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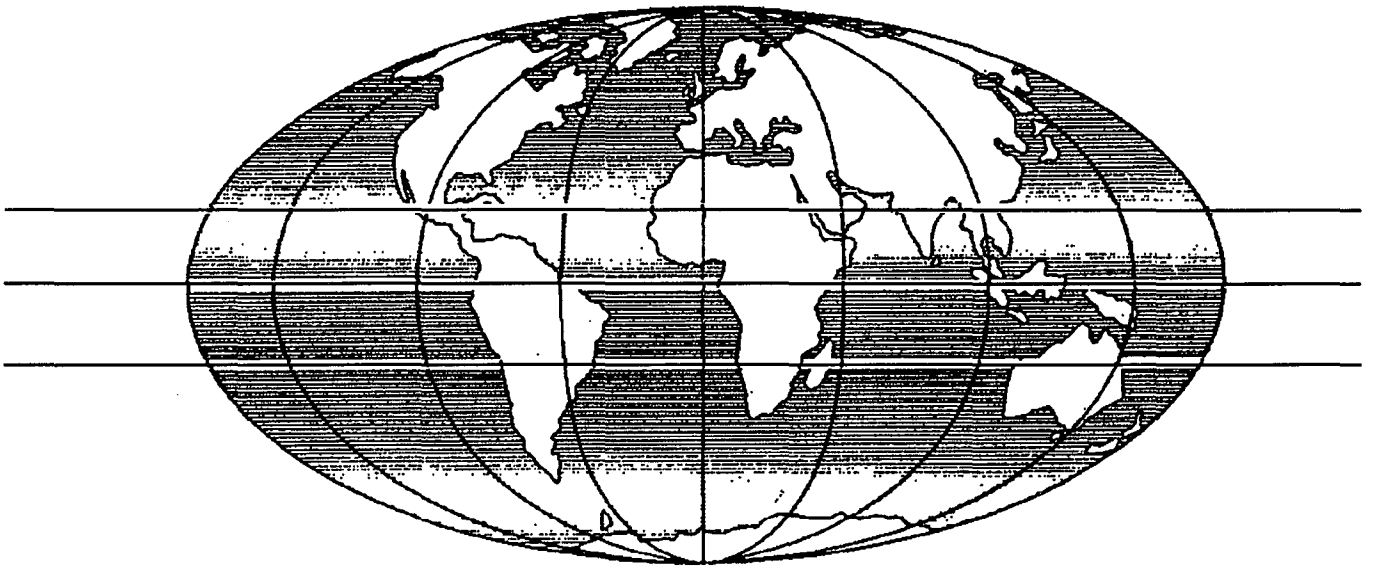

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Non-motorised travel in Third World cities

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ABSTRACT

This paper reviews material which has been collected from surveys of urban transport in cities of the Third World. It highlights the importance of non-motorised means of travel in these cities, particularly in satisfying the travel requirements of the extensive low-income communities.

1. INTRODUCTION

Essentially non-motorised travel consists of walking and cycling. However, in many South-East Asian cities, particularly smaller provincial centres, the human-powered cycle-rickshaw is still an important component of the public transport sector. The more historic hand-pulled rickshaws are still in use in Calcutta but elsewhere are virtually non-existent. (By contrast, hand-pulled carts for freight carriage are still widely used.) Animal powered vehicles such as bullock carts and horse-drawn vehicles (calesas, tongas, etc) are also still used in the urban environment for both passenger and freight movement.

Cycling and walking are a major means of travel, particularly in small cities (with short journey lengths) and amongst the urban poor. This paper examines this proposition using evidence from travel surveys undertaken in a number of Third World cities. The role and the future of the cycle-rickshaw is also briefly assessed; it too is an important travel mode in some cities, and apart from anything else provides a major source of urban employment often taken up by urban migrants.

2. THE CYCLE

The cycle is particularly prevalent in the Indian sub-continent and China, where it is a major means of travel for the urban poor. The total number of bicycles in China has now reached 220 million with ownership levels in urban centres averaging 460 per 1000 population (Cai Jun-Shi, 1988). In India in 1976 there were some 30 million cycles (49 per 1000 population) with individual cities typically having 200 per 1000 population. These data cannot be precise, but evidently reflect the right magnitudes: a household survey undertaken in three medium sized Indian cities (Fouracre and Maunder, 1987) showed that the cycle is the most widely owned means of transport, with over 60 per cent of households having access to at least one cycle (which implies minimum ownership levels of about 150 cycles per 1000 population).

