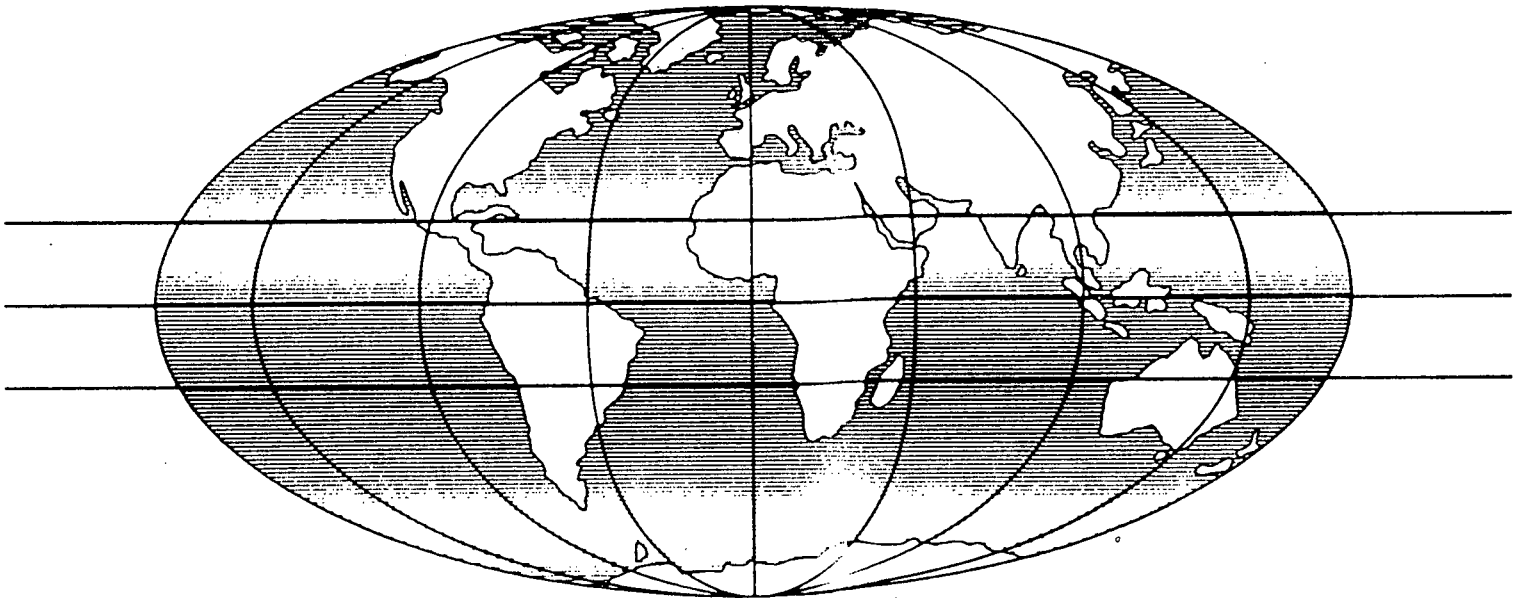


Reprint

Review of public transport operations



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A REVIEW OF PUBLIC TRANSPORT OPERATIONS IN
THIRD WORLD CITIES

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SYNOPSIS. Public transport in Third World cities consists of a wide assortment of modes ranging from traditional man-powered rickshaws and horse drawn carts to the conventional taxi, bus, tram and rail systems of the industrialised world. Demand for urban public transport services is growing at a rapid rate throughout the developing world due largely to growth in city area, population and small increases in wealth. This paper presents a general overview of public transport operations and outlines some of the key issues involved in its development in the Third World.

INTRODUCTION

1. In the UK the use of stage bus services has been declining since about 1950. A major cause of this decline has been identified as the rapid increase in car ownership that has taken place over the last 30 years (ref. 1). A more recent study of public transport operations in 117 cities in 16 European, North American and Australasian countries (ref. 2) showed that public transport usage is not in decline in all (developed) countries. In about 60 per cent of the cities studied the number of passengers carried actually increased between 1970 and 1980, though UK cities showed the greatest decline at about 4 per cent per annum. A number of factors affecting public transport usage were examined and levels of subsidy, urban density, levels of migration to the cities, urban form (degree of centralisation) and household size were all found to be important. Forecasts suggest that even in those cities showing relatively modest increases in public transport demand the future numbers of passengers are likely to decline unless the provision of substantial subsidies (and hence service levels is maintained).

