BALANCING THE SHARE OF NMT IN ROAD SPACE ALLOCATION: INTEGRATING RICKSHAW WITH BRT SYSTEMS IN DHAKA CITY, BANGLADESH

M. S. U. Rahman
Associate Professor, Urban & Regional Planning, Jahangirnagar University and
PhD Student, Institute for Transport Studies (ITS), University of Leeds, UK.
Email: shafiq_urp@yahoo.com

ABSTRACT

Many cities throughout the world have implemented or planning for mass transit systems to tackle the acute transport problems, most notably congestion. The government of Bangladesh is planning to have Bus Rapid Transit (BRT) systems for solving the transport problems in Dhaka City, the capital of the country. However, only providing the better transit system may not work in the city without the trip-end facilities. Traffic and transportation situation in Dhaka is unique, which is called 'city of rickshaw'. There are about 0.6 million rickshaws in Dhaka which carry about 20% of the total trips of the city. Often rickshaw is the only accessible mode to certain areas, particularly in narrow streets, and for certain groups of people. Thus, the success of BRT system in Dhaka City may greatly depend on it's integration with rickshaw and other intermediate or informal modes. However, rickshaws had been marginalized in many roads of Dhaka to provide room for motorized traffic as in many other Asian cities. Moreover, yet there is no BRT system in the world which demonstrates integration with rickshaws. Thus, it is going to be a great challenge in the plan preparation of Dhaka BRT how to integrate with rickshaws. This paper explores how it is possible to integrate the rickshaw with BRT system for faster, safe, convenient, and comfortable transfers/interchanges and how to ensure efficient utilization of road space. With a case study on Dhaka City, the research provides physical integration between rickshaw and BRT systems.

1. INTRODUCTION

Most of the cities in Asia are facing various transportation problems, most notably congestion and thus increasing travel time, air pollution, accidents, and so on. Much of the problems are due to rapid growth of car ownership but unavailability of the city to provide supporting infrastructure due to resource constraints (Pucher, et al. 2005). Dimitriou (2006) gave the typology of problems (both manifestation problems and root problems); where he argued as "urban transport founded on an unabated motorized vision are at the root of the more serious urban transport problems" (p.1094). Despite increasing car ownership, the majority of trips in Asian cities are on public transport and non motorized mode (NMT). This is happening because a significant numbers of people in many Asian cities are poor, who can not afford personal vehicle, and most of them are heavily dependent on public transport (Hossain, 2006).

However, often the public transport service is very poor and overcrowded due to inadequate supply of public transport. Given the situation of poor public transport, a variety of NMT and informal modes (IM) has been evolved in many cities of Asian and operating as para-transits or intermediate public transport (IPT). For instance, rickshaws in Bangladesh and India, bicycle in China and Vietnam, pedicab and habalhabal in the Philippines, cyclos and motoircycle in Vietnam and Cambodia, becak and ozek in Indonesia, tuktuk and samlors in Thailand, and so on. These NMTs and IMs are playing a crucial role to response the travel demand of people and serve the local demand. These can provide access to certain areas, particularly with narrow streets (Cervero and Golub, 2007), and certain group of people where regular public transport is not serving. Even, many cities are facing growing numbers of NMT and IMs.

Nevertheless, often the minimum infrastructure for NMT is not provided. Even, NMT is often viewed unsympathetically and has been restrained in many Asian cities. For instance, Bangkok banned rickshaw in 1960 and Karachi in 1962, Delhi put restriction on the number of registration as well as licensing of rickshaw whilst Dhaka made few major arterials as rickshaw-free (Rahman, et al. 2008). Even, rickshaws have been banned in Manila, Jakarta, Beijing, Mumbai and many other Asian Cities. Banning rickshaw certainly hamper equity in transport access, particularly, who do not have access to any other mode accept rickshaw or walking. Instead of restricting, if promoted as a feeder service of mass transit system, rickshaws could provide better results and solve many more urban transport problems (Rahman, et al. 2008). Given the socio-economic situation of developing cities, improved public transport services along with restricting car use and promoting NMT (green mode) are supposed to be the solution of urban transport problems. As claimed by ADB (2010), combination of BRT, walking, and cycling offers high urban transport carbon dioxide mitigation potential while lowering costs of mobility. BRT systems well connected with rickshaw could provide opportunity for improving urban transport situation as well as curbing the car use and thus reduce congestion in Asian cities.

