# RURAL TRANSPORT PLANNING IN DEVELOPING COUNTRIES : GENDER AND SOCIAL CLASS BIAS

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abstract : The paper highlights the shortcomings - gender and social class bias - of the current transport planning approach in developing countries with a case study of Bangladesh. A Household Travel and Transport Survey (HTTS) was conducted in two areas of Bangladesh encompassing all aspects of rural transport needs - economic, domestic, social and welfare. The study results show that the transportation needs of the rural poor who form the overwhelming majority of rural residents, and in particular of females, are rarely taken into account in the formulation of transportation interventions in rural areas. The findings of the paper call for designing transport interventions based on the comprehensive transport needs of the rural population be they subsistence or economic.

## 1. INTRODUCTION

In the history of development of human society, travel and transport have been of fundamental importance. A significant role is played by transport in enhancing mobility, agricultural and industrial production, trade and thereby economic growth. Transport contributes to the achievement of environmental and social objectives. With increasing integration of different countries into the global market the role of transport is getting enhanced. Considering the importance of transport in achieving the developmental objectives governments of developed as well as developing countries are investing heavily in transport infrastructure development.

High social value of transport - rural, urban and inter-urban - has been confirmed by macroeconomics analysis. In developing countries rural transport is of added importance as majority of the people lives in rural areas. Rural transport can play an enormous catalytic role in boosting agricultural production by lowering input prices hence production costs; improving access to credit; facilitating technological diffusion; lowering marketing costs hence improving the producers share of consumer price; and increasing land under cultivation. It also facilitates development of non-agricultural rural economy indirectly. Adequate, reliable and economic means of transport is a prerequisite for the overall rural development and for access to essential facilities by rural residents.

Following independence, the Governments of newly independent countries invested heavily in transport infrastructure. One estimate found that, in developing countries, about 20-25% of the public sector investment went to the transport sector overwhelmingly for investment in roads, mainly national and arterial (Edmonds & Relf, 1987). In the mid 70's, emphasis shifted to secondary and feeder roads (Dawson & Barwell, 1993). Huge investments were made and

continue to be made in the rural transport sector. As an example, by 1977, 93% of the total road lengths in World Bank projects were rural roads (Dawson & Barwell, 1993).

The basis for such optimistic investment in roads was the classical assumption and model applied in the developed countries that if the public sector built the infrastructure, the private sector would provide the vehicles and operate the services. In turn, the assumption goes on, that, as a result of the "improved access" to facilities in the rural areas the rural economy would respond and thrive. The role of the motor vehicle in meeting the resulting increased transport demand was taken for granted. Until the early 80's this model was widely accepted by transport and development planners. At that time different observations and studies around the world identified the limitations of the approach (Kaira, 1983; Carapetis S *et al.,* 1984). Some studies identified the approach as One of the limitations of this approach is its failure to respond to the transport demands of the majority of inhabitants who eke out their living through subsistence agriculture. The majority of rural trips are within the villages and rarely warrant the use of motor vehicles. Even if the motor vehicle could respond to the transport needs, it would be a long, slow process at current level of investment. For example, : (a) In India 70 per cent of the villages are yet to be connected with all weather road (Edmonds & Relf, 1987); and (b) Another 150 years would be required to make initial investment on the rural and feeder roads in Brazil at the current rate of investment (Carapetis S *et al.,* 1984). Kaira (1983) and Johnston (1993) have termed the above type of transport planning approach in rural areas as "road and car approach" and "road and motor vehicle fix" respectively. In this type of transport planning approach social justice takes a back seat due to overriding focus on economic development.

The general nature of the rural transport situation in Bangladesh is consistent with the comments made above. In the backdrop of the above an empirical study was conducted in Bangladesh with the following postulated hypotheses: (i) the conventional transport planning approach which focused on the "motorable roads and conventional motor vehicles" and conceptually evolved towards development and modernisation of agriculture is ineffective in addressing the real transport needs of the majority of the rural population who eke out their living through subsistence agriculture; (ii) there remains an enormous potential for IMT/NMT in addressing the transport needs of the rural population; and (iii) females are less benefited by the conventional transport planning wisdom. The paper describes the key findings of the study in relation to hypotheses (i) and (iii) - current transport planning approach and gender and social class issues. The following sections: (i) review in brief the current literature related to rural transport planning in developing countries; (ii) explain the methodology adopted for conducting this study; and (iii) present the results and some of the research findings.

## 2. LITERATURE REVIEW : RECENT LITERATURE ON RURAL TRANSPORT PLANNING IN DEVELOPING COUNTRIES

There are considerable problems in reviewing literature on rural transport planning related studies in developing countries those range from diversity of objectives between different studies to different analytical approach undertaken in conducting studies (Ahmed, 1995) This review of literature only covers the literature related to studies conducted since the late 80's with characteristics like : (i) rural transport was considered in totality, i.e. movements of rural people for domestic, economic and social needs; (ii) transport demand of the locality was analysed by analysing the transport needs of the households within them; (iii) analysis of access problem was not only done by the provision of transport infrastructure; (iv) transport

responsibility between men and women was distinguished and (v) studies contain disaggregated outputs .

Pioneering rural transport studies with the aforementioned characteristics were conducted in the 80s in Tanga region of Tanzania (1986), Makete District of Tanzania (1986-87), Ghana (1986) in the Philippines (1988) (Dawson and Barwell, 1993). Five studies were conducted in three countries of Africa as a part of the Rural Travel and Transport Project (RTTP) of the Sub-Saharan Africa Transport Programme (SSATP) under its Rural Mobility, Accessibility and Transport Services component. Of the five study areas, two were in Zambia, two in Burkina Faso and one in Uganda. These studies represented a wide range of conditions in East and West Africa and in South-East Asia. The studies quantified the transport demand and characteristics of rural households and, thereby, identified rural population's transport needs to recommend appropriate action for meeting those transport needs (Barwell, Howe and Zille, 1987; Dawson and Barwell, 1993; Barwell and Malmberg-Calvo, 1989; Airey and Strandberg, 1992; and Barwell, 1992)

Dawson and Barwell (1993); Barwell, Howe and Zille (1987); Airey and Strandberg (1992); and Barwell (1992) summarise the different aspects of the findings of the studies mentioned above. The main findings of the studies are : (i) a substantial amount of time and effort is devoted for transport by the rural people in the study areas. The majority of the time and effort are spent around the village, on foot and to meet domestic and subsistence needs; travel by motor vehicle was restricted to a very small numbers of long distance trips; (ii) Ownership of motorised vehicles is rare. Typical rural people make very limited use of for-hire transport. They live in a walking world and long distance trips are rare. Intermediate Means of Transport (IMT)/IMT Non-Motorised Transport (NMT) plays major roles in the alleviation of transport constraints - helping in crop production and harvesting activities and also helping in the first stage of the marketing chain. Bicycles and mopeds are the most widely owned IMT; The most common form of vehicles in the study areas is Non-Motorised Transport; ownership of motorised transport is rare; (iii) Much of the burden of rural transport falls on women and the majority of this burden involves water and firewood collection (measured in terms of time, it can go as high as some 85%)

The studies concluded that a considerable amount of time and transport effort were spent for providing for basic transport needs of households and thus limited the extent to which households could take advantage of economic opportunities. Barwell, Howe and Zille (1987) concluded that the conventional transport planning approach, which exclusively focused on the improvement and expansion of motorable road networks, was unlikely to relieve the transport burden of the rural communities.