It is likely that there has been real growth in the levels of ownership, though this is difficult to substantiate with hard evidence. The cycle fleet in China has probably doubled over the last ten years, reflecting average growth of 6 to 7 per cent per annum. The cycle fleet in Delhi increased from around 650,000 to 950,000 between 1971-80, an annual rate of growth of over 4 per cent.

By contrast to South East Asia, the cycle is not widely used in African cities. Surveys carried out in a number of smaller African cities (Jos, Dar es Salaam, Yaounde, Douala and Harare) indicate a range of 6-15% of households having access to a cycle (Maunder and Fouracre 1987a, 1987b, Maunder and Jacobs 1988, Maunder and Jobbins 1988). This represents an ownership level of around 20 cycles per 1000 population, little different from typical Third World car ownership levels.

Several reasons have been put forward to explain this difference between ownership levels in South East Asia and Africa. The absence of an extensive cycle manufacturing base in Africa may be significant: typically the cost of a cycle in an African city is between 1 to 3 times its owner's personal monthly income, whereas in India the cost was approximately 60 per cent of its owner's monthly personal income (unpublished TRRL survey material from 1979).

Status may be a more fundamental reason for the observed differences in ownership levels. In India the cycle still has a high status value (it is frequently given as a wedding present in low-income households) whereas in African cities it is considered demeaning to be seen riding one. If this is true then attitudes would have to be changed if cycle manufacturing in Africa is to succeeed.

A third reason appears to be that African cyclists perceive a high accident risk associated with cycling. There is no evidence to suggest however that their risk is any higher or lower than that of their counterparts in South East Asia.

The importance of the cycle in Indian cities can be seen from Table 1 which is based on a traffic survey of 14 Indian cities ranging in size from 0.1 - 2.5 million population (CRRI, 1986). Cycles typically account for between 35 -50 per cent of traffic on major corridors in these cities. In three cities (Jaipur, Kanpur and Lucknow), the cycle constitutes the main component of traffic. Only in the smallest cities (Mangalore and Guwahati) was the cycle component less than 20 per cent. In actual numbers cycle flows can be impressive: at one location in Delhi (the Jamuna Bridge) flows in excess of 7500 per hour were recorded during a TRRL survey in 1979.

TABLE 1 Cycle use in Indian cities

	1981 Population (million)	Proportion of cycles in traffic* (per cent)	Proportion of all trips by cycle (per cent)
Ahmedabad	2.5	38	21
Chandigarh	0.4	37	15
Coimbatore	0.9	43	13
Cuttack	0.3	35	8
Guwahati	0.1 (1971)	14	3
Indore	0.8	37	16
Jaipur	1.0	49	32
Kanpur	1.7	48	30
Lucknow	1.0	53	34
Ludhiana	0.6	40	23
Mangalore	0.3	10	2
Moradabad	0.4	43	25
Pune	1.7	41	16
Varanasi	0.8	33	21

Source: Central Road research Institute, 1986
* Traffic on main arterials.

The proportion of trips undertaken by cycle typically ranges from 10 to 30 per cent, the share tending to be higher in the larger cities. It is not surprising that many cities like Pune, Kanpur, Jaipur and Lucknow have been described as 'cycle cities' (CIRT, 1988). As would be expected of lower ownership levels, comparative modal choice data for African cities put cycle use at only 1 to 2 per cent of trips (TRRL Studies, op.cit).

Taking three medium-sized cities as a guide, the distribution of cycle ownership is fairly even over most income levels. This is shown in Fig 1 for the cities of Jaipur, Patna and Vadodara. When it comes to use, however, it is the low-income commuters who depends on the cycle; in Delhi, as Fig.2 shows, up to 40 per cent of their work trips in the range 2-8 km are by cycle whereas the respective figure for higher income commuters is less than 10 per cent. Beyond this distance the cycle is superceded by bus travel for most employment trips, though the cycle is still used by some. The average cycle trip length for work purposes in Delhi was 7.6 km (Maunder, 1984). As might be expected, the average journey length by cycle in smaller Indian cities is less, being about 3 km in Jaipur, Patna and Vadodara (Fouracre and Maunder, 1987).