Figure 1- A typical rickshaw

The objectives of the paper is to investigate what type of BRT station design could accommodate rickshaw in terms of road space use and provide faster, easy, convenient, comfortable, and safe transfers/interchanges between rickshaw and BRT. With the case study of Dhaka City, the research provides physical integration between rickshaw and BRT systems. Based on close observations of traffic and transport situation along with a series of consultation and discussion with different stakeholders and interview of the key informants, the paper provides a plan or design of the major junctions or intersections to integrate rickshaw with BRT system.

2. TRAFFIC AND TRANSPORT SITUATION IN DHAKA CITY

Transport environment of Dhaka, the capital city of Bangladesh, is characterized by traffic congestion and delays, inadequate traffic management, unaffordable and inaccessible public transport for the majority of the people, high accident rates, and increasing air pollution problems (Rahman, 2007; DUTP, 1998). Population of the city is about 12 million who is living in an area of 1,529 sq. km (GoB, 2000). The crisis in public transport in Dhaka City is largely the result of growing concentration of population and economic activities, and inadequate public transport systems. Existing poor transport systems are unable to cope with the expansion of city and thus increased travel demand.

Dhaka is one of the least motorized cities in the world with a total of 383,000 or approximately 30 motorized vehicles per 1,000 population (BRTA, 2007). Despite the very small number of motorized vehicles, Dhaka is one of the most polluted cities in the world because of high vehicular emissions. Nevertheless, the vehicle population of the city had been growing at an accelerating rate, much higher than that of population growth, which became almost 3-fold between 1995 and 2007 (Rahman, 2009). Furthermore, growth of MVs has largely dominated by small occupancy vehicles (i.e. car, van/pickup, motorcycle, etc.) where as bus and minibus have increased at a lower rate. Despite private car has lower passenger car unit (PCU), these have increased at a higher rate, 23% and 12% respectively during 1999-2003 and 2003-2007. On the other hand, though higher PCU for bus and minibus they had a lower growth rate, only 3% and 1% respectively during the same period (BRTA, 2008).

Traffic congestion and air pollution are the major problems of Dhaka City. This is mostly because private car ownership is steadily increasing due to increased growth or income level. Inadequate traffic management, inefficient road use, and poor operating conditions waste up to 50% capacity of the roads (STP, 2005). Because of inadequate and disorganized bus service most of the middle and lower-middle income groups are dependent on about 600,000 rickshaws (which accounts about 65% of the total vehicles) of the city available for hire (BRTA, 2003; Rahman, 2007). Consequently, despite having the wide variety of transport modes available, majority of the trips in Dhaka City is walking and rickshaw trips. However, in terms of passenger km traveled, the share of bus is 30.6% whilst rickshaw and walking are respectively 21.7% and 17.7% (DUTP, 1998). Data from a sample survey of STP conducted in 2004 reveals about 44% trips are on bus or minibus and 34% on rickshaw whilst the remaining are walking and other motor car trips respectively 14% and 8%. Nevertheless, information in 2010 reveals that about 38.7% trips of the city are made on rickshaw, where as it becomes 41% if only considered the school trips or 29% if only considered the home to work trips or 47.4% of the total trips if only considered the female travelers (DHUTS, 2010). Interestingly, average trip length of rickshaw trips is only 2.34 km and about 61% of all rickshaw trips are made by people in the 'medium' income level (STP, 2005). Rickshaws are playing a crucial role in providing transport access for many people particularly women and senior people and the areas where formal public transport network is not available or in the narrow streets.