However, these studies had some drawbacks like: (i) the analysis of the data mainly concentrates on household level averages for different transport task related indicators (trip, time, transport effort etc.). No attempts had been made at statistical analysis to gain more insight on household travel and transport patterns, such as, inter-household, inter-gender distribution etc.; (ii) due to undue emphasis on capturing households travel and transport burdens, some of the data are lumped in such a way that it is rather difficult to get representative pictures of transport related activities; (iii) aggregating data on households can be confusing at times. A household may have less transport burden per able bodied household member even if more time and/or effort is spent in meeting the transport needs of the whole household compared to another household. Hence, greater insight could be possible by

aggregating household level data from individual level data. (iv) more emphasis could have been given to the analysis of transport tasks on the basis of the different modes used in performing those transport tasks. Also there is no analysis on the extent of use of different types of transport infrastructure in performing the transport tasks; and (v) some trips were not taken into account in calculating the household transport demand; e.g. education related trips, work/business related trips etc.

Perhaps the first comprehensive study on rural transport in Bangladesh was done in 1975-77 (Transport Survey Section and Overseas Development Group, 1978). The findings are as follows: (i) state of rural transport at that time was not the only, or even the major, constraint to agricultural development. Limitations in the development of agriculture were due to the unequal access to production factors, like credit and agricultural inputs and tied marketing arrangement with traders; (ii) larger farmers and traders accrue most of the benefits from transport improvements; (iii) priorities for rural transport improvement should be decided on the basis of access into rural areas; and (iv) there was scope for the development of appropriate technology for IMTs in the rural areas. The study helped in throwing some light onto rural transport problems in rural areas of Bangladesh at a point in time when there was a dearth of knowledge on such problems.

Another empirical study was conducted in 1982 (Ahmed and Hossain, 1990). One of the important findings of this study was that the infrastructure had a profound effect on the income of the rural poor; it claimed that infrastructure could boost household's overall income by 33 per cent. Small farmers gather the major share of the income rise from the increased production of crops, wages and livestock and fisheries. Howe (1994) expressed apprehension and strong reservations on these findings on the following grounds : (i) there was contradiction between the theoretical argument and the empirical evidence; (ii) they reflected short term views of economic and social changes associated with new roads which was fundamentally unsuitable in Bangladesh; and (iii) it captured gross benefit rather net benefit, i.e. the data represents "effects" rather than "impacts".

## 3. RESEARCH METHOD

To test the hypotheses of the study, primary and secondary data were collected in Bangladesh. A Household Travel and Transport Survey (HTTS) was conducted using questionnaires in order to collect primary data in two study areas. In addition to the primary data, secondary data were also collected. First, the general areas for the study were selected. Due to their special nature, hilly areas were excluded. The rest of the country was then divided into three areas based on the predominant transport features - mainly land transport, mainly water transport and mixed land and water transport. The areas selected for study were those with mainly land and mainly water transport. Secondly, a representative Thana was selected in each area, and within those, two villages were identified, one relatively close to developed transport infrastructure and one remote from transport infrastructure. Thirdly, in each village, 25 households were randomly selected for Household Travel and Transport Survey (HTTS), a total of 100 households. In each household, all persons over 10 years of age[1] were interviewed - a total of 309 persons of whom 154 were male and 155 were female. Two types of questionnaire were used : (a) Household; and (b) Individual. The "individual" form was used

[1] Children below the age of ten years were not interviewed as found unsuitable for interviewing during pilot survey

for trip data for a range of purposes. During the individual interview, the interviewers helped to complete a travel-activity diary recording detailed information on the activities undertaken and trips made by the respondents the day before the interviews.

## 4. RESEARCH FINDINGS

### 4.1 Travel and Transport Patterns

#### 4.1.1 Trip Patterns[2]

**Figure 1** presents a plot of the numbers of trips per year made by the respondents (sorted in ascending order) for the four study villages. On average, respondents made 3018 trips per year (8.2 trips per day) with a relatively low level of variability among villages. The distribution of numbers of trips made per year by the respondents is "slightly" positively skewed and close to normal.. The "mean", the "median" and the "M-estimator"[3] of the values are very close.

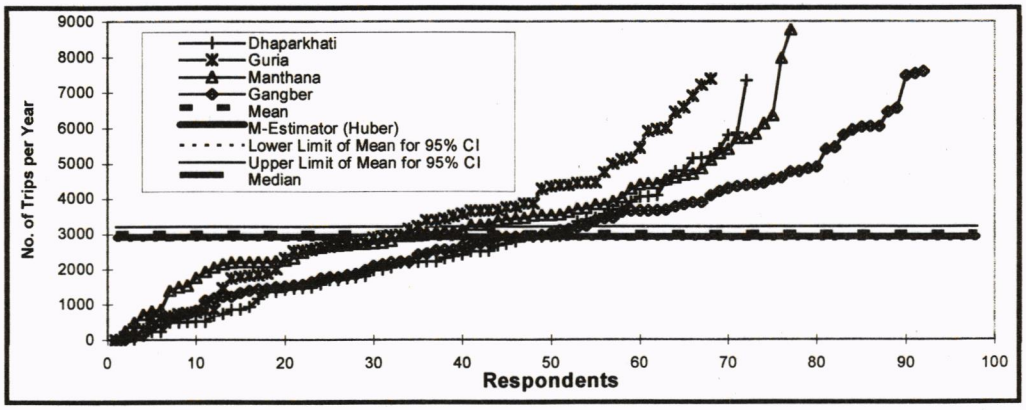


**Figure 1 : Numbers of Trips Made by the Respondents per Year**

Majority of the trips (98%) were made by the respondents without using any mode of transport other than walking. No substantial inter-village differences were found in terms of percentage of trips made by walking. 2% and less than 1% of the trips were made by using NMT and conventional motorised transport respectively. Overwhelming majority (98%) of trips were made using roads lower than feeder roads and water ways lower than river route (hereinafter referred as "lower category infrastructure"). The comparison of the use of "lower category infrastructure" ranged from 99.8% to 92.4% among villages. No significant correlation was found between the number of trips made by the respondents and operated land or cash income of the households.