2. In contrast, the urban public transport sector in developing countries is characterised by its high growth rate (in terms of passengers carried, vehicles in use and route kilometres operated). In most of these cities conventional bus operators play the dominant role in the movement of passengers but are often unable to meet the total demands of the travelling public. In consequence, paratransit or intermediate public transport (IPT) modes such as cycle or scooter rickshaws,

shared taxis, minibuses and even horse drawn vehicles play an important role. Another characteristic of the urban public transport sector in the developing world can be said to be its diversity. In many smaller cities paratransit systems may have the dominant public transport role, perhaps because they are better adapted to some of the difficult operating conditions. However, these vehicles are often expensive to use and beyond the reach of the lower income travellers for regular trip making.

3. Although a few cities in developing countries have or are building rail mass transit systems, the vast majority will still be relying for many years to come on road-based systems. Thus in the future, as at present, the conventional bus and the many forms of paratransit will be playing the key role in meeting the increased demand for transport in these cities.

4. This paper presents a broad review of public transport operations in Third World cities, drawing in particular on work carried out over the last ten years by the Overseas Unit of the Transport and Road Research Laboratory.

DEMAND FOR PUBLIC TRANSPORT

5. Over the last twenty years, the demand for public transport in the Third World has grown rapidly due largely to the considerable rise in population in most major cities. In 1960, the UN reported 53 cities in developing countries with a population of more than 1m: by the year 2000, the UN forecasts that there will be a total of about 300 such cities and by 2025 a total of about 500. By the end of the century it is forecast that there will be 144 cities in the world with populations in excess of 4m, with 123 (85 per cent) of these in the developing world. Thus growth will continue to take place in the cities that already have great difficulty in feeding, housing and transporting the millions who already live there.

6. Table I shows the percentage changes in the number of buses and passengers carried over the nine-year period 1974 - 1983 and five-year period 1978 - 1983 for 13 cities of the developing world. For comparative purposes trends are also shown for three groups of operators in the UK. In almost all the Third World cities there were considerable increases in the number of buses in use and passengers carried. In the major Indian cities, for example, the number of buses doubled in Bombay and trebled in Madras and Delhi between 1974 and 1983. Other cities such as Cairo and Tunis also showed large increases in the number of buses in use. Peshawar in northern Pakistan also showed an extremely large increase in the bus fleet over the five-year period 1978 - 1983. In contrast, the number of buses run and passengers carried in the UK by London Transport, the Passenger Transport Executives or the Municipalities decreased by 2 to 3 per cent per annum.

7. In all Third World cities for which data were available there were considerable increases in the number of routes operated. These have probably been introduced to serve areas of the city experiencing rapid population growth rates. The

Indian cities showed some of the largest increases in the number of routes operated. In these cities new routes have also been introduced in recent years which provide passengers with a higher level of service, with limited stops and guaranteed seats. Little background information is available on public transport operations in Peshawar, Pakistan. From the figures available, however, it would appear that the public transport system has been completely restructured in recent years with considerable investment in the bus fleet taking place.

Table 1. Average annual percentage change in number of buses, routes operated and passengers carried in selected Third World cities and the UK.

City	Total fleet		Routes operated		Passenger trips	
	1974-83	1978-83	1974-83	1978-83	1974-83	1978-83
Addis Ababa	0.6	11.0	2.0	4.7	7.4	5.0
Bangkok	1.5	-0.3	5.9	4.0	16.2	23.0
Bombay	7.8	7.9	7.1	8.6	9.0	2.1
Cairo	9.8	8.7	4.2	3.5	1.1	0.2
Delhi	24.9	39.1	18.3	17.8	24.3	20.7
Harare*		11.0		0		8.9
Istanbul*		8.7		4.0		-0.2
Madras	25.1	8.7	21.8	19.5	62.0	7.3
Nairobi	9.5	0		5.1		8.0
Peshawar		97.0		32.6		30.0
Pune	1.3	-1.2	2.0	18.1	0.6	10.8
Singapore	4.3	6.1	7.9	7.6		
Tunis	11.4	4.0		7.8		2.9
London Transport Executive Passenger Transport Executives, UK Municipal Operators, UK	-1.3 -1.9 -1.6	-2.2 -2.4 -2.1			-2.9 -2.7 -3.2	-3.3 -2.6 -3.7

* 1980 - 1983

Sources: TRRL, 1984 sample questionnaire, and Transport Statistics Great Britain 1973 - 1983, HMSO, London 1984.

