

Physical Characteristics of Intermediate Transport in Developing Countries: A Case Study in Khulna Metropolitan City, Bangladesh

M. E. MOLLAH¹, R. C. SAHA², Q. S. HOSSAIN³

¹Department of Civil Engineering, KUET, Bangladesh (emonce2k11@yahoo.com)

²Department of Civil Engineering, KUET, Bangladesh (rijusaha123@gmail.com)

³Department of Civil Engineering, KUET, Bangladesh (sazzad1999@yahoo.com)

Abstract

Intermediate transport modes are regarded as an important component of urban transport in the cities of developing countries due to its distinguishing characteristics, like low carrying capacity, low speed, low energy requirements, higher labor intensity, more dependable and small area of coverage. The aim of this study is to examine intermediate transport (Auto rickshaw and Easy bike) users and operators characteristics in Khulna metropolitan city. The intermediate transport users and operators characteristics data have collected through questionnaire surveys. According to the questionnaire surveys, about 63.8% male and about 36.2% female use intermediate transport because it is more convenient, providing door to door service and shorter travel time. Most of the intermediate transport drivers belong to medium income group with no or little education and about 92% of the drivers did not have their own vehicle. Some of the drivers have another job. Generally, the intermediate transport owners have low education level. Most of the drivers and owners have shown positive attitude for the separation of this mode from other motorized vehicles to improve the traffic condition.

Keywords: Intermediate Transport, Physical Characteristics, Questionnaire Survey, Users, Operators.

1 Introduction

Intermediate transport or Paratransit means alongside transit. It includes all public and private mass transportation in the spectrum between private automobile and conventional transit. The most logical and precise definition of Paratransit is the functional one, which states “Paratransit is urban passenger transportation service usually in highway vehicles operated on public streets and highways in mixed traffic; it is provided by private or public operators and it is available to certain groups of users or to the general public, but adoptable in its routing and scheduling to individual user's desires in varying degrees” (Vuchic, 1981).

Bangladesh is a densely populated country. Khulna is the 3rd largest city in Bangladesh with a population of 1.046 million (BBS, 2015). Khulna city is developing day by day. For this development, sustainability is necessary for all sectors. Development of a sustainable transportation system is also necessary for Khulna city. There are many types of transport in Khulna metropolitan city. Intermediate transport is one of them. Paratransit (Intermediate transport) is an indispensable mode of public transport in Asian developing countries, where there is insufficient mass transit system (Phun and Yai, 2015). Paratransit (Intermediate transport) mode play a significant role in the urban transport sectors of developing countries since in many cities more than half of the total public transport demands are carried by them (Joewono and Kuboota, 2005). It provides personalized and flexible transport services to general people with certain levels of service quality, and it covers service gaps between private transport modes and mass transit system (Roos and Alschuler, 1975).

In Dhaka, it is found that almost 72 percent households in the area use rickshaws for their daily travel (Shimazaki and Rahman, 1996). But after 2001, the people are willing to use Auto Rickshaw (locally known Baby taxi) and Easy bikes as a paratransit mode because of saving the time. Now a day's Auto Rickshaw and Easy bikes are the main paratransit mode. In the case of Khulna metropolitan city (KMC), this paratransit is playing an important role to transport the people and goods to reach their destination. About 600 auto rickshaws and more than 500 easy bikes are operating in Khulna (Newaz et al., 2014). In Khulna metropolitan city common forms of auto rickshaw are fuel operated auto rickshaw (locally known as Mahendra and CNG) and battery operated auto

rickshaw (locally known as Easy bike). By considering the importance of intermediate transport, it is essential to have research on the intermediate transport users and operators' characteristics, acceptability of it by Khulna's commuters, and the speed-density-flow relationship of intermediate transport.

2 Methodology

In order to fulfill the objectives of this study intermediate transport users and operators information were required. The data were collected from the study area and analyzed. The total Khulna metropolitan area is consists of the following zones (police stations): Khulna Kotwali Thana, Sonadanga Thana, Khalishpur Thana, Daulatpur Thana, Khan Jahan Ali Thana, Aarongghata Thana, Horintana Thana, and Labonchora Thana. In order to have the data, which represent the characteristics of intermediate transport users and operators of Khulna metropolitan city as a whole, data were collected from all areas or zones.

2.1 Collection of Intermediate Transport Users and Operators Characteristics Data

To know the intermediate transport (auto rickshaw) users characteristics, questionnaire survey for intermediate transport passengers were conducted in all CBD and outside CBD areas. A total of 400 numbers of questionnaire survey forms were distributed to the intermediate transport users in different areas. The items which included in the questionnaire form were: Age, income, education, vehicle ownership (Personal information); trip purpose, average trip travel time, the reason for choosing intermediate transport, the frequency of use, use of another mode, opinion about fare and safety, accident experience, opinion about the necessity and way of improvement of this mode of transport (Trip and other information).