On average, a household made 11718 trips. Comparable figures for other studies were 3598 for Tanga (Tanzania), 3544 for Makete (Tanzania), 8448 for Ghana, 3828 for Aurora

[2] one trip is defined as the journey from origin to destination

[3] Like median, M-estimator (maximum-likelihood estimator) is a resistant measure, the value of which is not influenced by a few outliers in a data set.

(Philippines), and 4364 for Mountain Province (Philippines) (Dawson and Barwell, 1993; Barwell 1992, 1990). Trips made by households in this study were "slightly" skewed (skewness of 0.73). The "mean", the "median" and the "M-estimator" of the values are not very different - the "median" and the "M-estimator (Tukey)" are 11447 and 11064 respectively. Households made higher numbers of trips for domestic activities (5498) compared to economic (4689) and social and welfare activities (1531).

There is positive but "weak to moderate" correlation between the number of trips made by households and their cash income and operated land area (correlation coefficient of 0.36 and 0.56 respectively with 2-tailed significance of .01). Controlling for household members, there is a significant but "weak" partial correlation (partial correlation coefficients of 0.42 with 2-tailed significance of .01) between operated land and total trips of the household. No significant partial correlation was found between cash income and total trips of the household controlling for household members.

Over the whole study sample there is a positive but "weak" correlation between the number of trips to health facilities (excluding trips to traditional healers) and cash income as well as operated land (correlation coefficient of 0.31 and 0.42 respectively with 2-tailed significance of .01). For individual villages, there is no such significant correlation for villages where households are remote from the health centres. But the correlations are found more prominent for villages where households are close to health centres. In case of one village where households are close to health centres correlation coefficients between numbers of trips to health centres and household cash income and operated land are 0.48 and 0.49 with 2-tailed significance of .01 respectively. For another similar village corresponding figures are 0.40 (2-tailed significance of .05) and 0.58 (2-tailed significance of .01) respectively.

on average, males made 2629 trips per year (7.2 trips per day) and females made 3404 trips (9.3 trips per day). There is relatively little difference between the "mean" of number of trips (3404 numbers) made by the female respondents; and the "median" (3378 numbers) and the "M-estimator" (3326 numbers) of values. Numbers of trips made by female respondents is "slightly" skewed with skewness of 0.1. In case of males, the skewness is 0.4. on average, the number of trips made by female respondents for domestic purposes (63% of average total trips) was substantially higher than for other purposes (economic and social welfare). But in case of male respondents, the average number of trips made for economic purposes (45% of average total trips) was considerably higher than for other purposes.

The percentage use of transport modes for different trip related attributes by female respondents. Almost all (99.8%) trips made by females are by walking. Walking trips made up about 95% of the male trips. More than 96% and 99% of trips made by male and female respondents respectively were on "lower category infrastructure". No significant correlation was found between the numbers of trips made by the male and female respondents and households' operated land or households' cash income. The significance for comparison of "means" of numbers of trips made by male and female respondents is 0.0001.

### 4.1.2 Travel Time Patterns

**Figure 2** shows the number of respondents by the time they traveled per year for the respondents in the study villages (sorted in ascending order). On average, respondents spent a total of 421 hours per year (1.2 hours/day) for trip making. walking was the mode used for an

overwhelming majority of the time traveled by the respondents (84%). There was no significant correlation between time traveled by the respondents and operated land or cash income of the households. The "mean", the "median" and the "M-estimator" of the values of time traveled per year by the respondents are not substantially different. However, the distribution of time traveled by the respondents was "fairly" skewed with skewness of 2.14. 46% of the total time was traveled by the top 20% of the respondents (43% in case of male and 45% in case of female). Mean travel time per trip was 8.4 minutes.

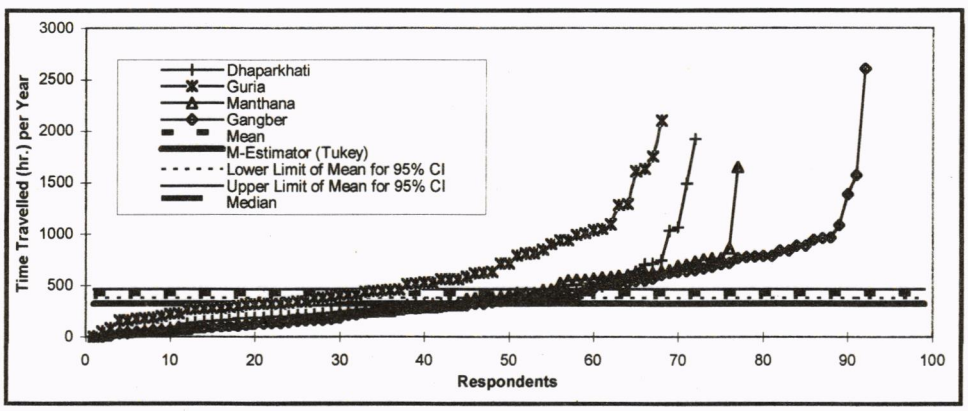


**Figure 2 : Time Traveled (hour) per Year by the Respondents**

On average, a household spent 1615 hours a year (4.4 hours/day or 31 hours/week) for transport related activities. Dawson and Barwell (1993) and Barwell (1992, 1990) presented the study result of time traveled by the rural households in different countries of Africa and Asia. The figures for this study are substantially lower than the similar figures for Tanga of Tanzania (2083 hours), Makete of Tanzania (2475 hours), Ghana (4832 hours), Lusaka Rural of Zambia (2711 hours) and Uganda (2337 hours); but substantially higher than Aurora in the Philippines (736 hours), Kaya of Barkina Faso (1123 hours) Dodougou of Barkina Faso (1259 hours) and Mountain Province in the Philippines (1006 hours). The figures are close to the corresponding figure for Kasama of Zambia (1737 hours). The distribution of time traveled by households was found "fairly" skewed with skewness of 1.65 due to 39% of the total travel time being accounted for by 20% of the top households. There exists considerable difference between the values of the "mean" and the "median" or the "M-estimator" (Tukey) - the median and the M-estimator are 1347 and 1363 hours respectively. There is a positive but "weak" correlation between the time traveled by the households and operated land area as well as cash income of households (correlation coefficient of 0.37 for cash income and 0.50 for operated area of households with 2-tailed significance of .01).