As cities expand in size (area) there will be a shift towards the use of mechanical means of travel and away from walking and cycling. There is some evidence that this is happening in one of the world's largest cycle cities, New Delhi, though the shift is also being influenced by increasing affluence which is generating growth in motor-cycle and moped ownership, especially in the middle-income community.

Despite the importance of the cycle in China, India and South East Asia little has been done to improve the travel conditions of the cyclist. Some modern cities (New Delhi and Chandigarh) have provided cycle lanes, but these are the exceptions. The Maharashtra State Planning Agency developed plans for an extensive cycle network in Pune, but implementation has been tardy with only a few measures implemented here and there. The total cost of the network was estimated at Rs150 million (£10m - CIRT, 1980), which is perhaps the main deterrent to implementation.

Cyclists inevitably seem to endure a poor safety record. A study in Delhi (unpublished TRRL material) showed that cyclists incurred almost 30 per cent of road fatalities and that cycles were involved in a similar proportion of fatal accidents. Along main corridors cycles make up about 20 per cent of road traffic in Delhi, but in terms of total travel something like 40 per cent of vehicle km is by cycle.

3. WALKING

Walking accounts for between 35-40 per cent of total trips made daily in a selection of Indian cities, and 20-40 per cent in a selection of African cities (see Table 2).

TABLE 2 Walk trips in selected cities

	Population (million)	Proportion of all trips by walk	Av.walking distance (km)
Jaipur	1.0*	39	1.2
Vadodara	0.7*	40	1.2
Patna	0.9*	36	1.3
Delhi	6.1*	40	1.1
Dar Es Salaam	1.5**	25	1.7
Jos	0.4***	23	1.2
Douala	1.1**	28	1.2
Yaounde	0.8**	30	1.7
Harare	1.3**	42	1.6

Source: TRRL survey material, 1983-88.
Note * Census of India 1981
** 1987 estimate
*** 1986 estimate

The trip rates in all these cities are roughly similar (in the range 1.5 to 2.0 trips per capita per day). Thus the generally lower propensity to walk in African cities, despite the lower cycle ownership, cannot be accounted for by differences in demand for travel. Inhabitants of African cities seem to have greater access to personal vehicles, as well as making more use of public transport. Even so, walking is still an important means of commuting in African cities as witnessed by the dense flows of pedestrians from outlying townships and suburbs to the city centres of Dar Es Salaam, Harare, Nairobi, Mombassa, Lusaka, etc. Furthermore, in many African cities walking is more popular at different times of the month, ie towards the middle and end when invidiuals run short of money and hence cannot afford to use public transport.

Average walking trip distances are between 1-2 km and there is some evidence that it is the low income residents who make more walk trips and walk further. Table 3 shows data on the walk share of trip making by income group for three Indian cities.

TABLE 3 Proportion of all trips, for given household income groups, made on foot

	Income group		
	low	middle	high
Vadodara	58	40	24
Jaipur	47	39	27
Patna	58	40	23

Source: Fouracre and Maunder, 1987

A far higher proportion of trips made by low-income travellers are on foot, as compared to both the other groups. This is also seen in Delhi

(Fig 2). For any given work journey distance the low-income commuter is more likely than his high income counterpart to walk. Furthermore, some low-income commuters walk up to 7 km.

Perhaps not surprisingly walking is the main means of travel to school and other educational premises. Table 4 shows data for walk trips by main trip purpose for three Indian cities.

TABLE 4 Proportion of all trips for given journey purpose made on foot

	Education	Employment	Social
Vadodara	57	30	40
Jaipur	59	19	39
Patna	45	31	28

As with cyclists, the pedestrian is given very poor facilities. The road itself is often the only direct footpath, which creates conflict with motorised traffic. Conflict also occurs at crossings, and pedestrians feature significantly in casualty and fatality figures. An analysis of some road accident reports in Bangkok showed that about 75 per cent of pedestrian accidents occurred on pedestrian crossings, compared to 5 per cent in built-up areas of the UK. Drivers in developing countries are much less prepared to stop for pedestrians on crossings (even where it is a legal requirement), and the significant delays caused to pedestrians, together with less awareness of the risks may be the cause of the high non-compliance by pedestrians in their use of crossings. In Bangkok and Surabaya more than 50 per cent of

pedestrians on average chose to cross in the area 45m either side of crossings compared to only 11 per cent at sites studied in UK (Jacobs et al, 1981). Table 5 gives pedestrian casualty data for a selection of Third World cities.

