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This is an abridged version of the paper presented at the conference. The full version is being submitted elsewhere. Details on the full paper can be obtained from the author.

ISBN: 978-85-285-0232-9

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ABSTRACT

There is evidence that in recent years, many cities have tried to ban rickshaws from specific areas/roads and such bans have been highly controversial, opposed by environmentalists, rickshaw-pullers and rickshaw users. The paper provides a solution that reconciles the two sides of the controversy. Focussing upon Dhaka (Bangladesh) it provides a plan for integrating rickshaws with Bus Rapid Transit (BRT) systems. A review of literature is made of the arguments for and against the ban. A system is designed whereby the rickshaws serve as feeder services to BRT. These designs were discussed with transport professionals, policy makers and experts in Dhaka City. It was found that the rickshaws could provide effective feeder services to BRT if the following points are addressed. Rickshaws should be well organized in terms of queuing at BRT stations. The physical design of BRT stations should ensure not more than 3 minutes of walk for modal interchanges between rickshaws and BRT, with better walking facilities and environment. A pre-determined fare structure for rickshaws should be implemented. Above all, design of the new system should involve active involvement of the rickshaw pullers and the public in the planning and decision-making process. This paper provides a potential solution for a common problem of urban transport (arguments between fast and slow transport) that exists in many countries.

Keywords: modal interchange, rickshaw, BRT, integration, access.

1. INTRODUCTION

Cycle-rickshaws (also known as rickshaw, becak, cyclos, samlors, pedicab, etc. in different countries) are available as a travel mode in many cities, particularly in Asia. In the past, many cities (i.e. Jakarta, Surabaya, Karachi, Manila, and Bangkok, Delhi, Dhaka) have tried to restrain or prohibit rickshaws from the entire city or from certain roads or parts of the city on the grounds of either reducing congestion for smooth flow of motorized vehicles or enhancing the city image by eliminating traditional modes. However, there are arguments

that decisions to ban rickshaws have not been based on scientific or technical grounds (see ITDP, 2009; Gallagher, 1992; Bari and Efroymson, 2005), but rather upon ad-hoc political decisions taken from the top (bureaucrats and richer car-owners). Furthermore, there were many protests and demonstrations by the rickshaw-pullers (and in a few cases by civil organisations) against the 'political decision' of rickshaw bans in each of the cities mentioned above. Moreover, with the onset of global warming there are arguments that transport modes resilient to climate change, including non-motorized transport modes (NMTs), should be promoted for sustainability. In summary, these comments clearly suggest that such bans have been highly controversial; opposed by environmentalists, rickshaw-pullers and users.

An alternative approach to placing outright restrictions on rickshaws could be to integrate them into the public transport system by using them as feeder services. The current paper is concerned with providing a solution that reconciles the two sides of the controversy - 'for' and 'against' the rickshaw bans. This solution involves providing a multi-modal integrated transport system where the formal mass public transport should get priority in the major arterials, with the rickshaws (or NMTs and other para-transits) operating in other (narrow) streets to provide feeder services or access/egress legs to public transport. Such a solution recognises that access/egress legs are very important for public transport trips because, in many developing cities, public transport is not available within walking distance, and passengers need to take NMTs or para-transits to reach a public transport station.
Many cities both in the global North and South have implemented bus rapid transit (BRT) systems as a form of mass transit, thus improving public transport and tackling increasing transport problems, whilst other cities are planning to do so. Several modern BRT systems such as Guangzho BRT in China and Bogota's TransMilenio BRT in Colombia have modal integration with bicycles; however, there is no BRT system in the world which demonstrates integration with rickshaws. When considering such integration, the design and planning of BRT stations is crucial for two main reasons. Firstly, the design of BRT stations is anyway very important for ensuring high levels of ridership. Secondly, the integration with rickshaws will involve different (special) planning and design requirements.