The average times traveled per year, by male and female respondents, were 577 hours (1.6 hours/day) and 267 hours(0.7 hours/day) respectively. The value of the "mean" of time traveled by the female respondents (267 hours) was not considerably higher than the "median" (221 hours) and the "M-estimator " (214 hours) of the values. The variability of the time traveled by the male respondents was considerably higher than for females (standard deviation of 415 hours for males against 218 hours for females). Time traveled by female respondents was "fairly" skewed (skewness of 2.16). This figure is marginally higher than the figure for males

(skewness of 1.81). The average time traveled by female respondents for domestic activities (108 hours) is marginally higher than for economic activities (98 hours). Travel time for domestic activities by the female respondents was mainly for "water collection" (29%) and "cooking fuel collection" (8%), and for economic activities, mainly for "other product production" (24%) and "crop production" (9%). Average time traveled by male respondents for economic activities (301 hours) was substantially higher than for domestic activities (186 hours) and social and welfare activities (89 hours). Males spent most of their travel time for "crop production" (13%), "other product production" (13%), "shopping" (28%) and "work/business" (20%).

walking constituted the overwhelming majority of the time traveled by female respondents (95%); in the case of males the figure was 79%. There were no substantial differences in the proportion of time traveled by walking by female respondents among different villages. On average, female respondents used "lower category infrastructure" overwhelmingly during the time they traveled (92% of the total time traveled). There is also no significant correlation between time traveled by female respondents and households' operated land or households' cash income; this is also the case with male respondents. Significance of comparison of "means" for time traveled between male and female respondents was found as 0.0000.

29% of households' total travel time (476 hours per year or 9.2 hours per week per households) had been supplied by females. Barwell, Howe and Zille (1987) reports that females of Ghana spent 1000 hours (19 hours per week) and females of Tanzania spent 1600 hours (32 hours per week) for transport activities. 70% and 75% of households' transport burden, in terms of time, was shouldered by females in Makete (Tanzania) and Ghana respectively (Barwell, Howe and Zille, 1987). Females contribute 50 per cent of the travel time for household transport activities (368 hours/year) in Aurora (Philippine) (Dawson and Barwell, 1993). An average adult female of Kasama (Zambia), Lusaka Rural (Zambia), Uganda, Kaya (Barkina Faso) and Dedougou (Barkina Faso) spent 975 hours/year, 747 hours/year, 988 hours/year, 459 hours/year and 357 hours/year respectively for transport activities (Barwell, 1992). 'The transport burden is fairly equitably distributed between males and females' was the conclusion of another study conducted in Mountain Province of the Philippines (Barwell, 1990, p.56).

### 4.1.3 Patterns of Distance Traveled

On average, respondents traveled 2427 kilometers per year (6.6 kilometers/day). In case of males the figure is 3888 kilometers/year(10.7 kilometers/day) and for females 976 kilometers/year (2.7 kilometers/day). Variability of distance traveled by the male respondents was quite high compared to female respondents (standard deviation of 4554 kilometers and 876 kilometers respectively).

The majority of the distances traveled by the respondents was without the use of any mode of transport (overall 59% of the distance traveled was on foot). Males traveled 53% of the distance without using any mode of transport whereas, for females the figure was 84%. Males used conventional motorised transport for 35% of their travel distance and the comparable figure for females was 13% Male respondents used NMT for 12% of the distance traveled compared to female respondents' 3%.

Respondents traveled 58% of the distances using "lower category infrastructure". Males and Females figures of infrastructure use ??? There was not any significant correlation found between the distances traveled by the respondents (overall, male and female) and operated land or cash income of the households. The "mean" of values of distance traveled by the respondents is considerably different from the "median" and the "M-estimator" of the values. Distances traveled by the respondents were "highly" skewed with a skewness of 4.45 resulting from the fact that 59% of the total distances traveled (53% in case of male and 48% in case of female) was by the top 20% of respondents.

Mean distances traveled per trip was 0.8 kilometers with 1.5 kilometers for males and 0.3 kilometers for females. The mean speed for trip-making was 5.8 kilometers/hour, with 6.7 kilometers/hour for males and 3.7 kilometers/hour for females.

### 4.1.3 Patterns of Transport Effort

**Figure 3** shows, in log-normal scale, the annual transport effort made by the respondents in the study villages sorted in ascending order. On average, respondents made a transport effort of 70 tonne-kms.[4] per year. The corresponding figure for males is 139 tonne-kms. per annum and for females 1.5 tonne-kms. per annum. Variability of transport effort made by the male respondents was extremely high compared to the female respondents (standard deviation of 671 tonne-kms. and 2 tonne-kms. respectively)

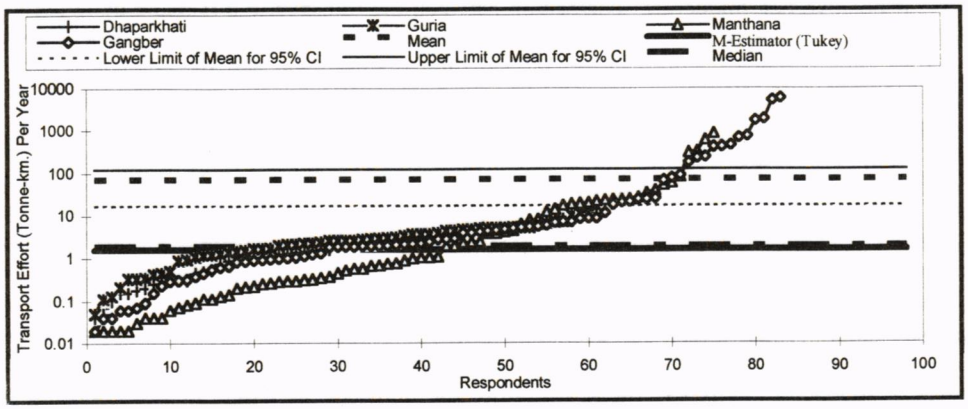


**Figure 3 : Transport Effort (tonne-km.) per Year by the Respondents**

The majority of the transport effort (88% of the total) was made by respondents using conventional motorised transport. The respondents used "Higher category of infrastructure"[5] for making 93% of the transport effort. Significant but "very weak" correlation exists between the transport effort by the respondents and operated land area of households as well as cash income of households. (correlation coefficient of 0.18 and 0.28 respectively with 2-tailed significance of .01).

