Planning for Pedestrians in Kathmandu, Nepal

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I. INTRODUCTION

The urban poor in developing countries resort to non-motorized modes primarily because they have no money and often the available alternative transport is too costly for them. The focus of this paper is the role of non-motorised transport, particularly the pedestrians in the cities of developing countries. Policy analysis and examples presented here are based upon studies in Kathmandu, Nepal (1,2).

The analytical methods developed in rich countries are based upon the concept of value of time, and that any and all time savings justify additional expenditures on transport. Furthermore, it is assumed that capital resources are readily available for providing adequate urban transport supply. Non-motorized modes (walk, bicycle) are considered negligible and often not included in the data collection and policy analysis except in special circumstances (recreational walkways and bicycle paths). Under these circumstances, the transfer of intellectual technology from the West to the East (North/South) without substantial modification is dangerous and will distort the planning process, policy analysis and investment priorities in developing countries (3,4,5,6,7).

Data collection and analysis without the inclusion of non-motorized modes persists. For example, in a recent study of 12 major cities in India conducted by the Government of India, there is no mention of pedestrians although the pedestrian trips could vary from 40% to 70% of ADT (5,8).

International technical assistance and lending agencies have a major influence on urban transport investment priorities and can also distort priorities. Bilateral assistance agencies such as CIDA (Canadian International Development Agency), U.S. AID (Agency for International Development) and JICA (Japan International Cooperation Agency),in the past, have emphasised high technology motorized transport solutions without any reference to the non-motorized modes (9,10,11). Only 1% of World Bank urban transport lending during 1972-85 was for non-motorized transport (pedestrians) as shown in Figure 1.

However, a more enlightened approach is being taken by some agencies such as IDRC of Canada and the TRRL (Transport & Road Research Laboratory) of UK. Recent studies, conducted in India, Nepal, Philippines and Indonesia with the assistance of IDRC, include and emphasize the non-motorized modes used by the urban poor (1,12,13). Agencies such as the World Bank, are slowly awakening to the importance of non-motorized modes (14).

Until recently, there was little realization of the importance of, and consequently little attention paid to, non-motorized transport by planners in developing countries. In general, the O/D surveys and planning methods have been based upon the experience of the developed countries. Many major transportation studies involving local and international funding have been primarily concerned with cars, trucks and buses and also relegated the non-motorized transport to nuisance status (7,8,9,10,). However, in recent years, planners are beginning to pay attention to non-motorized transport due to a variety of reasons which

Fig. 1 : Urban Transport Lending
World Bank (1972-1985)

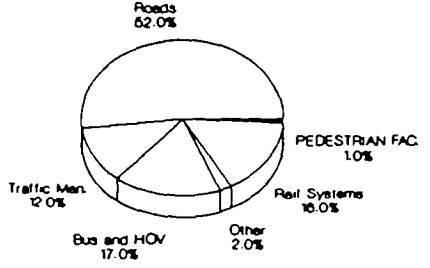


Fig. 2 : Urban Travel Patterns
Income: Mode Choice

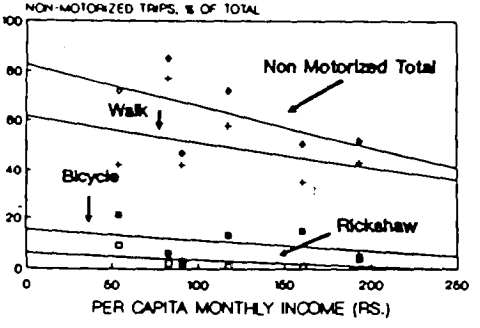
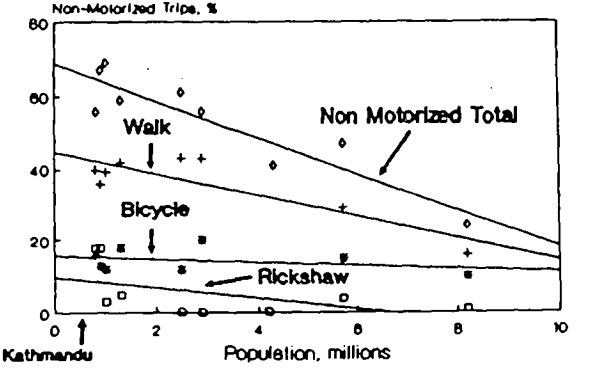


Fig. 3 : NON MOTORIZED TRIPS
SOUTH ASIAN CITIES



include their inevitable presence and their significance in urban transport (16,17).