3. BRT INTEGRATION WITH RICKSHAW

BRT systems well integrated with rickshaw could provide wider opportunity for improving urban transport situation as well as curbing the private car use and thus help to reduce congestion in many rickshaw-cities of Asia. Here the rickshaw city means the city which is bigger than 30 sq km or 0.3 million people and having either more than 3 rickshaws per 1,000 people or at least one percent of rickshaw trips.

3.1. WHAT IS INTEGRATION?

Urban growth or sprawl is leading to longer trips (Dimitriou, 2006, Gakenheimer, 1999, Srinivasan, et al. 2007) and connected or joint trips on public transport. This is happening because either public transport network is not available within the walking distance, hence people have to take para-transit/NMT modes to reach in public transport station (Rastogi and Rao, 2003), or NMT cannot serve the longer distance. So, transfer of mode are inevitable for longer trips on public transport; and thus combination of different modes between trip ends represents the new reality (Pitsiava-Latinopoulou, et al. 2008). The combination could involve between walking and NMT, or walking and public transport, or NMT and public transport, or various public transport modes, or private car and public transport. This interchanges between various modes should be convenient, fast, and safe for the users for their comfort and efficient journey. The interchange node is a complex infrastructure where the passenger could choose among different modal options available for their trip (Zito and Salvo, 2009). However, often the alternative options in the interchange nodes are not available and cause problems of passengers. Traveling from one place to another via rider friendly inter-modal facilities and inter-connections to reduce the costs and inconveniences of travel is termed as ‘transport integration’ (Ibrahim 2003). Beside this, integration also means to accommodate all type of travel modes on road. May and Roberts (1995) mentioned ‘integrated’ or ‘balanced’; or ‘package’ are synonymous which indicates combination of measures or balanced in the treatment for achieving higher performance.

Transport integration could be of various types, such as functional or modal integration, transport and planning integration, social integration, holistic integration, integration between authorities, between measures involving infrastructure provision, management and policy, and between transport measures and land use planning measures (May and Roberts, 1995; Potter and Skinner, 2000). Modal integration deals with easy transfer between different modes through their close physical location and/or integrated time-table planning. Lam and Toan (2006) mentioned that institutional integration and network integration are among the important strategies for achieving a multi-modal transit system in Singapore.

3.2. BENEFITS OF INTEGRATED TRANSPORT

Integrated urban transport does provide various benefits. May and Roberts (1995) argued that an integrated approach, in which infrastructure provision, management of existing infrastructure, and use of that infrastructure are coordinated, can significantly reduce the scale of urban transport problems. Integration can potentially achieve benefits either from measures which complement one another in their impact on users, or from measures which make other elements of the strategy financially feasible and public acceptability. Thus, significant improvements in overall transport performance can be achieved by careful integration of strategy measures.
Physical integration of multi-modal transport could provide convenience and comfort of public transport users; and also could reduce congestion (Ibrahim 2003). Thus, integration of various modes could improve capacity in public transport; so, it is important to ensure that each of the available transport modes is used in its most efficient way. Integrated strategies have the potential to improve sustainability (Potter and Skinner, 2000). To have a better service of public transport, Hossain (2006) argued, need for integrating different forms of public transport modes. A well integration of all transport modes may also provide better road safety and social justice. In the same direction, Patrick and William (2005) argued that BRT systems need to be integrated with the multi-modal transport network to have better results.

In Asia, Singapore demonstrates the improved and world class public transport services. A coordinated integration of different modes or integrated multi-modal transit system is the key for their success (Ibrahim, 2003; Lam and Toan, 2006). Improvements to all intermediate and end-point facilities, or the ‘enhanced access and connectivity’ and ‘greater integration at the operational and service level’ encourage commuters in their use of public modes (Ibrahim, 2003).

