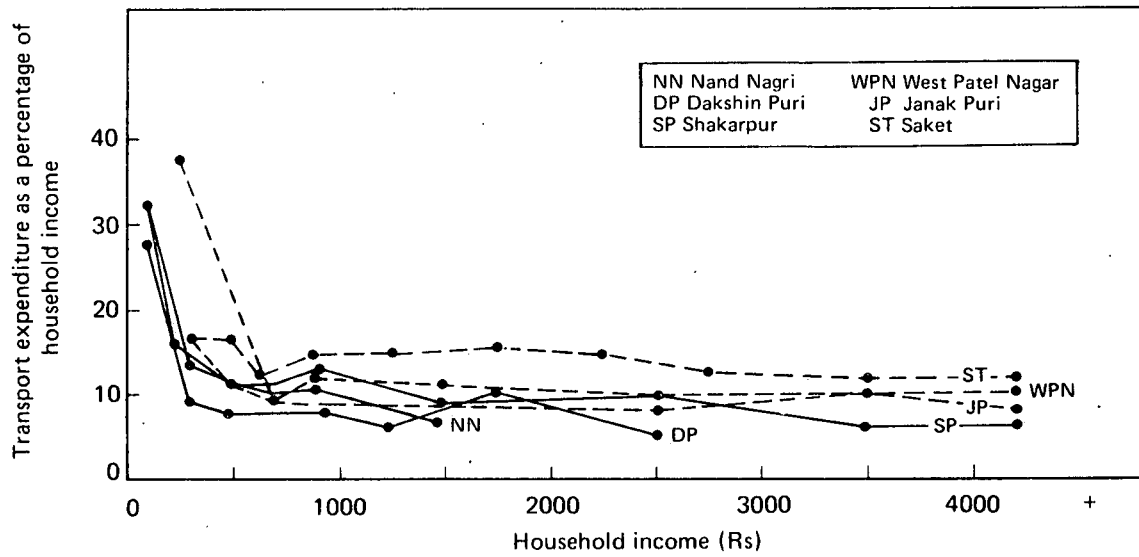
Fig. 1 Transport expenditure as a percentage of household income: All survey areas