[4] Equivalent to pulling 10 tonnes of load over a distance of 7 km.
[5] includes feeder roads and higher and river routes

the "mean" of values of transport effort of respondents is considerably different from the "median" and the "M-estimator" of values - the "M-estimator" and the "median" are only one forty fourth and one thirty seventh, respectively, of the arithmetic mean.. The distribution of transport effort made by respondents is "extremely" skewed with a skewness of 10.5 due to the fact that 96% of the total transport effort was made by the top 10% of the respondents.

Average transport effort per year made by households was 244 tonne-kms. The "mean" of the values of households' transport effort was "extremely" different from the "median" and "M-estimator (Tukey)" of the values - "median", 13.8 tonne-kms. and "M-estimator", 12.08 tonne-kms.. The distribution of values of households' transport effort was "extremely" skewed, with a skewness of 5.39 due to the fact that 95% of the total transport effort was made by the top 20% of households, 83% by the top 10% of households and 71% by the top 5% of households. Mean transport effort made by the households in this study was found considerably higher than the transport effort made by the households in Asia and Africa as found in other studies (Dawson and Barwell, 1993; Barwell, 1992, 1990). In Africa, the average transport effort made by households ranged from 216 tonne-kms. (Ghana) to 27.7 tonne-kms. (Kaya of Barkina Faso). Other average figures for Africa are 85 tonne-kms. (Tanga of Tanzania), 87 tonne-km (Makete of Tanzania), 52 tonne-kms. (Kasama of Zambia), 62 tonne-kms. (Lusaka Rural of Zambia), 64 tonne-kms. (Uganda) and 47 tonne-kms. (Dedougou of Barkina Faso). Average transport effort made by the households in the Philippines was 92 tonne-kms. and 36 tonne-kms. for Aurora province and Mountain Province respectively.

There is positive but "moderate" correlation between the transport effort made by households and households' cash income or households' operated land area (correlation coefficient of 0.58 and 0.43 with 2-tailed significance of .01 for total cash income and operated land area of households respectively).

The "mean" (1.5 tonne-kms.) of transport effort made by females is considerably higher than the "median" (0.9 tonne-kms.) and the "M-estimator" (0.8 tonne-kms.) of the values. Transport effort made by males was "extremely" skewed (skewness of 7.34 against female's 1.6) compared to females as well owing to the fact that 93% of the male transport effort was made by the top 10% of male respondents. In case of females, the corresponding figure is 39%. Average transport effort made by female respondents for domestic activities (1.43 tonne-km) was substantially higher than for economic activities (0.04 tonne-kms.). "Water collection" (68%) and "cooking fuel collection" (25%) formed the majority of the transport effort made by female respondents. Females' transport effort for domestic activities in the study villages ranged from 83% 100%. Average transport effort made by male respondents for economic activities (133 tonne-kms.) was substantially higher than for domestic activities (6 tonne-kms.). Male respondents made the majority of their transport effort for "crop marketing" (88%), "crop milling" (6%) and "shopping" (3%).

### 4.2 Discussion and Conclusion

#### 4.2.1 Discussion of Patterns of Trip Making

It may be inferred from the above Section 4.1.1 that males are mainly responsible for transport related to economic activities and females are mainly responsible for transport related to domestic activities. Females take part in transport for economic activities, like "crop production" and "other product production", it is usually within the vicinity of their

homesteads. Hartmann and Boyce (1988) and Jansen (1987) reached this same conclusion through their sociological study done in rural Bangladesh. These two studies concluded that women's work in rural Bangladesh consisted, predominantly, of cooking, caring for children, post-harvest processing within the compound of their homesteads, rearing poultry and livestock, carrying water from wells and collecting firewood.

The "mean" value of the numbers of trips per year made by all respondents, by males, by females and by households and the corresponding "M-estimator" and the "median" were very similar. This indicates that the "mean" values were not influenced by extreme values in the data set. It can be concluded that the above mentioned average values truly represent the average of "typical" households, respondents, males and females. The average number of household trips made per annum (11718 nos.) is substantially higher than the number of trips made by rural households in Tanzania, Ghana, and the Philippines as found by Dawson and Barwell (1993) and Barwell (1990). The average number of trips per household member is also considerably higher than the rural household members of the aforementioned countries. Although it is difficult to compare findings of this study with other studies difficult nevertheless it can be concluded that rural households in Bangladesh make substantially more trips than their counterparts in Africa and the Philippines. This is perhaps due to the relative proximity of Bangladesh households to their commonly used facilities such as, water sources, firewood sources, markets, etc.

Either no correlation was found or no pattern emerged between the number of trips made by individual respondents or by the households and the area of land operated by households nor with their cash incomes. Hence it cannot be concluded that there is a correlation between trip-making by the households and household wealth thresholds. Although a "weak" correlation was found between the numbers of trips to health centres and cash incomes of households, the correlation is stronger for the villages where households are relatively close to health centres. Therefore it may be concluded that there is a positive correlation between the number of trips made by households to health centres and their wealth thresholds and that correlation is strongest in case of villages which have close proximity to health centres.

Both males and females made the overwhelming majority of all their trips without using any transport modes and using "lower category infrastructure". No substantial difference was found among the villages in the use of transport modes or in the infrastructure used for tripmaking by the respondents. In the case of females no considerable inter-village difference is observed in the use of transport modes and infrastructure during trip-making as well. This is perhaps due to the type of transport activities undertaken by the females - mainly for water collection, cooking fuel collection and poultry/livestock rearing.

### 4.2.2 Discussion of Patterns of Time Traveled

Section 4.1.2 presents the patterns of time traveled by respondents, households and males and females. It can be seen that in the case of males and females, patterns similar to those of trip-making emerged. Females spent more time in traveling for domestic purposes than for economic and social and welfare purposes.

On average, time spent by the households, respondents and males are consistent with the travel times to the facilities most likely to be used by "typical" individuals[6] and "typical" rural males[7] in all but one village with better opportunities for cash crop. Hence it can be concluded that the travel activities of rural households and males are centered around those few facilities most likely to be used by households and by males respectively unless there is a potential for growing cash crops. Those facilities are most likely to be within or close to villages. On average, time spent by the females of all villages are consistent with the travel times to facilities most likely to be used by "typical" rural females[8]. Hence it can be concluded that transport activities of females are focused around those few facilities most likely to be used by rural females and, unlike males, their travel patterns are less likely to be affected by opportunities for market agriculture.