8. Analysis of data (refs. 3,4) on some 150 cities drawn from the UITP Handbooks for Urban Transport (refs. 5,6) has shown that, as might be expected, that the number of passengers using bus services increased with the size (both population and area) of the city, though this trend was more marked in Third World cities. The analysis suggests that for every additional 1,000 people in Third World cities, an extra 350 - 400 public transport trips per day will be generated. Similarly, for every additional square kilometre of city

growth, an extra 500 public transport trips per day will be generated. With both effects taking place simultaneously, passenger kilometres are thus rising at a faster rate than the number of passengers carried.

9. Relationships were also found to exist between income and bus patronage: increased income in developed countries was shown to result in a decreased patronage of public transport, reflecting higher income and vehicle ownership levels found in the developed world. However, in developing countries an increase in income led to a marked increase in public transport usage. Relationships between demand for public transport and factors that described the bus systems indicated a greater demand for public transport in Third World cities and an associated lack of supply. For example, a given number of buses in Asian and African cities generated twice as many passenger trips as those in developed countries. Conversely, in Western cities there were much higher levels of supply with correspondingly lower demand.

TRAVEL NEEDS OF THE URBAN POOR

10. Low income groups rely greatly on the cheaper forms of public transport. The stage bus service in Delhi for example carries more travellers on their journey to work than any other mode for middle and low-income groups. For the lowest income group, the stage bus carries the majority of these travellers. The Overseas Unit has made a detailed study of the travel needs and habits of different socio-economic groups in Delhi and the way in which these needs are met (ref. 7). In particular, the travel problems of low income communities have been investigated and comparisons made with other socio-economic groups. Many low income people in Delhi are former squatters now rehoused in resettlement areas sited at the edge of the city. One of the side effects of resettlement has been to create a captive market for cheap public transport services which can provide high capacity over long journey leads. Servicing this market has brought problems to the Delhi Transport Corporation (DTC) which has had to assume this role. The DTC incurs losses on all its routes, though losses tend to be greater on routes servicing low-income areas. The low fare structure imposed by central government, heavy investment required and long trip lengths all contribute substantially to this loss.

11. Estimates of the proportion of household income spent on transport in Delhi were high, often as much as 38 per cent, when the household income was less than Rs 500 (£33) per month. Beyond this level, the percentage expenditure on transport levels off at about 10 per cent suggesting a near constant transport expenditure budget over a wide income range once an initial threshold income of Rs 500 is reached. Low income families therefore spend proportionately more on transport than mid-income communities, whilst at the same time they make fewer trips (very few social and leisure journeys being made) usually on a poorer quality service.

12. Demand (and therefore expenditure) on public transport

could be reduced by the introduction of changes in land-use policy. For example, if the resettlement areas of Delhi were located closer to the city centre (say 15kms as opposed to 30kms) then use of cycle and walk modes would increase by over 100 per cent whilst bus journeys could be decreased by about 40 per cent. Similarly by providing employment at or near to resettlement centres walk trips could be increased by over 400 per cent and bus journeys correspondingly reduced by about 90 per cent.

PUBLIC TRANSPORT SUPPLY

13. In most Third World cities, public transport supply is characterised by a wide variety of modes and services available for use. There is a wide disparity in the supply of public transport between cities and by international standards, the level of provision of conventional buses is low. Table 2 shows the average number of buses and route kilometres operated per 100,000 population in developed and developing cities (ref. 8).

Table 2. Number of buses and route kilometres per 100,000 population in cities in developed and developing countries

Country/Region	Buses/100,000 population
Asia	48
Africa	30
India	30
Other (developing)	63
UK	90
	Route Km per 100,000 population
Developed (Av 97 cities)	100
Developing (Av 54 cities)	54

14. From Table 2 it can be seen that there were on average about 40 per cent fewer buses per head of population in Third World cities even though the levels of car and motor cycle ownership were much lower than in the industrialised countries. Similarly, the number of route kilometres per head of population was about half that in Europe and North America.