TABLE 5 Pedestrian casualties as a percentage of total road-based casualties

Addis Ababa (1982)	80
Amman (1981)	66
Bombay (1979)	68
Colombo (1980)	58
Delhi (1983)	36
Karachi (1981)	44
Urban areas of UK (1982)	24

Source: Jacobs and Sayer 1984

In many of these cities the proportion of pedestrian casualties is significantly higher than in UK cities. Evidently there are likely to be more pedestrians, but there are other factors in play; apart from the inadequacy of pedestrians facilities, many pedestrians are not sufficiently educated in an awareness of the dangers of traffic. A study of children's behaviour at road crossings in some Third World cities indicated that their poor approach to the use of crossings was partly related to a lack of previously acquired advice and knowledge (Downing and Sayer, 1982).

Some cities have introduced measures to improve pedestrian safety by the implementation of pedestrian precincts, signal controlled pedestrian crossings, bridges, underpasses and walkways. But these are sometimes poorly

managed and maintained and there is much to be done to improve pedestrian conditions generally. Equally, pedestrians must be educated in the proper use of these facilities. Recent research in Bangkok has demonstrated that pedestrian compliance with crossing regulations is good only where roads are wide, where traffic is significant but uncongested and where 'artificial' delays imposed by signals and police officers are absent (JMP Consultants, 1988).

4. NON-MOTORISED PUBLIC TRANSPORT

The main mode in this category, the cycle rickshaw, is still very important in the contribution it makes to public transport provision in many South East Asian cities. These vehicles are generally used to provide taxi-like services for up to two passengers (though in some cases, particularly where children are concerned, many more). The number in use in a city is often quite difficult to establish because of the way that registration is effected, and because of the presence of illegal operators. Table 6 presents some estimates of cycle rickshaw provision in selected cities over a number of years.

TABLE 6 Cycle rickshaw provision in selected cities.

	Number/1000 population
Chieng Mai (1)	20
Faridabad (2)	19
Meerut (2)	18
Penang (3)	6
Surabaya (4)	15
Calcutta (5)	1
Delhi (2)	1
Madurai (6)	9
Patna (7)	39
Jaipur (7)	7

Sources:
1. Fouracre and Maunder 1976
2. School of Planning and Architecture 1978
3. Meier 1978
4. Fouracre and Maunder 1977
5. Thomas 1977
6. Vadivelu 1986
7. Fouracre and Maunder 1987

Attitudes to cycle rickshaws on the part of city authorities vary even within a country. In India, Maharastra State has banned them whereas in the populous (and less wealthy) northern states of Uttar Pradash and Bihar they are often the main means of urban public transport. Table 7 shows that in some of these northern cities (Kanpur, Lucknow and Varanasi) around 20 per cent of all trips are undertaken by cycle-rickshaw.

TABLE 7 Proportion of all trips by cycle-rickshaw in selected Indian cities

	Proportion of cycle-rickshaws in traffic*	Proportion of all trips by cycle-rickshaw
Chandigarh	10	4
Cuttack	18	6
Guwahati	12	4
Jaipur	12	9
Kanpur	17	19
Lucknow	16	19
Ludhiana	15	7
Moradabad	22	18
Varanasi	22	20

Source: CRRI, 1986

Note * Main corridors

Each individual rickshaw handles perhaps 20 passengers in a day (Fouracre and Maunder, 1987, Vadivelu, 1988). Their significant role comes from the sheer numbers in use, rather than the individual output.

Average journey distances in rickshaws are short, in the range 1-4 km. There is some evidence that higher income users travel further than low-income users, and that the former also make more use (trips per capita) of the vehicle (Fouracre and Maunder, 1987). These differences in use are probably attributable to the cost of its use: the average fare is considerably greater than that for an equivalent journey by stage-bus. Vadivelu (1988) estimates that in Madurai the fare per passenger km by a rickshaw is ten times that by a bus.

All types of non-motorised public transport are labour intensive and provide significant employment where they are used in large numbers. It is probably inevitable that their role will diminish with increasing city size (the increased journey lengths requiring motorised travel) and with increasing affluence.