The average household spent 1615 hours/year (31 hours/week) for transport related tasks. This is close to the time spent for a full time job in a developed country. Although it is difficult to compare this figure with figures from studies in Africa and the Philippines due to the different survey and analytical procedures used, however, in general, this time is lower than the majority of corresponding figures for Africa and higher than figures for the Philippines. When looking at households' travel times there are differences between the values of the "mean" (31 hours/week) and the "median" (26 hours/week) and the "M-estimator" (26.2 hours/week). This means that existence of "outlier" values in the data set influence the value of the "mean". Even if the value of the "median' or the "M-estimator" is considered as the average transport time burden of "typical" rural household in Bangladesh, it is still quite substantial.

An average female of Bangladesh spent 267 hours (5.1 hours/week) on transport. This figure is substantially lower than similar figures for Ghana (19 hours/week), Tanzania (32 hours/week), Zambia (14-19 hours/week), Uganda (19 hours/week) and Burkina Faso (7-9 hours/week). Females contributed 29% of the transport time burden of households. This is substantially less than similar figures for Ghana (75%), Makete of Tanzania (70%) and Aurora of the Philippines (50%). Females' contribution to household transport in Bangladesh was also substantially less than that by African females as found under SSATP and by females in the Mountain Province of the Philippines (Barwell, 1992; Barwell, 1990). Females main transport input, in terms of time, is for domestic (35%) and social and welfare activities (38%).

No correlation was found between wealth thresholds of the households and the time traveled by respondents, by males and by females. Accordingly, it can be inferred that there is no interrelationship between time traveled by rural population, males and females and wealth thresholds of the households. A "weak" correlation was found between time traveled by the households and households' wealth thresholds. When this was analysed for individual villages, no patterns or strong relationships emerged. Therefore, it is not logical to conclude that there exists correlation between households' wealth thresholds and time traveled by the households.

Walking and use of "lower category infrastructure" accounted for the overwhelming majority of the time traveled by the respondents, by males and by females. No substantial inter-village differences were found between time traveled by walking and use of "lower category infrastructure" for females. However, males of one village spent a substantial proportion of

[6] Includes pure water source, firewood source, mosque/temple, traditional healer, local market, primary school
[7] which includes mosque/temple, traditional healer, local market and primary school
[8] Includes pure water source, firewood source, traditional healer and primary school

their time traveling (31%) using some transport modes, mostly NMT. This increased use of NMT, by the males of that village compared to other villages, is perhaps due to the increased presence of NMT in this area owing to improved infrastructure and suitability of NMT in carrying out the transport related tasks of males in rural areas. Hence it can be concluded that proximity of villages to transport infrastructure may encourage marginally higher use of transport (especially NMT) in case of males. Due to the nature of transport task carried out by females no substantial difference was found in the use of NMT by the females among the study villages.

Despite the significant differences in the availability of and proximity to different levels and quality of transport infrastructure, no pattern emerged from the use of "higher category infrastructure" by the respondents of the different villages. None of the results relating to overall patterns of travel time suggest that proximity of "higher category infrastructure" increases the use of such infrastructure. However, in all four villages males are more likely than females to use "higher category infrastructure". This is perhaps due to males being overwhelmingly involved in economic activities which somewhat warrants the use of "higher category infrastructure"

The results showed that the "mean" time traveled by males is significantly higher than that of females. Average trip time of males is about three times that of females -13.2 minutes for males against 4.7 minutes for females. Patterns of average trip times by females in the four study villages are closely consistent with the patterns of sums of average distances from households to those facilities most likely to be used by rural females. Except in the case of one village, patterns of average trip times for both overall respondents and males are consistent with the patterns of sums of average times from households to those facilities most likely to be used by rural population and males. This again confirms the local nature of travel needs of rural populations, males and females except where opportunities exists for marketable agriculture. This has also been corroborated by Jansen (1987) who states, 'Most of the inhabitants of village seldom leave the village and its neighboring area'. In explaining the importance of local primary markets Hartmann and Boyce (1988) also substantiate this finding when they state, 'Almost all amenities of village life are available at Ketupur market [a primary market] ... It is an important contact between village and the outside world'.

### 4.2.3 Discussion of Patterns of Distance Traveled

Section 4.1.3 presents the patterns of distances traveled by the respondents, males and females and households. In the case of females, an overwhelming majority of their travel distance (84%) was without the assistance of any modes of transport. The average distance traveled by males (10.7 kilometers/day) is four times higher than that of females (2.7 kilometers/day). This is a substantial transport burden on males considering that a major part of their travel distance (53%) was by foot. For females, although their transport burden, in terms of distance is not substantial compared to their developed country counterparts, it is nevertheless quite burdensome considering that 80% of the distance traveled was on infrastructure that is likely to be in poor condition[9] and little of their travel involves use of any transport modes. Jupp (1995) confirms that females in Bangladesh takes "lower category infrastructure" avoiding main roads

[9] As per World Bank (1996), conditions of "lower category roads" in Bangladesh are more likely to be poorer than other roads.

due to cultural reasons in a traditional society. The substantially higher distances traveled by males, compared to females, using conventional motorised transport and "higher category infrastructure" is due to their overwhelming involvement in economic activities. A significant finding is that proximity to improved infrastructure failed to generate any increased use of conventional motorised transport either for males or females. Both males and females of three villages with comparatively poor access to infrastructure traveled a considerably higher percentage of their travel distance using conventional motorised vehicles than in one village with comparatively good access. Considering that the males of one village with good access to infrastructure traveled a substantially higher absolute and proportional distance using NMT than in other villages, it can be concluded that proximity to infrastructure may induce enhanced use of NMT. Due to the nature of their transport tasks no substantial differences were found in the use of NMT by the females among the study villages.

The results of "mean distances per trip" by the respondents, males and females also closely conform to the patterns of sums of average distances from the sampled households to those facilities most likely to be used by the respondents, males and females in the four villages. The respondents have also traveled at an average speed (5.8 kilometers/hour) slightly higher than the walking speed of an able bodied male. The results also demonstrate that improved infrastructure failed to generate substantial increase in the speed of travel of males and females; the average speed of travel for both genders were found to be similar in all study villages.

Households carry considerable transport burdens in terms of distance traveled - 26 kilometers/day - the majority of which was traveled on foot. If the value of the "M-estimator" (21 kilometers/day) or the "median" (20 kilometers/day) is taken as the average for a "typical" household, it is still quite substantial. Although there is a positive correlation between the distance traveled by households and their operated land and cash income, an analysis of these relationships in the different villages produced no conclusive pattern for such a relationship. Therefore it cannot be concluded that there exists positive correlation between distance traveled by households and their operated land and cash income.