II. MOTORIZATION

The desire for increased personal mobility is universal and is accompanied by motorisation. This motorisation and the consequences to non-motorised transport and its users are influenced largely by national policies regarding motor vehicles and taxation, city size and trip lengths, incomes, and the availability of alternative modes and their cost.

Income is a major determinant of mode choice among the poor. Walking and bicycling are common among the poor even when trip lengths are high. Figure 2 shows the decrease in non-motorized mode use as incomes increase in Asian cities. City size has a major influence on motorisation. Larger cities involve a larger portion of longer trips. Figure 3 shows the changes in non-motorized mode use in relation to city size.

As incomes increase, there will be higher motor vehicle ownership (cars, motorcycles, mopeds). However, it is unlikely to be high in poor countries. Figure 4 shows the car ownership -income relationships in Asian cities. Low car ownership rates correspond with low incomes. National policies regarding ownership and use of private cars has significant influence in spite of incomes. For example,Singapore, with higher incomes, has lower car ownership rates than Kuala Lampur because of very high taxes and import duties in Singapore.

The availability of affordable public transport is a major influence on trip making by the poor. Public transport availability in Asian cities is shown in Figure 5. The forecasts shown in Figures 4 and 5 are based upon assumptions stated in Table 1.

Table 1. Expected Income Growth Scenarios

Location Scenario	Annual Growth Rate %	Present Income US$	20 yr Forecast Income US$
Kathmandu Expected	0.2	300	312
High Grth	0.9	300	359
"Typical" Expected	0.9	300	359
High Grth	2.8	300	521

Given the slow growth rates of the lower income economies, rapid increases in per capita income cannot be expected. As a consequence, neither rapid increases in either private vehicle ownership or public transport availability can be expected. Table 1 shows the future income scenarios for both Kathmandu and a "typical" South Asian city in a less developed economy. These forecasts have been applied to both Figures 4 and 5 with the aim of estimating car ownership and public transport availability. Even in the best case, the high growth scenario for the "typical" lower income economy, car ownership and public transport availability estimates remain low. Car ownership could double from 20 to 40 cars/1000 people but remain far below the typical 400-500 cars/1000 people in the West. Public transport availability is also expected to remain low at about 1.2 buses/1000 people.

FIG. 4 : CAR OWNERSHIP VS INCOME
South Asia

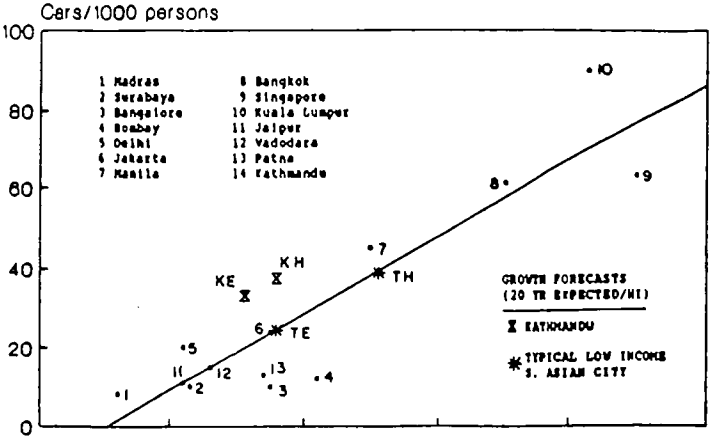
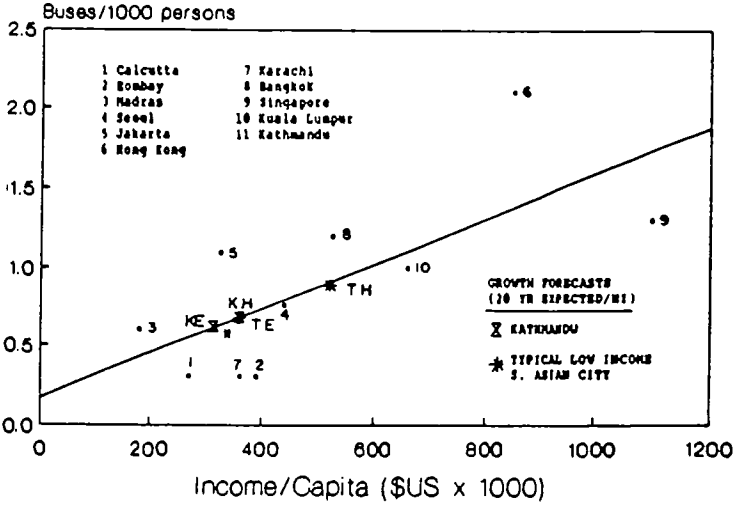