3.3. WHY ROAD SPACE IS AN ISSUE?

Roads, being the public space, use should be efficient for greater social benefit as well as reducing congestions. The Passenger Car Unit (PCU) is widely used common unit of measurement to identify the space requirements for different types of vehicles. PCU value of rickshaw is 0.5 (adopted both in Bangladesh and Indonesia), which means the rickshaw needs only half the road space of the average car or less than baby-taxi which have PCU about 0.9 (Gallagher, 1992: p. 270). However, road space required per passenger of different mode would be ideal to judge the efficiency in road space use of a vehicle. Thus, the number of passengers carried by a vehicle is important. Gallagher (1992: p. 252) showed that on crowded urban roads the rickshaws have a much greater passenger capacity than cars; because, road space used by the average car passenger is about 45% more than the average rickshaw passenger, and 5 to 10 times of bus passenger. Undoubtedly the buses and bicycles provide better results than any other mode for space efficiency as well as economic efficiency. That’s why it is often argued that “giving equal access to cars and other vehicles, as well as non-motorized transport, penalizes those who walk, cycle, or ride the bus - generally the economically weak” (CAI, nd: p.15). This is because individual private cars take up significantly more road-space than public transport or NMT.

On the other hand, different category of roads serves different social and economic functions. For instance, the major arterials are very wide and suitable for fast and long-distance vehicles while local streets are narrow and suitable for localized low-speed vehicles or NMT to serve door-to-door. For this reason, municipalities reserve the right to regulate access to different roads for different types of vehicles. Road classification system or hierarchy of urban roads is very important for this; however, many cities in the developing countries often do not have a basic functional road classification system.

On the contrary, the roads in developing cities are being used for trade and other multiple purposes along with traffic (Lorenz, 2002). These non-traffic activities take up a major portion of road space and consequently the pedestrians and traffics had to compete to find a room. For instance, pedestrian paths are often occupied with street vendors and pedestrians are forced to move on roads and compete with NMT and other MT.

3.4. WHY NEED TO INTEGRATE WITH RICKSHAW?

NMT, particularly rickshaws, play a crucial role for providing transport access of many people in Asian cities. This provide flexible and demand responsive service and often the only mode accessible to narrow streets. Beside this, rickshaw provides employment to many people. Restraints on rickshaw does hamper equity in transport access, particularly, who do not have access to any other mode except rickshaw or walking. Instead of restricting, if the rickshaw is promoted as a feeder service of mass transit system, it could provide better results and solve many more urban transport problems (Rahman, et al. 2008). Rickshaws play a crucial role for trips to school or work and particularly for travel of women in Dhaka city (DHUTS, 2010).

Success of Bogota BRT systems has encouraged most of the Asian cities to have BRT for solving the city transport problems within their budget constraints. A growing number of high capacity BRT systems, most notably the Bogota in Columbia and Guangzhou in China, offer capacities almost equal to the metro systems, carrying 25,000 to 35,000 or more passengers per hour per direction (ADB, 2010). However, only providing the transit systems may not provide ultimate benefits without having proper feeder services and the trip-end facilities. Rickshaws could play a major role as the feeder services of the mass transits.

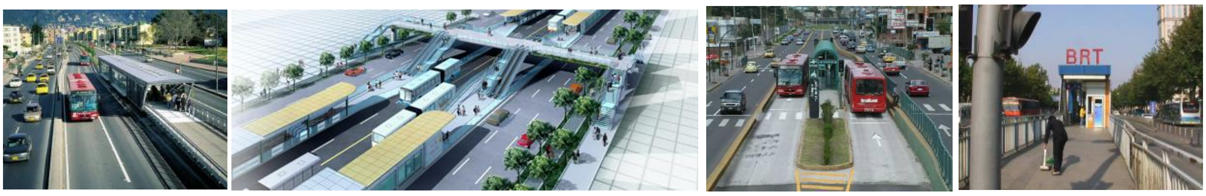


Figure 2 – Typical BRT systems, at BRT station

Safe and comfortable transfer between different transport modes is a critical issue for integrated transport. There are many BRT and metro systems currently world-wide which is physically integrated with other mode such as car (provided park & ride facilities) and bus. Modern BRT, mostly in China, are even integrated with bicycle. However, up until today, there is no metro or BRT system which is integrated with rickshaw. Being a common mode in Dhaka City as well as many other Asian cities, it would be worthwhile to integrate rickshaw with BRT systems. However, integrating rickshaw with BRT would be a great challenging task. Integration in this study indicates only the modal integration or easy transfers between rickshaws and BRT systems by providing their close physical location and planning to make the travel easier during one journey of the passenger which may involve both modes.