Intermediate transport (auto rickshaw) drivers and owners were interviewed in order to collect data about price, operating cost, operating time, fare rates, facilities, opinion about improvements, and also other aspects of the operators. A total of 100 numbers of survey forms were distributed to the drivers and 50 numbers of survey forms to the owners in the study areas. For drivers the following items were collected: Age, income, marital status, house ownership, education and working experience (Personal information); Working shift time, working hours, vehicle ownership status, rental fee, operating cost, accident experience etc. (Job related information); Opinion about intermediate transport and its existing system. For owners the collected items were the age, education, another job status, number of auto rickshaw owned, license fee, the problem faced as an owner, performance to improve and opinion about intermediate transport system.

2.2 Data Analysis

The responses from the intermediate transport users and operators questionnaire survey were analyzed by using micro-soft Excel computer software and also manually. The degree of acceptability of intermediate transport by Khulna's commuters, the reason for choosing intermediate transport, the frequency of using this mode, social status of users, the safety of using intermediate transport, etc. were determined. On the other hand, users' opinion about the speed of intermediate transport and the existing fare system were also analyzed. The responses which were obtained from the intermediate transport drivers were used to analyze the drivers' social status, working schedule, driving experience, vehicle ownership, opinion about the rental fee, preference to improve this mode etc. Data related to price, lifetime, per day rent, working day per week, daily income, maintenance cost, registration or license fee, renewable fee per year, etc. were used to compute the daily and monthly income of drivers determined. The responses from intermediate transport owners' questionnaire survey were used to analyze their social status, a number of vehicles owned, opinion about license fee and major problems faced as owner, preference to improve the mode etc. were analyzed. All the analyzed results were reported by developing frequency distribution tables and cross-classification tables.

3 Results and Discussions

To analyze the intermediate transport users and operators characteristics questionnaire survey were conducted. From the questionnaire survey the obtaining data were summarized and analyzed below.

By the cross-classification of gender by the age of the intermediate transport users, it was found that the male group is the highest percentage (63.8%) within age groups 21 to 40 years. The female group also had the highest percentage within age groups 21 to 40 years. The cross-classification is shown in Table 1.

Analysis of the frequency of intermediate transport using resulted that 29.3% of the intermediate transport users used intermediate transport every day, 35.3% every working day and followed by 17.5% used intermediate transport 3-4 days per week. While 14.8% used 1-2 days per week and only 3.3% of the respondent used intermediate transport very seldom.

Table 1. Cross-classification of age by gender of intermediate transport users

Gender	Age (Years)							Total (%)
	Below 15	15-20	21-30	31-40	41-50	51-60	Above 60	
Male	7 (70%)	21 (72.4%)	105 (64.4%)	94 (63.1%)	17 (54.8%)	8 (61.5%)	3 (60%)	255 (63.8%)
Female	3 (30%)	8 (27.6%)	58 (35.6%)	55 (36.9%)	14 (45.2%)	5 (38.5%)	2 (40%)	145 (36.2%)
Total	10 (2.5%)	29 (7.3%)	163 (40.8%)	149 (37.3%)	31 (7.8%)	13 (3.3%)	5 (1.3%)	400 (100%)

Regarding the occupation of the intermediate transport users, it was found that students, businessmen, and housewives were the principal intermediate transport users and a very few percentage of respondent were a farmer, retired staff and unemployed. Most of the intermediate transport users' income level belong to BDT 5000 to BDT 20000. Students and housewives with no income level were also the significant number of the all intermediate transport users as shown in Table 2.

Table 2. Frequency distribution of occupation by income of intermediate transport users

Occupation	Income (BDT/Month)						Total (%)
	No Income	Less than 5000	5000-10000	10000-15000	15000-20000	Greater than 20000	
Government Employee	-	-	-	22 (27.8%)	10 (14.1%)	7 (24.1%)	39 (9.8%)
Business	-	-	18 (32.1%)	24 (30.4%)	42 (59.2%)	13 (44.8%)	97 (24.3%)
Retired Staff	3 (1.9%)	-	5 (8.9%)	4 (5.1%)	-	-	12 (3%)
Labor	-	-	23 (41.1%)	16 (20.3%)	2 (2.8%)	-	41 (10.3%)
Farmer	-	-	1 (1.8%)	2 (2.3%)	-	-	3 (0.8%)
Private Employee	-	-	-	2 (2.5%)	17 (23.9%)	9 (31%)	28 (7%)
Student	87 (55.4%)	8 (100%)	3 (5.4%)	4 (5.1%)	-	-	102 (25.5%)
Housewife	46 (29.3%)	-	5 (8.9%)	2 (2.5%)	-	-	53 (13.3%)
Unemployed	21 (13.4%)	-	1 (1.8%)	3 (3.8%)	-	-	25 (6.3%)
Total (%)	157 (39.3%)	8 (2%)	56 (14%)	79 (19.8%)	71 (17.8%)	29 (7.3%)	400 (100%)