### 4.2.4 Discussion of Patterns of Transport Effort

Section 4.1.4 presents the patterns of transport effort by households, respondents, males and females. The average transport effort by males was extremely high and 93 times higher than by females. Even within the sample of males some made considerably higher transport effort than others as the variability of transport effort by males was substantial. Transport effort for the purpose of agriculture activities by households, respondents and males of one village with cash crop opportunity constituted overwhelming majority of their total transport effort. Simply, opportunity of growing cash crop produced enormous amount of average transport effort on the respondents, males and households of a village compared to the other three villages. "Crop marketing" accounted for the overwhelming majority of the transport effort of the respondents, males and households of the particular village. The overwhelming majority of the transport effort by females was for domestic activities. This is also consistent with the patterns of trip numbers, time traveled and distance traveled by females. "cooking fuel collection" and "water collection" constituted the majority domestic transport effort of females. Patterns of transport effort by females in different villages are consistent with the patterns of distances to pure water sources except one village where the source of firewood was quite distant compared to the water source.

The average transport effort by households in Bangladesh was extremely high (244 tonne-kms.) compared to households studied in Africa and Asia. Rural households in Ghana produced the highest transport effort (216 tonne-kms.) among different countries of Asia and Africa, but for an average household size of 11.4 compared to household size of 5.4 for this study. However, for Bangladesh households, a different picture emerges from a careful examination of the results of the analysis. As seen in Section 4.1.4, there are considerable differences between the "mean" of households' transport effort and the "median" and the "mode" of the same data set. This indicates that the "mean" is influenced by some outliers in the data set. This is also confirmed by the fact that only 10% of households are responsible for 83% of the transport effort. If the highest of the values of the "median" (13.8 tonne-kms.) and the "M-estimator" (12.08 tonne-kms.) is taken as the average transport burden in terms of transport effort of a "typical" household then the transport effort of the sampled households in Bangladesh was considerably less than the households of the Philippines and Africa. However, the reports of the Asian and African studies do not include similar analysis so it is not possible to verify this conclusion.

In the case of females, almost 100% percent of the transport effort was made using "lower category infrastructure" and without the assistance of any modes of transport. In the case of males, an overwhelming majority of the transport effort was made by motorised transport and using "higher category infrastructure". For males, different patterns of use of transport modes and infrastructure emerged among villages with and without marketable agriculture opportunities. In areas with marketable agriculture opportunities the pattern is similar to the overall pattern of use of transport modes and infrastructures - i.e. overwhelming use of transport modes and "higher category infrastructure". In areas without such opportunity, the overall pattern of use of transport modes and infrastructure is similar to the patterns for females - overwhelmingly done without use of any modes of transport and using "lower category infrastructure". None of the results suggest that improved infrastructure may enhance the use of motorised transport modes and higher category infrastructure in making transport effort. However, there is evidence that infrastructure improvement may induce overall use of NMT by the rural population and particularly by males but not in the case of females.

Although there is a "moderate" correlation between overall transport effort made by the households and their operated land area and their cash income, in the case of one village with cash crop opportunity the relationship is very strong. This implies that there is a strong correlation between transport effort of an household and operated land and cash income where there is ample opportunity for growing cash crops.

The transport effort by females was overwhelmingly (96%) for domestic purposes. On average, females of Bangladesh made an annual transport effort of 1.49 tonne-kms. This figure is substantially lower than similar figures for Ghana (46.6 tonne-kms.), Zambia (30-36 tonne-kms.), Uganda (42 tonne-kms.), Burkina Faso (10-21 tonne-kms.) and the Philippines (23 tonne-kms.). Further, the average transport input by females in terms of transport effort was only less than 1% of total household effort, also substantially lower than similar figures for Ghana (80%), Makete of Tanzania (85%) and Aurora of Philippines (25%). Proportional transport input by females in terms of transport effort in Bangladesh is also found substantially lower than input by African females and females of Mountain Province of the Philippines as reported by Barwell (1992, 1990).

### 4.2.5 Discussion of Affordability and Suitability of Transport Modes

In the month before the survey, 25% of all respondents had spent any money for transport. Similar figures for males and females are 35% and 15% respectively. On average, respondents spent Taka 590 (US$14.7) per year for transport with male spending an average of Taka 1039 (US$26) and females Taka 144 (US$3.6). When asked what type of transport was appropriate to carry out principal household activities, nearly half (44%) replied that no transport was required. A significant portion of the households in rural Bangladesh lives in such a low scale of economics that no type of transport is necessary to carry out their normal household activities. This is also evident considering the spending pattern of the respondents on transport; only 25% of the respondents spent any money on transport. Of the 56% who identified some mode of transport necessary to carry out principal household activities, 96% identified NMT as the potential preferred transport. Of the households which identified they needed some means of transport to carry out transport related tasks an overwhelming majority (93%) did not have such transport. This indicates the enormous need for the provision of some means of transport in rural areas of Bangladesh. "shopping" and "work/business" were the main domestic and economic activities respectively identified by the households hampered due to the non-availability of transport. Only a small minority of the households identified crop marketing and input collection as the activities hampered due to non-availability of transport. Interestingly, average time traveled, by respondents, to carry out "shopping" and "work/business" were found to be the highest among the domestic and economic activities. This indicates that rural households are fully aware of their transport problem.

The relatively low priority given by the households to crop marketing is perhaps justified when one looks at their selling patterns for cereal. The overwhelming majority of the cereal produced (82%) by households was consumed by the households themselves. Only in cases of cash crops, did the question of marketing arise at all. Where cereals were sold, most was sold either in local markets or at their houses. Most of the cereals sold were sold to end users. A different picture emerges in the case of cash crops. Almost 90% of cash crops were sold to middlemen either in local markets or in towns. The market for cash crops is far from transparent. For instance, small farmers of one village were obliged to sell early variety potato to the middlemen in Dhaka as they get seed and input as credit from the agents of the middlemen in the nearby urban centre. With such type of marketing arrangements small farmers are left with little or no bargaining power. Jansen (1987) and Hartmann and Boyce (1988) in their sociological study, depicted a similar plight of small farmers in other areas of Bangladesh. Because cash crops are higher priced per unit volume or unit weight, transport unit costs are a lower proportion of consumer price compared to bulk commodities like rice or paddy. This has also been corroborated by Maziruddin (1983), who also argued that unit costs for short distance movement of farmers' crops from their homes to the nearest rural markets were very high compared with long distance haulage.

It has been found that an insignificant portion of the activities to which households must have access were accessible by mechanised vehicles. The majority were accessible by either NMT (13%) or walking (41%) or by combinations of modes like motorised vehicles, NMT and walking (46%). Of these essential activities 58% were accessible directly by NMT itself or in combination with either motorised vehicles or walking. The conclusion is that NMT has enormous potential in addressing the transport problem in rural areas.