5. SUMMARY

Over the last twenty years or so, cities of the Third World have been growing extremely rapidly both in terms of population and area. Needless to say this high growth rate is forecast to continue well into the foreseeable future. The matching growing demands for increased access and mobility are imposing severe strains on the already overloaded public transport systems.

Unlike cities in the West, (residents of) cities in developing countries still rely heavily on non-motorised forms of transport. Indeed, in virtually all Asian cities, the majority of trips are undertaken by non-motorised means of travel. Conversely, in African cities lower cycle ownership levels, and a lower propensity to walk are reflected in lower, but still substantial, use of non-motorised travel.

Despite the importance of these modes of travel little has been done to improve the travel conditions for those members of the community who are heavily dependent on their use. Because the commuting cyclist and walker tends to come from the lower-income community, and because they bear little or

no taxation they tend to be ignored when traffic and transport planning issues are being decided. Thus in the past transport policy issues have centred on improving car speeds, perhaps to the detriment of the non-motorised traveller. Attitudes are changing and certainly more attention is now given to improving public transport performance through traffic management techniques. Similarly a major problem in introducing real-time area traffic control to Beijing has been the need to adapt the system to the presence of vast numbers of cycles in the network. It is seen as a requirement to accomodate cyclists in traffic management developments rather than to try to ignore or restrain them. However major policy issues concerning land-use planning, the location of employment centres, schools etc which improve the mobility of people obliged to walk and cycle long distances are rarely in evidence.

6. ACKNOWLEDGMENTS

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7. REFERENCES

CAI JUN-SHI (1988) Public transport in China. UITP Singapore Conference: City Transport in Asia, UITP.

Central Institute of Road Transport (1988). Report on energy implications in urban transport. Central Institute of Road Transport Pune, India.

Central Road Research Institute (1986) Traffic and transport flows for selected cities in India. Central Road Research Institute, New Delhi, India.

Delhi Development Authority (1982) Delhi 2001. Seminar on Transportation Delhi 2001. Prospective Planning Wing, Delhi Development Authority. April 26 1982, New Delhi India.

DOWNING A J and I A SAYER (1982). A preliminary study of children's road crossing knowledge in three developing countries. Department of Transport Supplementary Report SR771, Transport and Road Research Laboratory, Crowthorne.

FOURACRE P R, and D A C MAUNDER (1977) Public transport in Chieng Mai Thailand. Department of the Environment, Department of Transport, TRRL SR285 Transport and Road Research Laboratory, Crowthorne.

FOURACRE P R and D A C MAUNDER (1978) Public transport in Surabaya, Indonesia. Department of the Environment, Department of Transport, TRRL SR370. Transport and Road Research Laboratory, Crowthorne.

FOURACRE P R and D A C MAUNDER (1987). A comparison of public transport in three medium sized cities of India. Department of Transport TRRL RR82: Transport and Road Research Laboratory Crowthorne.

JACOBS G D, I A SAYER and A J DOWNING (1981). A preliminary study of road user behaviour in developing countries. Department of Transport TRRL SR646, Transport and Road Research Laboratory, Crowthorne.

JACOBS G D (1986) Road accident prevention: the work of the Overseas Unit, TRRL. In: Department of Transport et al. Sino-British Highways and Urban Traffic Conference. UK Papers presented in Beijung, 17-22 November 1986.

JACOBS G D and I A SAYER (1984). Road accidents in developing countries - urban problems and remedial measures. Department of Transport TRRL SR839, Transport and Road Research Laboratory, Crowthorne.

MAUNDER D A C (1984) Trip rates and travel patterns in Delhi India, Department of Transport TRRL RR1. Transport and Road Research Laboratory, Crowthorne.

MAUNDER D A C and P R FOURACRE (1987) Public transport provision in Jos Nigeria, Transport and Road Research Laboratory Working Paper OU219. Unpublished.

MAUNDER D A C and P R FOURACRE (1987) Public transport provision in Dar es Salaam Tanzania. Transport and Road Research Laboratory Working Paper OU231. Unpublished.

MAUNDER D A C and G D JACOBS (1988) Public transport provision in Douala and Yaounde, Cameroon. Transport and Road research Laboratory Working Paper OU242. Unpublished.

MAUNDER D A C and S JOBBINS (1988) Public transport provision in Harare Zimbabwe. Transport and Road Research Laboratory Working Paper OU248. Unpublished.

MEIER A (1977) Becabs, Cemos, Lambos and productive pandemonium Technology Review, January.