From the analysis of the reasons for using intermediate transport, it was revealed that majority of users (43%) made all kinds of trips by this mode because it provided door to door service, the second highest number users (20%) opinion was it is more convenient and the third highest number users (16.3%) opinion was it needs less travel time as shown in Table 3.

Table 3. Reason of using intermediate transport by intermediate transport users

Reason of Using Intermediate Transport	Frequency	Percentage
More Convenient	80	20%
Shorter Travel Time	65	16.3%
Cheaper	47	11.8%
Safer	36	9%
Door to Door Service	172	43%
No Other Choice	-	-
Total	400	100%

Regarding the safety of intermediate transport, it was revealed that about 41.5% of the users claimed that this mode was ‘not so safe but not so risky’, about 32.3% of the users claimed that this mode was ‘quite safe’, about 18.8% users said that this mode was ‘quit risky’. About 7% claimed that this mode was ‘very safe’ and very few users (0.5%) thought that this mode was ‘not safe at all’.

Table 4. The necessity and the way of improving of intermediate transport by intermediate transport users

Opinion about Necessity of Intermediate Transport	Opinion about Improvement of Intermediate Transport			Total (%)
	Separate Lane or Path	Provide more Parking Facility	Give Special Treatment	
Yes, necessary	307 (97.5%)	71 (98.6%)	13 (100%)	391 (97.8%)
No, Not necessary	8 (2.5%)	1 (1.4%)	-	9 (2.3%)
Total (%)	315 (78.8%)	72 (18%)	13 (3.3%)	400 (100%)

From the cross analysis of the intermediate transport users attitude to improve the intermediate transport in Khulna city with its necessity, it was observed that 97.8% of the users gave their opinion that this mode is necessary, among which 78.8% of the users wanted to provide ‘exclusive paths or lanes’ and 18% users wanted to have more parking bay in public areas as shown in Table 4.

Regarding the intermediate transport fare, it was found that about 72% of the intermediate transport users claimed that the intermediate transport fare was reasonable, 21.3% of users expressed as cheap while only 6.8% of the users claimed that the fare was expensive. From the analysis of survey responses, it was found that most of the drivers (83%) were married. The majority of them (59%) had 3 to 4 children and very few of them (2.4%) had greater than 4 children. Also most of the intermediate transport drivers (49%) had no education level and the next highest percentage (28%) hardly had primary educational attainment. Very few percentage (4%) of drivers had an education level of secondary school level.

From the cross analysis of driving frequency per week of intermediate transport drivers with their working duration in month per year, it was revealed that 45% of the drivers used to drive 7 days per week. On the other hand, 38% of the drivers used to drive 6 days and 12% of the drivers 5 days per week. Whereas none of the drivers used to drive only in the weekend. From the analysis, it was also revealed that 86% of the drivers used to drive the whole year, whereas the second highest percentage (13%) of the drivers used to drive 8 to 10 months per year as shown in Table 5.

Table 5. Cross-classification of the frequency of driving per week and the working duration per year of intermediate transport drivers

Working Days per Week	Working Duration (Months)				Total (%)
	Less than 6	6-8	8-10	Whole Year	
7	-	1 (2.2%)	6 (13.3%)	38 (84.4%)	45 (45%)
6	-	-	5 (13.2%)	33 (86.8%)	38 (38%)
5	-	-	2 (16.7%)	10 (83.3%)	12 (12%)
3-4	-	-	-	5 (100%)	5 (5%)
Weekend only	-	-	-	-	-
Total (%)	-	1 (1%)	13 (13%)	86 (86%)	100 (100%)

Regarding the rental fees, 91% of the drivers gave their opinion that this was expensive. On the other hand, 7% of the drivers said rental fees were reasonable and only 2% of the drivers mentioned as cheap. Furthermore, from the cross-examination with the fixing rental fee by the government, most of the drivers (87%) showed positive responses as shown in Table 6.