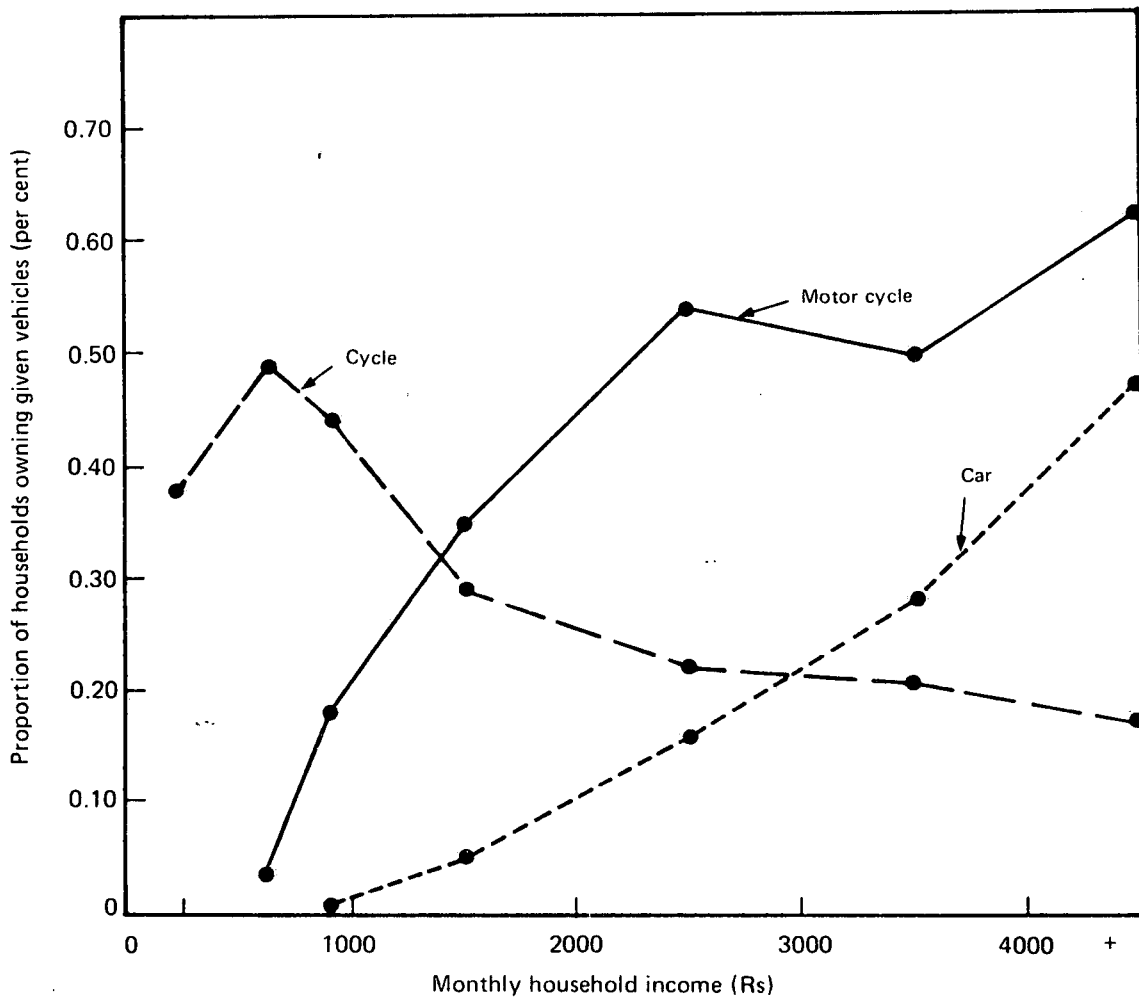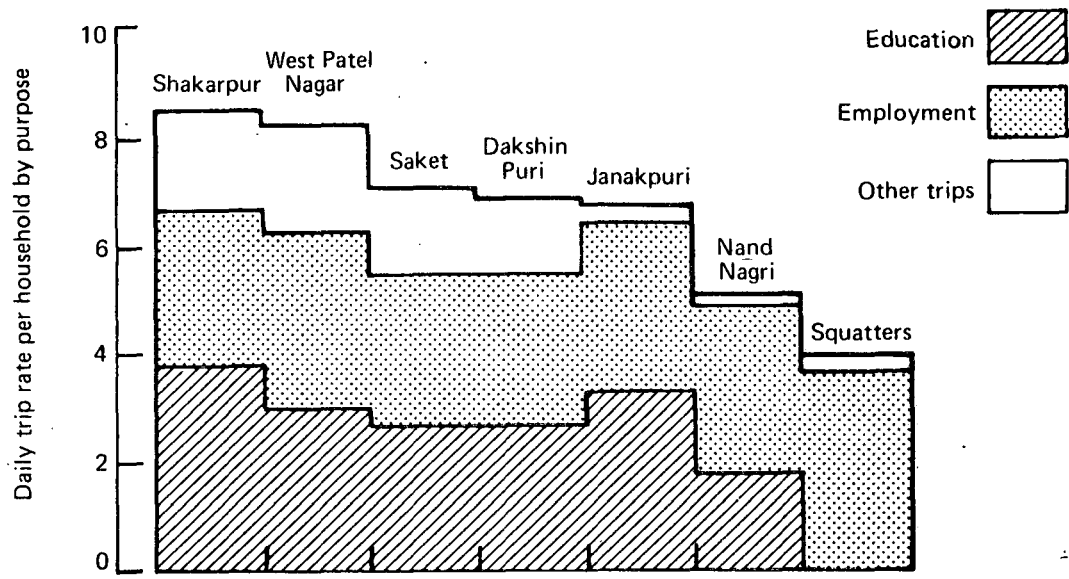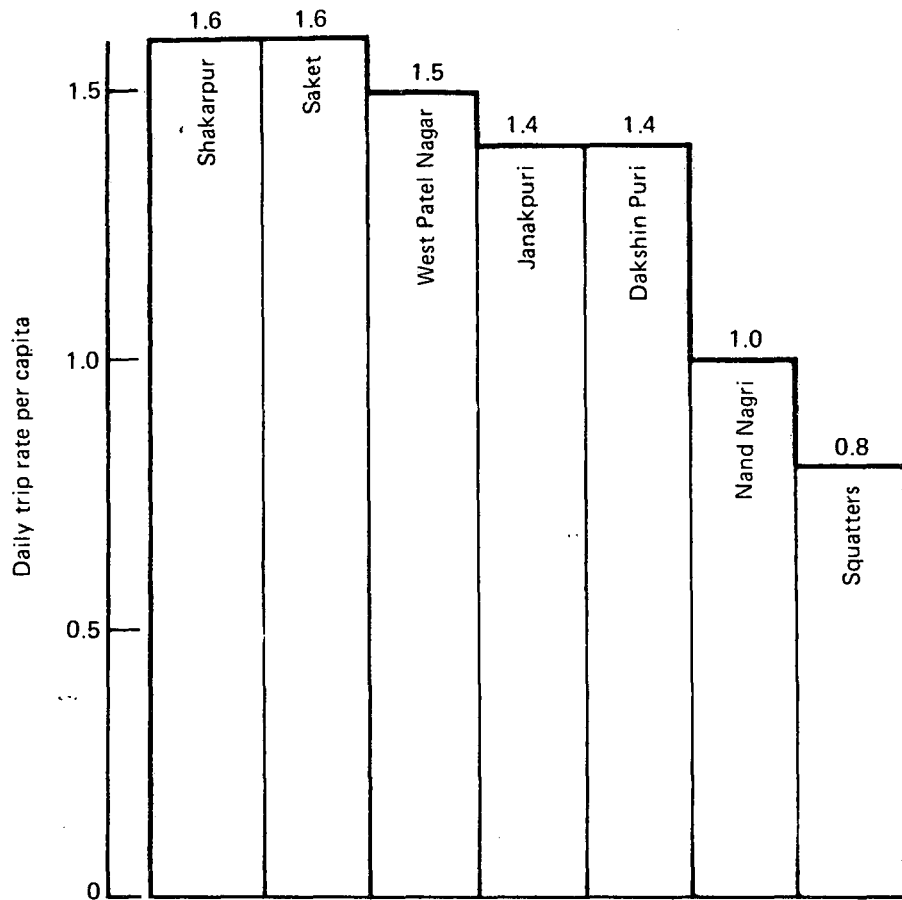