Putting together the various elements described above, the paper reports, in Section 2, on the arguments 'for' and 'against' the rickshaw bans, based on a review of relevant literature. Section 3 then describes a 'generic' approach for the design of a system in which rickshaws serve as feeder services to BRT. Section 4 reports on the results of interviews from a case study conducted with transport professionals and experts in Dhaka City about a specific system designed for the city.

2. ARGUMENTS FOR AND AGAINST THE RICKSHAW BANS

2.1. Are rickshaws an efficient mode or do they create congestion?

Reducing traffic congestion for better traffic flow or speed is one of the major reasons put forward for rickshaw bans in many cities (Samanta, 2012; Gallagher, 1992; Bari and Efroymson, 2005). For example, rickshaws were banned in the central areas and high-class

residential suburbs of Jakarta (Gallagher, 1992) and in a few major arterials of Dhaka (Ahmed and Rahman, nd; Rahman *et al*, 2008) for this purpose. However, traffic congestion is directly related with the speed and flow of traffic. Efficiency in road space use of various modes could be an option to judge or compare with rickshaws. An ITDP study (2009) shows that the passenger car unit (PCU) or passenger car equivalent (PCE) value of a rickshaw in Bangladesh and Indonesia is 0.5, as in Table 1; which suggests that a rickshaw needs only half the road space of an average car. Gallagher (1992) showed that on crowded urban roads in Dhaka the rickshaws have a much greater passenger capacity than cars: 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. Moreover, road space required per passenger trip on a particular vehicle would be appropriate to judge the efficiency on road space use and Table 1 shows rickshaws are more efficient than private cars, but less efficient than buses.

Table 1 - PCU, PSCE, Average Occupancy, Road Space per Trip and Flow of Passengers of Different Mode

Mode	PCU[1]	PCSE[3]	Average Occupancy	Rod space per person trip (sq. m)[7]	Flow of passengers (per lane) [6]
Bus	2.5	1.80	52[4]	0.2	6,600
Car	1.0	1.0	1.5[5]	2.2	470
Bicycle	0.2	0.10	1.0[5]	NA	1,500
Rickshaw	0.5[2]	0.18	1.6[6]	1.3	1,000

Note: PCSE is the relative space that any vehicle category occupies in relation to a standard car.

Source: DITS, 1998[1]; ITDP, 2009[2]; Bari, 2000[3]; Bari and Efroymson, 2005[3]; Mannan and Karim, 2001[4]; Efroymson and Bari, 2005[5]; Gallagher, 1992[6]; DTCB, 2005[7].

Nevertheless, a broader economic analysis of each trip on different modes for different lengths at different speeds and traffic levels are needed to justify the efficiency (Replogle, 1991). This is because different functional hierarchy of roads may have different level of utility from different modes at different speeds. The existence of such road hierarchies potentially leads to greater social and economic benefits as well as better traffic safety, as compared with having no road hierarchy. For instance, Kurosaki *et al* (2012, p.48) stated "reasonable restrictions, such as, restriction of slow-moving traffic from busy arterial roads or highways should not be rejected" to prioritize high speed and mass transits. However, for doing this, having a basic functional road classification system or hierarchy of urban roads is the most important; which often is not in place in many cities of developing countries, such as in Dhaka. Thus, ITDP (2009) claims that banning rickshaws is unlikely to be successful and instead of banning recommends limiting the number (applying a cap) in major arterials.

After the rickshaw ban on Mirpur Road of Dhaka, a certain number of (former) rickshaw passengers shifted to walking, buses, and other motorized modes for about 25%, 33%, and 42% respectively (Barakat *et al*, 2004). Given the poor pedestrian facilities it is unlikely that people would enjoy walking. For trips up to a certain length, say 1 km, improving pedestrian facilities could be a sufficient alternative for some rickshaw users; however for longer trips such measures would be insufficient and people need to use bus or other motorized modes. Modal shift from rickshaw to bus (which is already overcrowded) would create extra problem

for passengers to secure a seat or get a room to board in bus unless an adequate number of fleets are provided whilst a shift to motorized modes such as private cars would aggravate travel problems by increasing congestion and emissions as Table 1 shows these are not efficient than rickshaws.