3.5. STATION DESIGN FOR PHYSICAL INTEGRATION AND EFFICIENT UTILIZATION OF ROAD SPACE

The public transport interchanges in developing cities are often dull and unsafe for the passengers and they have to walk a longer distance. Moreover, multiple activities other than traffic in the public transport stations or roads of developing countries often make it difficult for the passengers for easy and safe transfer. The interconnection of different modes seems to have easy solutions; however, its implementation involves complex details of accessibility and urban space management (Burckhart and Blair, 2009). This section gives detailed design of BRT station to accommodate rickshaw in terms of road space utilization and easy, convenient and faster transfer between BRT and rickshaw.

However, till now the research is in the data generation stage. So, instead of the detailed station design, now here it is given how the research will be done to fulfill the objectives.

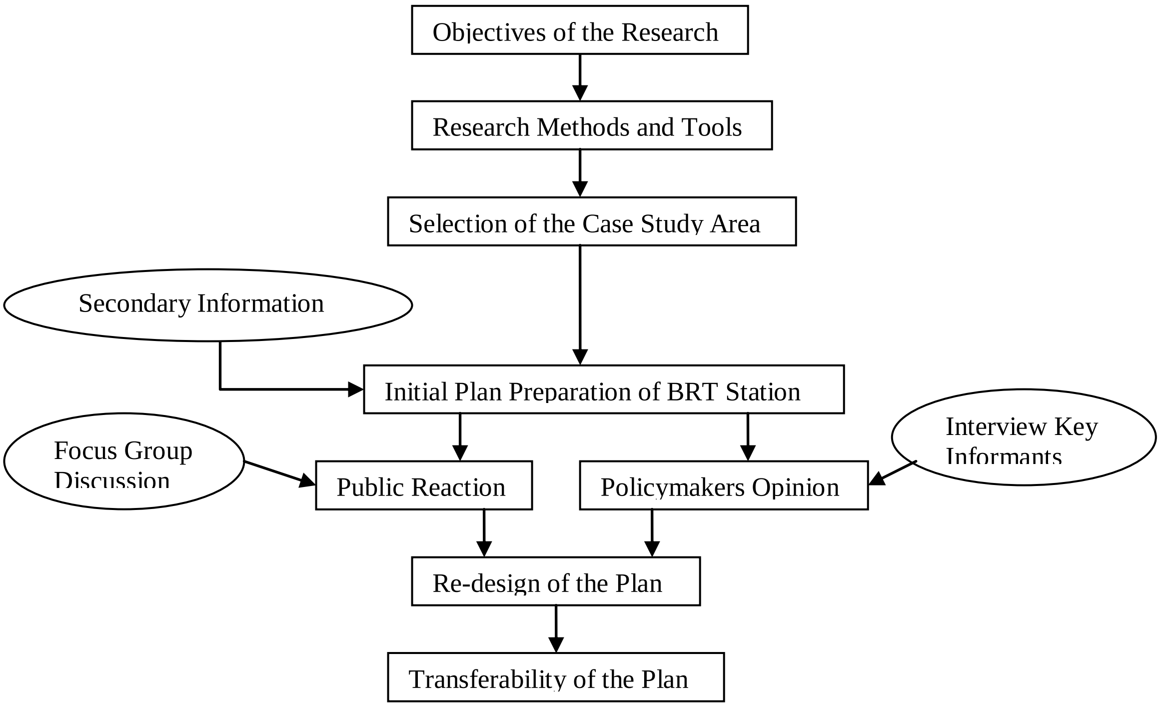
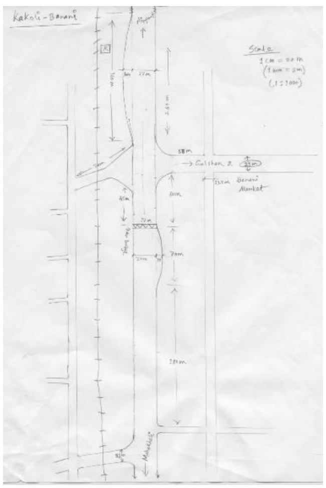