15. This shortfall is to some extent made up by the operation of paratransit systems. A comparative analysis (ref. 9) of the output of conventional buses and the main form of paratransit (usually cycle and autorickshaw) in about 20 Indian cities suggests that in many medium sized cities (0.2 to 2.0 million population), paratransit accounts for at least 20 per cent of public transport output and may account for as much as 60 - 70 per cent in some cities. In general, the smaller the city the less the total provision of public transport. There would also appear to be no clear-cut pattern about the role of

paratransit. It might have been expected that smaller cities would rely more heavily on cycle and autorickshaws but the data did not substantiate this. Table 3 indicates the importance of paratransit in some cities of South and South East Asia.

Table 3. Percentage of total trips by road based public transport in selected Asian cities (1979)

	IPT	Conventional bus	Total
Delhi	17	83	100
Bangkok	19	81	100
Jakarta	20	80	100
Vadodara	30	70	100
Manila	64	36	100
Jaipur	71	29	100
Chieng Mai	93	7	100
Surabaya	93	7	100
Kanpur	93	7	100
Patna	92	8	100

16. A minority of cities in the developing world have a metro. A survey of UITP statistics (ref. 6) shows that less than 40 per cent of reporting cities, with more than 5 million population, have an operational system. This compares with 85 per cent for the developed world. Third World cities of this size are more likely to have a tram or trolley bus system, perhaps reflecting the cheaper capital costs involved. Typically the construction costs of a metro range from £20M to £40M (1985) per route km, with significantly higher costs for extensive underground tunnelling. Light rail transit (LRT) is cheaper at £5M to £15M per route km, but the capacity of such systems is clearly less than that of a full metro. Recent World Bank evidence (ref. 10) suggests that an LRT system may be capable of handling only half the passengers (20,000 - 36,000 per track per hour) of an elevated or underground metro system.

User costs

17. The level of provision of different types of public transport has important implications on cost to the user. In general taxi-like services are much more expensive than bus-like services. (The former having less rigid fare structures and routing than the latter). The cost of provision of paratransit seems to be broadly related to the competition between modes experienced within the paratransit sector; the greater the choice available, the less the cost to the user. Where taxi charges are fixed (by metering), increasing competition between taxis may encourage vehicle sharing by strangers; the resulting service is often more in the nature of a bus-like service in that the operation of the vehicle trip becomes more fixed.

18. Indian experience (ref. 11) clearly shows that user charges are a distinguishing feature between the two basic service types. Taxi-type services have a cost range of 16 paise (1p) to 67 paise (4.2p) (cycle rickshaws) per passenger Km. Bus-type services have a range of 4 paise (0.25p) (conventional buses) to 17 paise (1p) (horse drawn tongas) per passenger Km. At an even lower level are suburban rail services, which charged (in 1979) about 2 paise per passenger Km.

19. City form is likely to influence the type of public transport which can be employed and hence the level of user charges that can be expected. Dense, compact cities may have a high paratransit content because it is physically impossible to use buses efficiently. In these circumstances public transport users may incur high public transport unit costs though their demand for public transport may be low. In more open cities (Delhi for example), unit costs of public transport are low but users 'consume' more public transport because of the distances involved. As stated earlier, for all but the poorest sections of the community, there may be a constant transport budget for different income groups, irrespective of the city in which they live.

Output levels

20. In comparison with UK operators, many urban bus operators in the nationalised sector in Third World cities maintain a high level of output. Thus Indian buses carry twice as many passengers per day, on average, as UK buses. This high passenger handling and the associated high level of vehicle utilisation reflects the very high demand for public transport services and the associated lack of supply in Third World cities. Not surprisingly the level of staffing is usually high by Western standards. (about eight persons per bus in India). Few operators have attempted to introduce one-man operation of buses probably because labour rates and costs have not been considered a dominating item. There are also technical reasons in that buses might have to be substantially redesigned for one-man operation and the more complex equipment would require more skilled mechanics in depots and workshops. There is generally a lack of data on productivity on the private sector of conventional bus operations, but it seems probable that productivity is better than in the nationalised sector.