It has been found that only 17% of the households owned any means of transport. Bicycles were the most popular means of transport - of the households that own any means of transport 74% own bicycles. Ownership of transport was found to have dependent on the wealth thresholds of the households - average operated land and cash income was 90% and 81% higher respectively for households with some means of transport than the overall average.

Affordability of use of transport by the rural households was extremely low; 31% of households were unable to afford to hire any type of vehicle even in times of emergency. Of the other 69%, 80% could afford NMT, 16% could afford autorickshaw/mechanised boat and only 4% could afford to hire a car. Accordingly, it can be seen that NMT is the most affordable means of transport in rural areas.

### 4.2.6 Discussion of Effectiveness of Current Transport Planning Wisdom in Bangladesh

Until recently, the 1984 rural development strategy presented the official guidelines for designing rural development projects (Bangladesh Planning Commission, 1984). Recent effort to update the strategy on the basis of experience from different rural development projects since 1984 have re-endorsed the strategy defined in 1984 (World Bank, 1996). The 1984 strategy, acknowledged that physical infrastructure programmes would benefit the rich owing to their access to means of production. Although it also documents the plight of rural poor, actual projects have continued to give priority to the development of agriculture. In spite of stressing the need for emphasis on production and employment programmes for the rural poor, the overwhelming majority of project expenditure has been for physical infrastructure development which has favoured the wealthier classes. Also there is little evidence to suggest that the situation of the poor has improved (Ahmed, 1995). Physical evidence and spending patterns in rural development in Bangladesh suggest that the driving force behind rural transport planning and development in Bangladesh remains "agriculture production, and the motorable roads and motor vehicles fix".

Previous sections of this report have presented irrefutable evidence that the overwhelming majority of the transport needs of rural people is of a local nature and carried out without use of any modes of transport and using "lower category infrastructure". Both poor and wealthier households alike bear a considerable burden in terms of time and distance to be traveled to perform their household transport activities. Further, although there is no relation between proximity to infrastructure and the use of conventional motorised transport, the use of NMT by males does increase due to infrastructure improvements. Improved infrastructure only helps the top 10% of households to market their marketable agriculture surplus and cash crops. Several studies also suggest that Government's agricultural policies, and related infrastructure strategies, present a bias towards the rich, towards capital, towards bureaucracies and towards landlords (Hartmann and Boyce, 1988; Jansen, 1987; Bangladesh Rural Advancement Committee, 1983). Further, the Government's trickle-down philosophy has failed and will continue to fail to bring any positive change in rural areas because (Jansen, 1987; Hartmann and Boyce, 1988): (i) agricultural surpluses from big landowners are rarely invested for productive purposes; (ii) inequity always undermines the benefit of increased production; and (iii) agriculture production oriented strategy will not succeed in helping the poor who lack the land on which to grow foods and money with which to buy food. In fact, the larger land holders tend to invest their surpluses from agriculture in buying up small parcels of land held by the poor and thus increasing the powerlessness of the poor.

Recent attempts to update the rural infrastructure strategy have made some progress in addressing some of the deficiencies of rural transport planning in Bangladesh (World Bank, 1996). The new draft strategy proposed for improving transport planning calls for attention to the complementarity of land and water transport. More importantly, it also calls for a more participatory approach involving the community in the decision making process and for examining infrastructure development from the viewpoint of accessibility. Notwithstanding, this amended emphasis in the strategy, actual investment patterns proposed still demonstrate a bias towards agriculture development and road and motor vehicle solutions.

Hence the current rural transport strategy of Bangladesh with its overwhelming focus on development of agriculture and on marketing of agricultural surpluses is inflexible in responding to the needs of the majority of the rural population who eke out their livelihood through subsistence agriculture. This is not to propose that transport interventions for the development of agriculture will have to be abandoned altogether; rather there is a need to reorient the approach to include acknowledgment of and focus on the transport needs of the majority of the rural population.

Conventional transport planning as presently practiced in Bangladesh is far less appropriate for females than for their male counterparts. The transport contribution of females is mainly related to household domestic activities and predominantly done on foot and using "lower category infrastructure" which are most likely to be in poor condition. Although not equivalent to their counterparts in the Philippines and Africa the transport burden on females in Bangladesh is substantial. More attention to the maintenance of the infrastructure commonly used by females and making provision for simple transport-aids may ease the transport task of females. Spelling out details of the interventions which might help to ameliorate the transport burden is outside the scope of this study and would need a different specifically designed study and research.

Several studies in the past have defined social relationships in Bangladesh as vertical; that is families of different status are bound together through their kinship, thus ensuring guaranteed employment and credit for poorer kin in conditions of labour surplus and scarcity of formal credit. In these circumstances, the poor are powerless and have little say in the policy making process which is dominated by the rich who exert influence on the state through its officials. Apart from the limitations of the lower social classes, there are cultural factors that exclude the females of poorer households from the policy making process. Hence modalities are needed urgently to ensure proper community participation, especially of the poorer section of the people, in the transport planning process.

### 4.2.7 Conclusions

The findings of this study would be more conclusive if data from a larger sample size could be collected representing geographic, physical and transport characteristics of the whole of Bangladesh. These shortcomings were unavoidable due to time and financial constraints.

Nevertheless, from the discussions made in the earlier section following conclusions can be made in relation to the hypotheses:

- **Conclusions in relation to Hypothesis-I:** (i) the conventional transport planning approach practiced in Bangladesh which focused exclusively on "motorable roads and conventional motor vehicle" is ineffective in addressing the transport needs of the rural

population; (ii) travel and transport needs of rural population in Bangladesh is shaped by subsistence agriculture and of local nature which rarely warrant the use of conventional motorised vehicles; (iii) there exists considerable transport burden on rural households in Bangladesh which is unrelated to agriculture marketing; and (iv) trips made by the rural population are frequent and accompanied by low-volume loads over short distances without the assistance of any modes of transport and using "lower category infrastructure".

- **Conclusions in relation to Hypothesis-III:** (i) conventional rural transport planning wisdom practiced in Bangladesh rarely relieves rural females of their transport burdens; (ii) in contrast to males, females' main transport tasks arise mainly from domestic requirements, like water collection, firewood collection, rearing poultry and dairy within the vicinity of the homestead and some social and welfare requirements. Males' main transport tasks arise from economic activities and some of the domestic and social and welfare activities; (iii) males' transport tasks in Bangladesh require significantly longer distance travel, considerably higher volume of load carrying and significantly lower frequency of travel compared to females.

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