Figure 3 - Flowchart of the research process

Several major road intersections or public transport stoppage of the city will be identified as the case study areas for detailed and in-depth studies. While selecting the areas for in-depth study, it will be kept in mind that they do represent the whole city in terms of socio-economic condition, demography, urban structure, traffic situation, trip generator, etc. Thus, only 2 to 5 areas would be selected where each area should represent at least one of the following:

- CBD (Central Business District)
- Well-planned and high-income residential area, possibly with higher car ownership.
- Unplanned and low-income residential area, usually developed along the major corridor.
- New commercial and business area of the city located on major corridor.
- Older part of the city with narrow roads but very high population density.
- Institutional area where various academic institutions are located.
- Major road junction/node of the city.

If the study areas are very limited, say only two, the areas should be one with the rickshaw-free BRT route and the other BRT route with rickshaw operation. For instance, for this proposed study, Figure 4 reveals one location with rickshaw-free BRT corridor while in other location rickshaws are also operating in the BRT corridor.



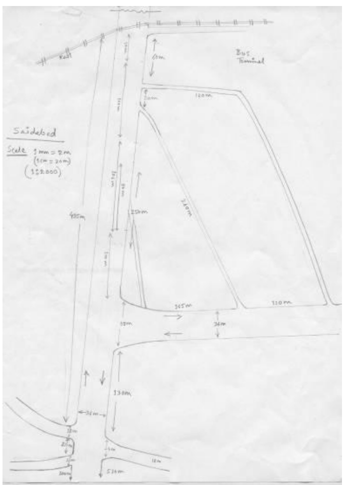
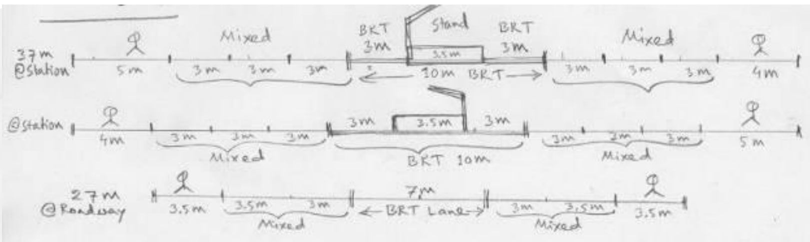


Figure 4 - Location of the case study, rickshaw-free (left) and with rickshaw (right)

A plan for the selected road intersections or BRT stations and their vicinity of the case study area will be prepared for ensuring the integration between rickshaw and BRT. This initial design of BRT station will be based on criteria or attributes, derived from literature review, to ensure easy, convenient, fast, safe, and comfortable transfer of passengers between BRT and rickshaw.

Here, only a location (rickshaw-free BRT route) has been considered for preparing the BRT station design. Figure 5 shows the design – whole study area, rickshaw waiting and boarding area, and the width for different traffic lane or BRT or station.