The discussion above reveals that a growth in cars leads to higher levels of traffic congestion than a growth in other modes. Car ownership rates are increasing very rapidly in developing cities (Morichi, 2005); and it has mainly been responsible for creating congestion (Gakenheimer, 1999; Gallagher, 1992; Dimitriou, 2006; ITDP, 2009). There is evidence that cities have not been able to get rid of congestion by restricting rickshaws (Bari and Efroymson, 2005; Gallagher, 1992).

2.2. Do rickshaw undermine the image of a city?

Some critics consider rickshaws to be an "anachronism in the modern world" (Kurosaki *et al*, 2012: p.2): politicians and policy makers often view it as a traditional outdated mode of travel. So, with a notion to improve the city image many cities have in the past banned rickshaws claiming that they represent backwardness (Samanta, 2012; Gallagher, 1992; Bari and Efroymson, 2005). For example, rickshaws have been prohibited from operating in a few major (VIP) roads in Dhaka for the first time in December 1986 and then again in December 2004 and the (then) minister for home affairs of Bangladesh declared in 2011 that operating in all other major roads of Dhaka will be prohibited step by step.
However, Gallagher (1992: p.63) argued that the real reason for rickshaw ban in developing cities was that "wealthy people didn't like them. They detracted from the modern city image that they were trying to create, and they got in the way of the motor cars". Instead of viewing them negatively or harshly, rickshaws could be considered as a part of heritage, history, and culture. They could be modernized and showcased to other nations; as the City Authority of Yogyakarta (Indonesia) took initiatives to modernize and preserve rickshaws as well as providing infrastructure for them. Yogyakarta city perceives rickshaws as a part of social and cultural pride rather than backwardness (Zudianto and Parikesit, nd; Utz and Peterson, nd). In the inaugural session of the Cricket World Cup 2011 held in Dhaka (Bangladesh), millions of viewers watched on TV whilst the captains took a rickshaw ride when entering the stadium to give a lap-of-honour (Busfield, 2011; Sportsmail Report, 2011). As has been reported by Wipperman and Sowula (2007), rickshaws are a symbol of Bangladesh and foreign visitors know them. Presumably, the organizers of the Cricket World Cup thought that rickshaws represented an aspect of the socio-cultural pride of the city/country and hence showcased them to the world. These examples indicate that it is not inevitable that rickshaw conveys a negative image of a city and that in some cases the image might be highly positive.

2.3. Is rickshaw pulling inhuman or a sector of employment and economy?

Rickshaw sector absorbs unskilled labour forces, which have mostly migrated from rural areas. There are about 600,000 rickshaws in Dhaka (Rahman, 2007; STP, 2005), about 7,800 in Bandung (Joewono and Kubota, 2005), about 106,000 in Kolkata (Gupta and

Agarwal, 2008), and about 456,000 in Delhi (Kurosaki *et al*, 2012). Assuming average household size 5, it is clear that in each of these cities a large number of people are directly (pulling) dependent on rickshaws for their livelihood. Moreover, there are many more people who are indirectly dependent as repairmen, shop keepers selling parts or providing pumping facilities, owners, etc. Thus, rickshaw is an important sector of the economy in many cities/countries. For instance, rickshaws are one of the largest sources of employment in Indian urban centres and its contribution to the economy is enormous (Samanta, 2012). It has been estimated that about 6% of national GDP in Bangladesh could be accounted for by rickshaw pulling (Ali and Islam, 2005); and its contribution is more than the combined contribution of Biman Airlines (national flag-carrier airline) and Railway of Bangladesh (Gallagher, 1992). Rickshaw pullers in Delhi or Dhaka transfer a portion of their income to the villages where their families are living (Samanta, 2012; Kurosaki *et al*, 2012; Begum and Sen, 2005); and this may help in reducing rural poverty or rural-urban gap.