Table 6. Drivers' opinion about rental fee and fixing the fee by the government

Opinion about Rental Fee	Opinion about Fixing Rental Fee			Total (%)
	Yes/Agree	No/Don't Agree	Don't Care	
Cheap	-	1 (50%)	1 (50%)	2 (2%)
Reasonable	2 (28.6%)	5 (71.4%)	-	7 (7%)
Expensive	85 (93.4%)	5 (5.5%)	1 (1.1%)	91 (91%)
Total (%)	87 (87%)	11 (11%)	2 (2%)	100 (100%)

From the survey analysis it is found that about 87% of drivers had no other job and 13% of drivers had another job. The majority of drivers who had other job were businessmen. Regarding the vehicle ownership status of intermediate transport drivers, it was found that only 8% of the drivers interviewed had their own vehicle. Rest of the drivers (92%) had to rent their vehicle from owners. Regarding the preference to improve the intermediate transport, it was found that most of the drivers (89%) wanted to improve the intermediate transport by providing separate intermediate transport lanes or paths in all routes and 10% of the drivers gave their opinion to provide more parking bay in public areas. Regarding the daily earning, it was revealed that the intermediate transport drivers in Khulna city were found as medium income group. It was also concluded that the highest percentage (68%) of the drivers had monthly net income BDT 18001 to BDT 20000. The second highest percentage (14%) of the drivers had the monthly net income BDT 15001 to BDT 18000. On the other hand, only 3% of the drivers had monthly net income less than BDT 10000.

Most of the intermediate transport owners' attitude was positive in improving the intermediate transport by implementing some facilities. If the facilities of intermediate transport improved and implemented, then their vehicles will not be mixed with other modes of transport and can run on the good pavement surface. From the analysis it was found that 54% of the owners preferred to have separate intermediate transport paths or lanes in all routes, while 42% of the owners preferred to have more parking bay in public areas. The most important

problem faced by the intermediate transport owners in doing their business in Khulna City was the license renewal. They had to renew the license of intermediate transport every year or every two years. The intermediate transport (auto rickshaw) in Khulna City was operated by fuel or battery. There was no gas operated auto rickshaw. They felt the necessity of having gas operated auto rickshaw because the operation cost of gas operated auto rickshaw was lower than fuel operated auto rickshaw. The operation cost of battery operated auto rickshaw was low but it consumed so much electric power.

It was revealed that the intermediate transport owners education level vary from no education to above Higher Secondary School (H.S.C) level. About 38% of the owners had education class VI to class IX and 30% had only primary education level as shown in Table 7.

Table 7. Educational qualification of intermediate transport owners

Item	Educational Attainment of Intermediate Transport Owners						Total
	None	Primary	VI-IX	S.S.C	H.S.C	Above H.S.C	
Frequency	2	15	19	10	3	1	50
Percentage	4%	30%	38%	20%	6%	2%	100%

4 Conclusions

From the results, it is shown that in Khulna metropolitan city most of the intermediate transport users are male and few of them are female and also they are from different background with various educations level. Most of the users using intermediate transport because it is convenient and provides door to door service. Most of the intermediate transport drivers are married. The majority of them have no education and few of them hardly have primary educational attainment. In Khulna City, most of the drivers don't have own vehicles and they rent the vehicles from the owners. Most of the intermediate transport owners have little educational attainment. According to their (Users and Operators) opinion, it is necessary to have separate intermediate transport lanes or paths for the improvement of this transportation mode.

References

- Bangladesh Bureau of Statistics (BBS) (2015). Bangladesh Population and Housing Sensus-2011, Community Report: Khulna, Statistics and Informatics Division, Ministry of Planning, Government of the People's Republic of Bangladesh.
- Joewono, T.B. and Kuboota H. (2005). The Characteristics of Paratransit and Non-Motorized transport in Bandung, Indonesia. *Journal of the Eastern Asia Society for Transportation Studies*, Vol. 6, pp. 262 – 277.
- Newaz, M. S., Rahman, M. A., Hossain, and Q. S., Ali, S. A. (2014). A paratransit maintenance cost-allocation model for Khulna metropolitan city, Bangladesh. *Proceeding of the 3rd World Conference on Applied Sciences, Engineering & Technology*, Kathmandu, Nepal, September 27-29, 2014.
- Phun, V. K., and Yai, T. (2015). State of the art of paratransit literatures in Asian developing countries. *Proceedings of the 13th Eastern Asia Society for Transportation Studies*, Cebu, Philippines, September 11-14, 2015.
- Roos, D., Alschuler, D. (1975). Paratransit — Existing issues and future directions. *Transportation*, Vol. 4, pp. 335-350.
- Shimazaki, T., Rahman, M.M. (1996). Physical characteristics of paratransit in developing countries of Asia. *Journal of Advanced Transportation*, Vol. 2, pp. 5-24.
- Vuchic, V. R. (1981). *Urban Public Transportation Systems and Technology*. Englewood Cliffs, NJ: Prentice-Hall.