Fig. 5 : Public Transport Availability
South Asia



While motorisation will likely continue to increase in developing countries, non-motorized modes are here to stay for the 20-30 year planning horizon. This is significant for the very poor countries like Nepal. Under these circumstances, there is an urgent need for further research into the efficient planning, design, regulation and control of non-motorised modes.

III. MODE CHOICE

Income is a major determinant of mode choice, especially among the poor. The poor walk and bicycle simply because they cannot afford to pay for other modes (5). In some instances, accessibility measures for these modes are either equal to or better than measures for motorized modes (16). Depending upon the availability and quality of public transport, walking and bicycles can be as efficient or better depending upon trip lengths, terrain, climate and cost.

Urban transport policies and priorities also have a major influence on mode choice. These policies cover pricing, regulation, enforcement and safety aspects. Quite often non-motorized modes except walking are banned from the CBD's. There is often inadequate provision of safe footpaths (sidewalks). In many developing countries the supply side (technology and economics) and the regulation side (enforcement, economics and availability) favour motorized transport. Planning, design and road space allocation is heavily weighted in favour motor vehicles. The intellectual technology relies heavily on equivalents of passenger car units (PCU). This would change enormously if the professional and research basis was on "person trips" and not on "vehicles".

Mode choice differences are probably the single most important factors in the reduction of the effectiveness of the models transferred from the industrialized to the developing nations. Many local economic, cultural and geographic factors combine to create quite a different set of mode choice conditions in the LDC's for which new mode choice models must be calibrated. An understanding of the set of parameters relevant to developing nations and, more importantly, the values attached to the parameters by the particular population is essential.

Generally, the personal modes of travel such as bike, motorbike and auto will provide greater convenience and flexibility but with a requirement of an initial capital sum. The passenger modes such as the Low Cost Transport Modes (LCTM's) and the bus will be less flexible but may offer more comfort in the guise of protection against the elements and possibly greater speed, at a similar cost in continual smaller payments.

The treatment of time as a parameter in mode choice models is probably the major source of differences between the LDC's and the more industrialized nations. In general the traveller in the developed world can concern himself with optimizing his travel time whereas the traveller in the developing nation is more concerned with the immediacy of ensuring his arrival. As a result income, passenger transport availability, trip distance and terrain have greater significance.

The most critical parameter affecting mode choice in the developing nations is income. At the most basic level income may inhibit choice by causing mode captivity. The very poor with minimal or no income may have to walk for the simple reason that all other modes have an associated financial cost which the very poor may be unable to bear. Even the poor with a small income may be captive to a low cost passenger transport mode such as a rickshaw or minibus if

distance prohibits them from walking and capital outlay prohibits them from use of the cheapest of the personal transport modes, the bicycle. Aside from causing mode captivity, income (or cost) is also one of the strongest factors in the balancing of values of the traveller in the comparison of the relative merits of each mode.