Above discussion reveals rickshaw pulling can be viewed in a positive way that it is a trade or employment which provides income earning opportunities for poor individuals. Authors such as Bari and Efroymson (2005), Kurosaki *et al* (2012), Sangathan (nd), Samanta (2012) also mentioned this view. However, on the other hand, some critics consider rickshaw pulling as inhuman or an insult to human dignity and exploitation of human labour (Kurosaki *et al*, 2012). This is mainly because pulling a rickshaw involves hard physical labour under difficult conditions. Nevertheless, the issue of whether 'pulling a rickshaw is inhuman or not' could be important while discussing the arguments for and against of rickshaw bans; however, it is not the main part of this paper and hence further analysis on this topic falls outside the scope.

2.4. Role of rickshaws as a travel mode

Rickshaws provide flexible and demand-responsive taxi-type services as a feeder to public transport or for the entire trip. Travel data reveals that rickshaws contribute 38.7% of trips in Dhaka (DHUTS, 2010), 13.2% of trips in Kanpur (Gupta and Agarwal, 2008), and 12% of work trips in Bandung (Joewono and Kubota, 2005). Furthermore, it can be a popular mode to certain groups of people who have difficulties gaining access to the overcrowded public transport. For instance, considering only the female passengers or school trips in Dhaka, the contribution of rickshaw trips is 47.4% and 41% respectively (DHUTS, 2010). However, rickshaw trips are usually short; as in Dhaka or Delhi is below 3 km (ITDP, 2009; STP, 2005).

Feeder service is crucial for many people in developing cities to have access the public transport services. This is because only the NMT and para-transits are able to enter in narrow alley-ways (Cervero and Golub, 2007). There are many areas or narrow streets in Dhaka which deny access to formal public transport but are accessible by rickshaws (Rahman *et al*, 2012). Therefore, rickshaws potentially have a useful role in the city transport.

Rickshaws are usually complementary rather than competitive to public transport (Rahman *et al*, 2008; Gallagher, 1992). Given that rickshaw trips are usually for short distances, this might be true. However, if public transport services are very poor, say buses are overcrowded or not frequent, then rickshaws may eventually compete with buses. Thus,

public transport services need to be improved in order to rickshaws to be used as feeder services. Nevertheless, motorized formal public transport would not replace the rickshaws; or as Replogle (1991) claims rickshaws would not replace the motorized vehicles. In the case of Delhi, this argument has been supported by evidence that the Metro has increased the demand for rickshaws (Kurosaki, 2012). The reason for increase is not known; however, it is hypothesised that a high volume of Metro passengers need a feeder mode to/from stations. In summary, the above discussion indicates existing motorized transport alone is unable to meet the diverse travel demand and as a flexible mode there is a demand for rickshaws.

2.5. Rickshaws as an environment friendly sustainable public transport

In recent years, 'sustainable' development has been amongst the top agenda items of governments as well as researchers across the globe (Ibrahim, 2003). Thus, NMTs have received much attention as a form of transportation. Furthermore, a modal shift towards low emissions vehicles and NMTs have been recommended for reducing climate change effects and achieving environmental sustainability (WBGEF, 2003; Sahai and Bishop, 2010). Being an emission free mode ('green vehicle'), rickshaws could play a crucial role in environmental aspects for sustainable transport. Furthermore, given the nature of rickshaw trips as well as rickshaw's contribution to the economy, as discussed in previous sections, rickshaws may have potential role in socio-economic and financial aspects of sustainability.

3. SYSTEM DESIGN FOR INTEGRATION OF RICKSHAWS

Some researchers (i.e. Kubota and Kidokoro, 1996; Tiwari, 2003; Samanta, 2012; Schipper, 2004) argue for considering and treating all the available travel modes (including NMTs) together in multi-modal transport systems to maximize synergies with existing transport and built infrastructure. This is because, "it is uncommon for a single mode of transport to be the most efficient ….. Rather, a combination of modes needs to be accommodated in a complementary fashion to meet the needs of diverse ……" (Replogle, 1991: p.9). Rickshaws could play a significant role in sustainable transport, particularly as a feeder to complement the public transport, if they are planned properly and the required facilities are provided. They fill a niche in transport - when the speed and/or distance are not important (Gallagher, 1992).