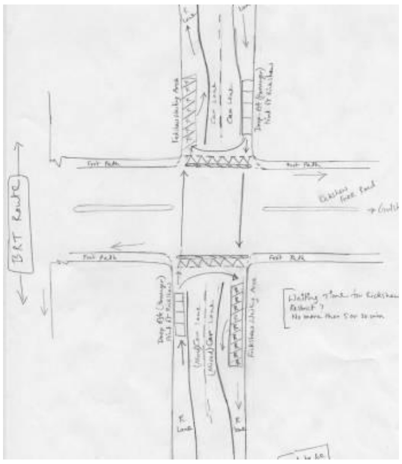


Figure 5 – BRT station design, (left) whole area (right) right road for rickshaw integration, (top right) width for different lane and station

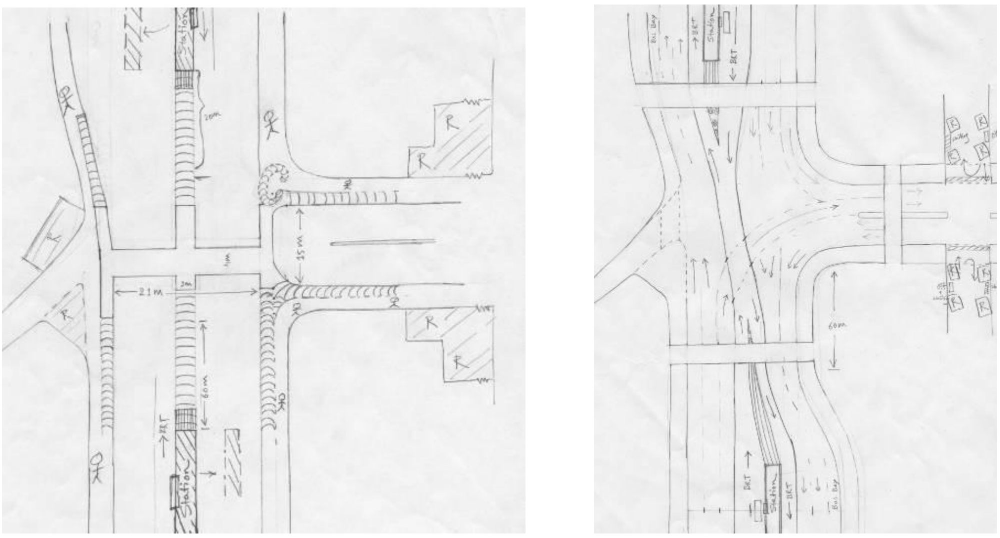


Figure 6 – Connection between rickshaw and BRT station - pedestrian crossing with overpass (left) and at grade (right)

Only the technical or engineering aspects often fail to engage effectively with the knowledge, value and interests of stakeholders and wider society (Burgess and Stirling, et al. 2007). Often the views of rickshaw pullers and other informal modes are not considered in traditional transport planning and decision making process in the developing cities. However, transport planners should actively involve the community people in planning and implementation process because the context-sensitive design needs to respond the physical environment as well as social and economic conditions, including neighborhood concerns and aspirations (McAndrews, et al. 2006). Incorporating the opinion of stakeholders may produce better results; hence, participatory research methods should be applied. Opinion of the key policymakers and the stakeholders about the BRD station would be gathered and incorporated their views and concerns and modification will be done for integrating with rickshaw.

Participatory action research (PAR) with the stakeholders will be conducted to get their opinion (public reaction) regarding the initial design of BRT station. It will be very difficult to get all the concerned public officials and policy makers at a specified time and place for conducting PAR; hence, a face-to-face questionnaire interview and discussion with them will be done. Thus, a combination of FGD and interview method will be applied to assessing and updating the plan. After having the policymaker's reaction and public opinion, the design of BRT station or plan of the study area will be modified to incorporate their opinion and suggestions so that the plan will fit best with the local condition and will be acceptable by all the road users.

3.5.1. Public Reaction

'Deliberative Methods' enable the researchers to gain insight into existing public attitudes, views, and opinions through initial discussions through focus group approach; which is a powerful research tool with greater potential for application in transport field (Marsden and King, 2009). FGD are frequently used in PAR, where a group of individuals discuss and give opinions on a particular topic or issue. Information gathered from this method usually reflects the collective views of the group members (MacDougall and Fudge, 2001). The qualitative sampling requires identification of appropriate participants, being those who can best inform the study (Fossey, et al. 2002). So, the pedestrians, the rickshaw pullers and the rickshaw users, and the transit users should be given priority even though all stakeholders will be considered for FGD.