Trip distance is also a strong factor in mode choice for the traveller in the LDC's. This factor, as well as mode type, impacts on energy expenditure, travel time, and protection from hot weather. The cost of these of the passenger modes is also often linked to trip distance limiting the availability of these modes to the poor when they have to make long trips.

The availability and cost of passenger transport also has a strong bearing on the choice of mode. Similar to the developed nations, especially with fixed route modes, transfer point proximity to both origin and destination and convenient scheduling are factors considered. This is less important in the case of the more flexible LCTM's although for reasons of economics even these will still tend to congregate on the more highly frequented routes and a premium may be paid for deviation from these.

The climate, terrain and available infrastructure also affect the choice of mode. Poor weather conditions such as heavy rain or extreme heat or cold may inhibit the use of non-motorized modes such as walk and cycle putting a premium on covered passenger transport modes. Rough terrain and steep hills may also inhibit cycling whereas poor roads may inhibit the use of the motorized modes.

Finally, there is a host of cultural and historic factors which may enhance or inhibit certain mode choices. For example, religious beliefs may preclude any contact between women and unknown men in public such as bus use by women. Frequent past bicycle use by a family will enhance this mode to new travellers because of familiarity, availability and past route choice experience. These effects may prove the most difficult to discern especially for expatriate "specialists" with little knowledge of the customs and culture of the developing country.

IV. KATHMANDU EXPERIENCE

A. BACKGROUND

Nepal is a small land-locked country completely surrounded by India and China. It is a very poor country with a per capita GNP of US$160 in 1984; the seventh lowest in the world. Its economic base is mainly agricultural which provides employment for 93% of the labour force (18). Motor vehicles and parts are not manufactured in Nepal and are imported at significant cost. In contrast, bicycles and bicycle rickshaws (non-motorized transport) are often manufactured and repaired locally.

Nepal's 16.5 million inhabitants are mostly rural with only 7% living in urban areas. However, between 1973 and 1984 the urban growth rate was very high at 8.4% annually. Kathmandu, with a population of 235,000 has approximately one quarter of the urban population of the country and is the largest and quite primate city (1).

As with most LDC's unemployment and poverty are prevalent in Nepal. There is a significant amount of both unemployment and underemployment, especially

among the uneducated. Shah reports that various surveys have found unemployment among the uneducated to be between 25% and 65%. Income statistics, for Kathmandu are not readily available, however, given a poor income distribution in combination with the extremely low per capita GNP cited above a fairly high level of poverty is apparent. In fact between 40 and 60% of all households are considered poor (2). Unlike most Asian cities though, the poor in Kathmandu have been relatively well dispersed spatially therefore the city has, to date, avoided the usual problems with slums and squatter settlements (1).

B. TRANSPORTATION: DESCRIPTION AND OBSERVATIONS

The following description of the transportation system of Kathmandu stems from two major studies and personal observations by the author during several visits to Kathmandu during 1983-88. The first was a comprehensive study carried out by Tribhuvan University during 1984-1987,coordinated by the author and funded by the IDRC of Canada (1). The second was a miniature traffic study conducted in 1988 (2).

The transport system of Kathmandu is typical of the poor Asian cities with a heavy emphasis on non-motorized transport. Walking is the dominant mode. Figure 6 shows that 56% of daily trips were walking trips. The poor in Kathmandu are relatively well dispersed and as such seem able to keep their travel distances short, a necessary condition for the pedestrian travel mode. Figure 7 shows that a large number of trips are less than 5 Km. and that 2/3 of these trips are by walk.

Bicycle use is minimal in Kathmandu. This is due in part to the hilly terrain and in part to the low availability of bicycles. The hiring of bicycles is restricted somewhat by the lack of an identification system for users. In addition, only 18% of all households own a bicycle; significantly less than in many other lower income nations. Local production of bicycles and access to financing may induce more bicycle use.

Other modes in Kathmandu are buses and Low Cost Travel Modes (LCTM's): cycle rickshaws, tempos, meter tempos and minibuses. Fig. 6 demonstrates the popularity of LCTM and buses which carry 25% of all trips. Figure 8 shows that the actual use of buses is higher than the LCTMs in relation to seat capacity. However, LCTMs provide employment to a large number of the poor.