Operating costs

21. A recent examination (ref. 12) of the structure of operating costs in cities in developed and developing countries revealed some interesting differences. In the UK the major cost component, about two-thirds the total, was that of staff, with maintenance and spares making up most of the remainder. Operating costs in the Third World cities were markedly different, with staff costs being about one-third the total, but with fuel and depreciation/interest costs being much greater than in the UK. In Blantyre and Lilongwe, the main urban centres of Malawi, the cost of fuel actually exceeded staff

costs and represented a remarkable 40 per cent of total operating costs.

22. Another interesting difference in operating costs between cities in the UK and cities in the developing countries is the proportion of total costs allocated to depreciation and interest. In many Third World countries the operational life of a bus is often extremely short, sometimes as low as six years; consequently vehicles have (in theory) to be replaced at very short intervals of time and depreciation costs are correspondingly high. In addition, many public transport operators in developing countries receive virtually no government support at all. In order to continue supplying public transport services, loans have to be acquired (sometimes from central government itself, as in Delhi, or from state governments, as in Calcutta). The interest paid on these loans is often a considerable proportion of total operating costs for these bus companies.

Economic viability

23. Conventional urban bus operations in the nationalised sector tend to be unprofitable. Revenues are increasing at about the same rate as costs, but always one step behind. The increase in revenues is as much a result of changes in demand structure (increasing journey lengths) and an associated increase in productivity (ie increased load factors) as to fare increases. In India, losses incurred are covered by a variety of sources: profits on inter-city operations and/or other commercial activities or loans from State or Central Government. There are no clear criteria on which to judge whether losses incurred are commensurate with benefits to the travellers. The continued losses do not encourage expansion of the industry to meet the ever-increasing demands, which in part must be generated by the low traffic levels.

24. Results from a recent survey of costs and revenues of bus operations in developing countries (ref. 12) showed that about two thirds made losses in 1983. Figure 1 shows the revenue and operating costs per bus - km operated for the cities surveyed. It can be seen that the medium revenue per bus - km travelled was 33p whilst the medium operating cost was 39p.

25. Though there are few statistics available to substantiate the case, it is likely that private operators of conventional buses have lower operating costs than those in the nationalised sector. Their better productivity and lower wage rates are probably achieved because private operators are less open to the pressures of organised labour and to the structures of labour legislation. The Delhi Transport Corporation have estimated that they incur an extra 14 per cent cost to run their own vehicles as against hiring similar vehicles from private operators.

26. There is much damning evidence on the financial viability of metros and LRT (refs. 13,14). A pessimistic estimate suggests that in the Third World the cost per place km on metros could be as much as 80 per cent higher than on buses.

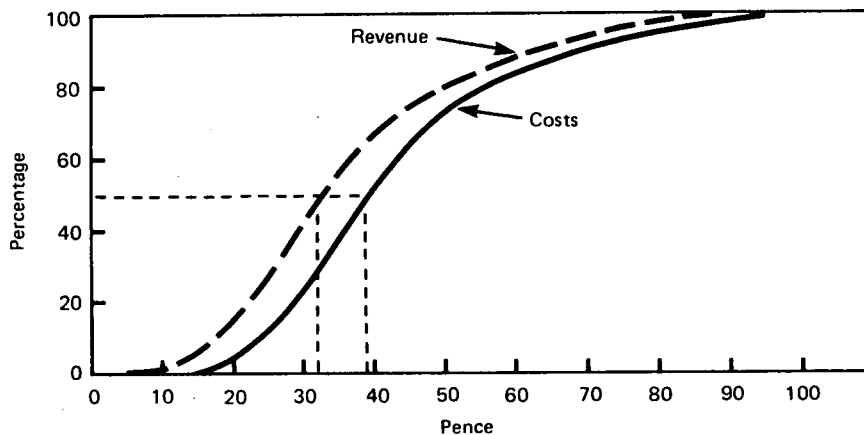


Fig.1 Revenue and operating cost per bus kilometre

Despite this, metros still find a place in Third World urban transport development with a number of cities actively constructing or planning a system. It may be that planners have been persuaded that the metro is the only technical solution to moving large volumes of people quickly and efficiently. It may also be that economic considerations (the effects of a metro on both user and non-user costs) outweigh financial implications.

DISCUSSION

27. The analysis of public transport usage in Third World cities carried out by the Overseas Unit indicate the growing demand for public transport that has taken place in recent years. With the relatively low levels of car ownership that exist in most cities in developing countries, it is essential for the social and economic wellbeing of the community that an adequate public transport system be provided.