Travel pattern and requirements often may vary according to employment and income pattern. Even, there is likely to be greater differences in travel patterns between men and women of the same household in developing countries (Peters, 2001). This indicates the importance of gender inclusion in transport infrastructure and services provision. However, the user group planning techniques typically fail to ensure adequate gender representation, as Turner and Grieco (2006: p.62) reported, "the evidence is that when women speak within mixed groups, conversational dynamics work against them being listened to". That's why they argued for 'women only user groups' to have better representation of gender aspects. Beside these, many Asian cultures endorse values, such as respect for authority and saving face, which is incompatible with the public expression of conflict (Tannen, 1998). While arranging the group for FGD, it should be formed based on personalities to maintain homogeneity and gender balance among the participants. The major stakeholder groups should include:

1. Rickshaw pullers

2. Disabled people
3. Women-only user group, middle-income
4. Women-only user group, lower-income
5. Men-only user group, middle-income
6. Men-only user group, lower-income

Each of the group should include 5 to 8 people. Each session of FGD will last for about 2 hours and an outline of discussion topics will be followed to cover the major topics. The discussion should be recorded in video tapes along with note taking.

3.5.2. Policy Makers' Opinion

A thorough discussion with the policymakers or key informants will be conducted to get their opinion about the initial design of BRT station. A semi-structured open-ended questionnaire will be prepared for the discussion or face-to-face interview and at least 15 face-to-face interviews should be administered.

The key informants must include of the following people:

- BRT Project Manager and/or BRT Consultant
- Chief and/or Planner of the city transport authority
- Urban Planner of the city development authority and/or local government
- Officials of Road Transport Authority
- Officials of the Transport Ministry
- Officials of the Traffic Enforcement Authority
- Transport experts or Professors (Urban/Transport Planning, Architecture, Geography, Sociology)
- Officials of the Department of Environment
- Elected public representatives

3.6. TRANSFERABILITY

Although the study is based on a case study city, the methodology developed is transferable to other rickshaw cities. It is worthwhile to determine whether the prepared design of BRT station for accommodating rickshaw would be transferable in other rickshaw cities and what would be the issues and concerns for that. It is expected that the design for BRT station prepared for Dhaka City would be transferable to other rickshaw cities of similar size (i.e. Kolkatta, Chittagong, Manila, Yogyakarta) in Asia. Nevertheless, cultural aspects of the city (i.e. behavior of people or road discipline or voice of people in decision making process), availability of motorcycle or bicycle in high number, and policy of the city government towards NMT and public transport, etc could be the major issues and concerns for transferability.

4. CONCLUSIONS

A variety of travel modes are available in the cities of developing countries. Transport policy should strive to take advantage of all transportation modes, encourage their use for the most appropriate circumstances while prioritizing access. Policy aspects are very important, which should be on top of all other measures, for integrating rickshaw with the BRT systems. Without a policy shift towards NMT promotion for sustainability, integration of rickshaw with BRT will be impossible. Moreover, an intuitive design of BRT station is also crucial for accommodating rickshaws with BRT.

It is clear that the major cities in Asia needs a good transit system well integrated with NMT to increase ridership on public transport. High-quality BRT, walking, and cycling, together with effective traffic management, can create a favorable environment to curb excess congestion and boost the quality of urban life (ADB, 2010). This should not be forgotten that rickshaw should be accommodated with BRT systems to improve urban transport situation of the rickshaw cities. This paper gave two issues of rickshaw: how to provide faster, easy, convenient, comfortable, and safe transfers/interchanges between rickshaw and BRT; and how to ensure efficient utilization of road space use for them in the rickshaw cities.

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