Fig. 2 The relationship between vehicle ownership and household income: All survey areas

(Note: Social/leisure trips not included for Janakpuri and Nand Nagri)

Fig. 3 Daily trip rate per household by purpose: All survey areas

(Note: Social/leisure trips not included for Janakpuri and Nand Nagri)
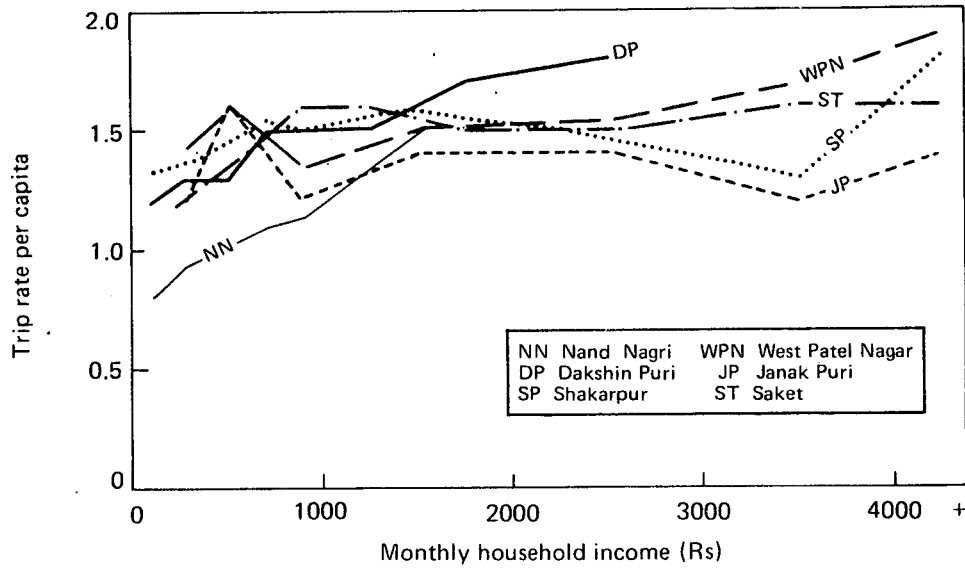
Fig. 4 Daily trip rate per capita: All survey areas

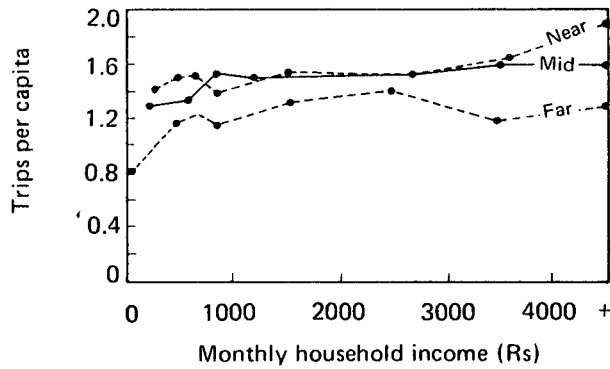**Fig. 5 Total number of trips made daily per capita by household income**

Fig. 6 Variation in per capita trip rates with income for households located similar distances from the city centre
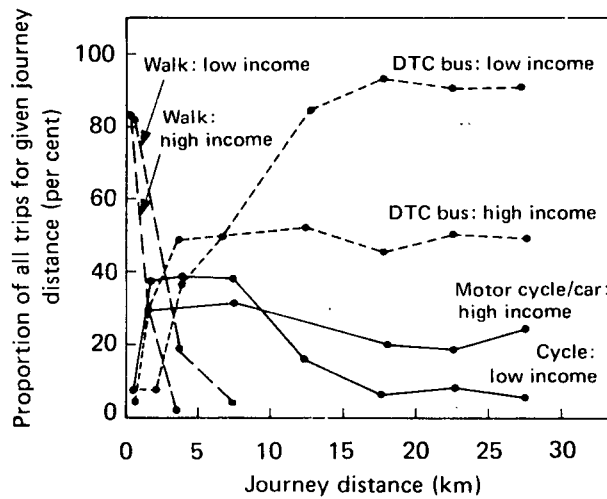

Fig. 7 Proportion of all employment trips undertaken by personal modes and DTC bus services by distance travelled