Nepal is one of the poorest countries and nearly half of Kathmandu's residents are poor. The effect of income on mode choice is shown in Figure 9. In addition, the dependency ratio is very high and incomes very low. Under these circumstances, a majority choose to walk and/or use other cheaper non-motorized modes of transport.

Because of the hilly terrain and very cold climate during 6 months of the year, trip distances have significant influence on mode choice even by the poor. Figure 10 shows that walking is the most predominant mode when trip length is less than 5 km. After that there are major shifts to buses and other modes. In the range of 6 - 15 km., terrain, climate and fatigue are major factors influencing mode choice. Beyond 16 km. walking is insignificant.

Fig. 6 : Mode Split - Kathmandu
% of Total Trips

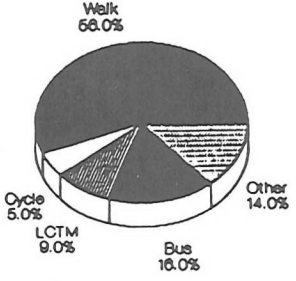


Fig. 7 : TRIP MODE SPLIT CHARACTERISTICS
Kathmandu

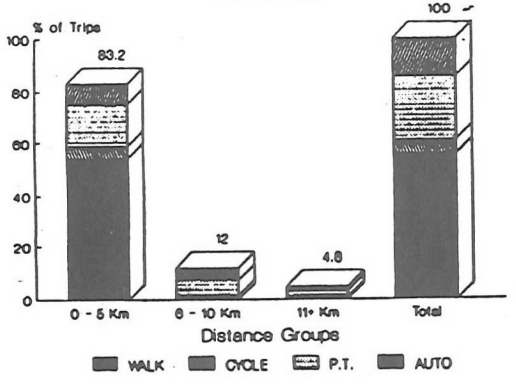
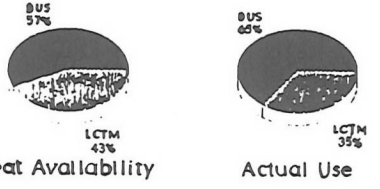


Fig. 8: Passenger Travel
Kathmandu



Seat Availability

Actual Use

Fig 9 : Mode Choice Vs Income
Kathmandu

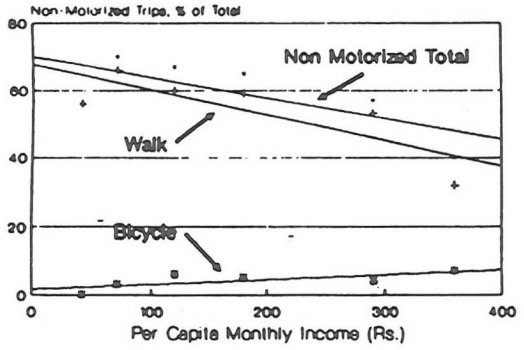


Fig. 10 : Distance vs Mode Choice
Kathmandu

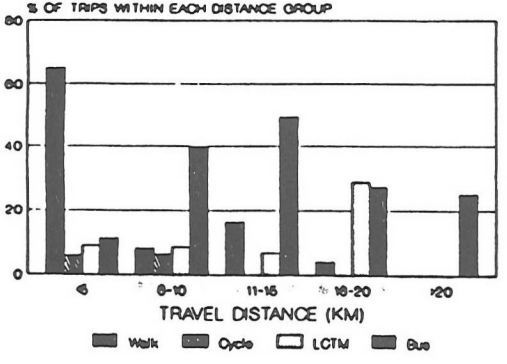
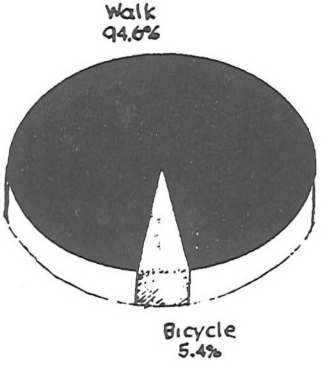


Fig. 11: BhotaHity
Mode Split



C. CONFLICT MITIGATION AND CAPACITY ENHANCEMENT

Traffic patterns in three specific areas of Kathmandu were studied in 1988: BHOTAHITY, LAINCHAUR and RATNA PARK (2). Only the traffic volumes and modes during peak hours were analyzed.