28. In a number of major cities, paratransit systems play an important role. In Manila, Nairobi and Istanbul for example, the number of passengers travelling by minibus, etc., probably exceeds those travelling by conventional bus. In other cities such as Cairo and Bangkok the number of minibuses shared taxis, etc., has increased very rapidly over the last few years. Recent studies in India indicate that in some medium sized cities up to 80 per cent of public transport is provided by cycle rickshaw.

29. The development of paratransit systems has generated controversy over the use of small or large vehicles, the encouragement of small or large enterprises, and whether the public transport sector should be privately-operated or nationalised. Resolving the arguments is not an easy task because technical merits of a particular system may be masked by institutionalised constraints. In general, small vehicles are likely to be more expensive to operate (per seat-km) than large vehicles (assuming the same operator were to be running the two types). But returns on the smaller vehicle may be higher because of higher load factors and fares (per passenger-km). A small enterprise is likely to be able to operate a given

vehicle type more cheaply than a large enterprise. This is less likely to be because there are any economies of scale, but because labour productivity is higher in the small enterprise, for institutional rather than technical reasons. The small enterprise is less subject to labour laws and union pressures, which affect manning levels, working hours and wage rates. Lastly, the nationalised industry is likely to incur higher costs than a private concern in operating a given number of vehicles, but the nationalised concern is likely to be under much greater pressure to provide high service levels at artificially low fares.

30. Recent studies suggest that the economic viability of private operators (using conventional vehicles) may be due, in part to higher fares charged as well as to lower costs per vehicle or per vehicle-km operated. Labour productivity could undoubtedly be improved within the nationalised sector following trends adopted in the Western world such as, for example, one-man operation of buses. However, the associated need for expensive, special technologies (eg automatic doors) may make such an exercise prohibitive. Neither is there the same pressure on labour costs where, as seen above, approximately 30 - 40 per cent of costs are attributable to this source compared with 65 - 70 per cent in the UK and other Western countries. Despite the large and increasing demand that exists for public transport services in Third World cities, relatively few bus companies are profitable and without problems. Most suffer from a shortage of vehicles, thus the total number of buses per head of population is considerably lower than in developed countries. Existing fleets are inadequately maintained, yet used intensively in terms of hours of operation (in service) and kilometres operated per day. Public transport fares are politically sensitive, as in Third World cities large segments of the population are particularly poor and unable to pay the true market cost of providing the service. However, a cheap fares policy can be regressive in that large numbers of passengers who benefit could well pay more for travel.

31. A bus company which is impoverished by virtue of a low fare structure and at the same time is not in receipt of positive government support will always be short of investment capital, as a consequence of which the service will inevitably deteriorate. (Operating cost figures obtained from a recent study suggest that active government support is needed at least to reduce fuel costs). The decaying or stagnant service is further eroded as paratransit forms develop, their owners taking the opportunity to fill the gaps in transport supply.

32. Much interest is being devoted to the development of metros in Third World cities. It should be recognised, however, that the enhancement of bus systems through provision of segregated rights-of-way, priority manoeuvres, convoy working, etc. may provide sufficient capacity at much lower capital cost. Buses operating on segregated bus-ways should be capable of handling 30,000 passengers per lane hour: this compares

favourably with the capacity of an LRT and costs between 20 - 50 per cent less per passenger km (ref. 10).

33. Increasingly, public transport facilities are being developed as an adjunct of traffic management schemes designed to reduce congestion. A satisfactory public transport system, for providing alternative means of transport to private vehicles may be contributory to the success of schemes which seek to restrict the numbers of vehicles entering the city centre. It is interesting to note that two such schemes have been tested in the Third World: area licensing has been successfully installed in Singapore and was also considered in both Bangkok and Kuala Lumpur; road pricing technology has been successfully tested in Hong Kong and is being considered for use in Kuala Lumpur.

34. Transport policies obviously have to be planned in the light of urban development objectives, operating circumstances and resources available. Different cities in the Third World have approached the problem of providing for transport demand in different ways. There is evidence of a broad correlation between certain characteristics of the city and its transport system and also between the demand for public transport and the level of supply. However, the mechanism of interaction between these factors needs much greater understanding in Third World cities if only to avoid the (frequently) inevitable result of creating long-term problems through solving immediate problems concerning transport demand.

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