SCHOOL OF PLANNING AND ARCHITECTURE (1978). Report on objective assessment of the role of intermediate public transport in Delhi, New Delhi India (School of Planning and Architecture).

THOMAS T (1981) in association with UNNAYAN. Rickshaws in Calcutta. UNNAYAN. Calcutta India. February.

VADIVELV S (1988) A study of urban public transport in Madurai city. Doctoral thesis, Madurai Kamaraj University, Tamil Nadu India. Unpublished.

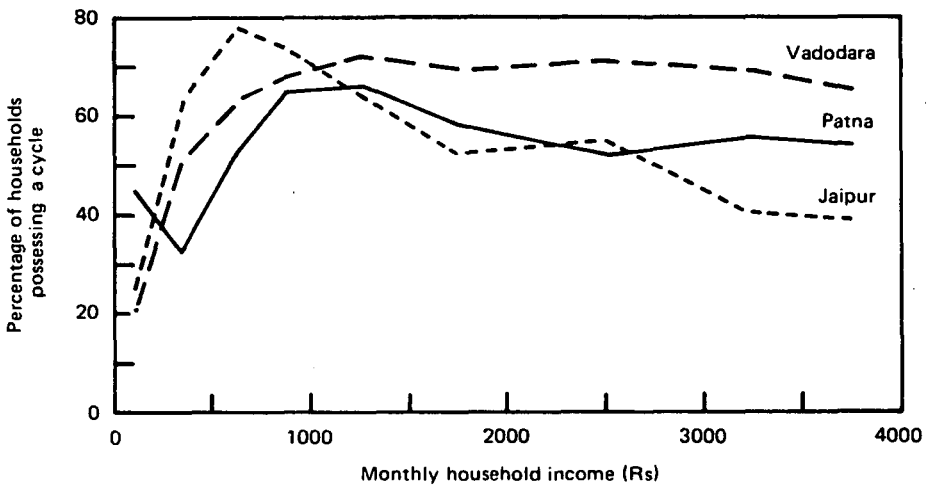

Fig. 1 The relationship between cycle ownership and income in Jaipur, Patna and Vadodara

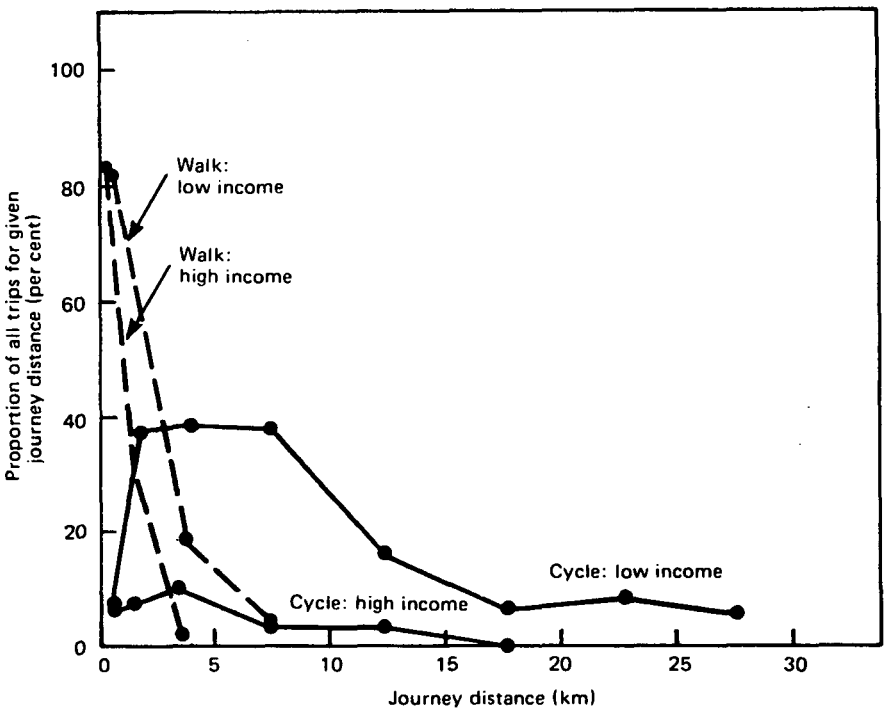

Fig. 2 Proportion of all employment trips undertaken by cycle and on foot by distance travelled in Delhi