Bhotahity is an ancient inner city market area with very narrow streets with thriving retail businesses and a lot of informal vending on the streets, quite typical of Asian cities. The street widths (R/W) from building line to building line are only 8 - 12 meters.

Expansion of these streets to allow for all modes is economically prohibitive. As a result, rather than allow motorized transport during peak periods at the expense of pedestrian capacity, restrictions to motorized traffic have been decreed. From 8 a.m. to 8 p.m. only bicycles and pedestrians are allowed. Motorized personal vehicles are permitted only when the owners live in the area. Goods vehicles are allowed access for delivery purposes. The result is a non-motorized precinct allowing for relatively free and safe pedestrian and cyclist flow. Obstructions inhibiting capacity were very apparent, especially in the form of sidewalk vendors. This informal sector activity is a significant source of income to the poor and elimination of street vending restrictions is considered inappropriate. Once the motorized traffic was removed, there was adequate capacity both for non-motorized traffic and street vending.

In Bhotahity, the number of cycle rickshaws, delivery vehicles and personal motorized vehicles was very small. The traffic was primarily pedestrians and cyclists. The peak period mode split is shown in Figure 11 and pedestrian flows in Figure 12. Traffic flows were 5,015 pedestrians/hour and 286 bicycles/hour.

In the Lainchaur area, traffic counts were made on Kanti Path, a major arterial street just outside the CBD. In Ratna Park, the counts were made on Ratna Park East and Ratna Park West, two one way couplets, designed originally as ceremonial streets and now major arterials.

Mode split and traffic volumes for Lainchaur are shown in Figures 13 and 14. Similar data for Ratna Park is shown in Figures 15 and 16. On these two arterials, there are no capacity process. However, visual observations suggest 1) inefficient traffic controls 2) insufficient enforcement of pedestrian use of the vehicular roadway and 3) undisciplined use of space at bus stops, tempo stops and intersections, similar to other major Asian cities. Although more than 60% of all trips in Kathmandu were by non-motorized modes, there were less than 15% non-motorized trips. This suggests that non-motorized traffic on arterial routes is reduced by the use of non-motorized precincts such as Bhotahity. The reduction of non-motorized traffic on the arterial routes increases the capacity of these routes by 1) reducing the effects of the slower cyclists on the speeds of the faster motorized modes, 2) allowing for possible additional roadway width through smaller pedestrian flows, and 3) reducing conflicts. This is illustrated in Figure 17.

Such efficient use is possible only when planners focus on total person trips (not on vehicles only) and allocate appropriate exclusive/mixed precincts for various modes. This must be done by recognising the very important role of non-motorized modes in poor countries.

Fig 12 : BhotaHity
5 Min. Pedestrian Flow Rates

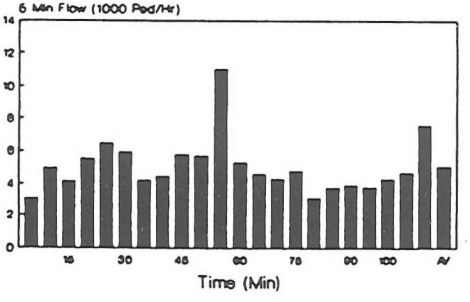


Fig 13 : Lainchaur
Mode Split

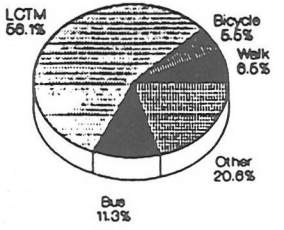


Fig 14 : Lainchaur
5 Min Pedestrian Flow Rates

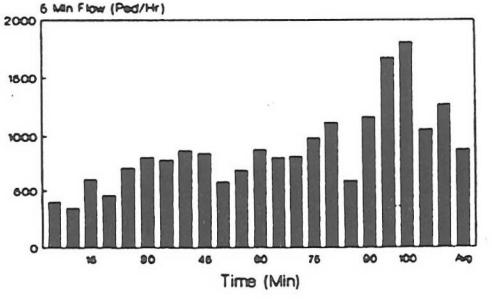


Fig 15 : Ratna Park
Mode Split

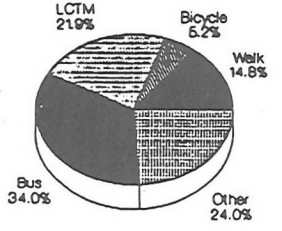


Fig. 16 : Ratna Park
5 Min. Pedestrian Flow Rates

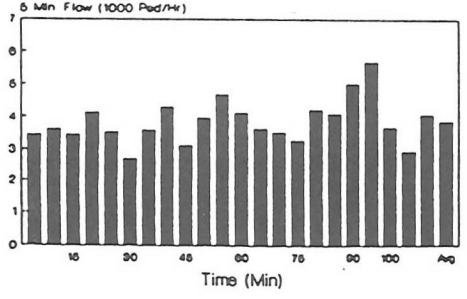
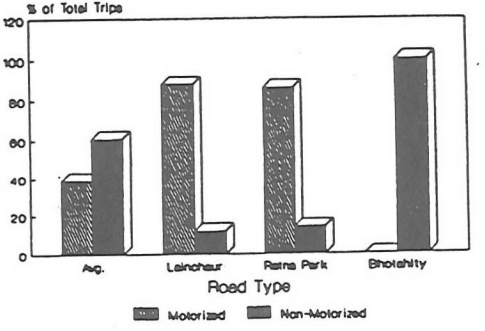


Fig. 17 : Mode Separation Effects
Kathmandu



V. CONCLUSIONS

The data and analysis presented here leads to several conclusions:

1. Developing countries and major international lending agencies have previously ignored the non-motorized modes, particularly the pedestrians. These attitudes appear to be changing as planners begin to recognise that a large majority of the people in poor countries are dependent on non-motorised transport, particularly walking.
2. Income is a major determinant of mode choice. Since rapid increases in personal incomes are not predicted for Kathmandu, the vast majority will continue to walk.
3. It is unlikely that there will be a significant increase in bicycle trips in Kathmandu because of the constraints of terrain and climate. Currently the available bicycles are all single speed.
4. Bicycle and cycle rickshaw trips in Kathmandu are significantly lower than in cities of similar size. This attributed to terrain, climate and cost/income factors.
5. While that motorization will continue to increase. Considering the predicted GDP/income increases for Nepal, motorized vehicles and motorized trips will remain proportionately insignificant during the next 20 year period.
6. Bus availability is a function of both regulation policies and urban transport investment which is dependant upon the strength of the national economy especially when it involves foreign currency expenditures. Kathmandu is likely to increase its bus fleet but unlikely to do so in a substantially large measure.
7. Car ownership in Kathmandu is now higher than in other Asian cities with similar economic status.
8. 56% of all daily trips in Kathmandu are by walk and another 5% by bicycle. Other low cost transport modes account for 9% of the total.
9. People walk up to 5 km. for a variety of reasons including cost and unavailability of other cheap transport. Beyond 5 km. walking appears to be impractical even for the poor.
10. There is a pronounced shift from walking to public transport for trips longer than 5 km.
11. The Public Transport system is overloaded and there is an adequate supply of other for hire transport.
12. Kathmandu planners have successfully used exclusive pedestrian precincts within the CBD to: a) relieve congestion b) create additional capacity on other arterial streets by diverting pedestrians to these precincts c) achieve higher safety levels
13. On certain arterial, it would appear that apparent crowding is a result of capacity obstructions (trees), undisciplined mix of traffic (pedestrians on the roadway), inadequate traffic controls and unplanned bus, tempo and taxi stands and stops.

VI. ACKNOWLEDGEMENTS

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