This section provides the issues should be considered for integrating rickshaws to serve as feeder services to public transport. Transport integration could be of various types and forms (see May and Roberts, 1995; Potter and Skinner, 2000; Sahai and Bishop, 2010). This paper deals modal and fare integration of rickshaws with public transport to enable easy transfers through their close physical location and multi-modal journeys with a single payment.

3.1. Modal interchange area: public transport station

The modal interchange area at a public transport station is crucial in a multi-modal integrated transport system. Usually, public transport passengers do not like interchanges because of the intrinsic costs of transfer, waiting times, inconvenience, and uncertainty. For instance, in

the UK walking and waiting times required at an interchange penalize the passenger by the equivalent of 21 minute in-vehicle time (IVT) on a bus trip or 37 minute IVT on a train trip (Paulley *et al*, 2006). However, public transport interchanges are often dull and unsafe for the passengers in developing cities where they have to walk for a long distance. A major hurdle to the use of high-speed trains in Korea is poor access to stations and inconvenient transfers from trains to local transport modes; for this purpose, developing the environment and services for all transport modes at public transport stations has been recommended to enhance accessibility (ITF, 2012). The operators and passengers of public transport in Athens (Greece) emphasized (as top priority) on quality of service and transfer quality (Tyrinopoulos and Antoniou, 2008). Hence, it has been argued that along with reliability and comfort of the service, the operations must also reduce travel and transfer times (Rivasplata, 2008). Transfer times between modes may greatly depend on distance need to walk between two modes as well as the spatial contexts and pedestrian facilities of that area. Thus, public transport terminals need to be carefully designed so that interchanges become convenient, faster and safer for passengers.

Distance need to walk at interchange

Transport literature suggests acceptable distance of walk trips (see Rastogi and Rao, 2003; Munoz-Raskin, 2010; Krygsman *et al*, 2004; Sahai and Bishop, 2010) as access or egress to public transport is variable about 0.5 km to 1 km or a 10-minute walk. However, certainly the distance for changes between modes should be less than a complete walk trip. A distance of less than 200 m or a walk of a maximum 2-3 minutes was reported as a comfortable walking distance by the participants of focus groups in Dhaka for their modal changes between rickshaws and BRT (Rahman *et al*, 2012). However, for disabled or older people this would be very short, say 50 m or less; as Rahman (2012) explored that the disabled group would expect other modes at the same place where alighting from rickshaws/BRT.

Safety at interchange area: grade separation Vs. at-grade crossing

The interchange area is usually very chaotic, multiple traffic modes and the busy pedestrians moving fast; which could be a potential spot for traffic hazards. So, safety of the passengers at this area should be given high priority. Passengers may need to cross the road at the interchange area; and at-grade would be most convenient for pedestrians. Rahman *et al* (2012) explored different choice options about pedestrian road crossing among different stakeholders in Dhaka: the female middle-income group and the older people suggested an at-grade zebra-crossing whilst the disabled group mentioned for under-pass with ramps. However, recent research suggests that zebra-crossings are only suitable for narrow roads or low-volume or low-speed but do not make safer crossings at higher volumes or speeds or high number of lanes (Zagger *et al*, 2004 cited in NelsonNygaard, 2005). Nevertheless, there are many techniques (i.e. raised crosswalks, speed humps and other traffic calming measures, kerb extensions at intersections, increasing predictability and visibility, etc) for providing safer and effective pedestrian crossing (NelsonNygaard, 2005); which should be needed along with zebra-crossings at higher volumes or speeds or number of lanes.

On the contrary, many traffic engineers recommend grade separation for pedestrian road-crossing. Jakarta BRT provides pedestrian access to the station crossing the road by a bridge connected with sloping (1:8 gradient) ramps (Sutomo *et al*, 2007). However, grade-separation (overpass or underpass) requires more time and efforts of pedestrians for crossing the road. MVs can use a longer route and over-bridges, however, a pedestrian or NMV would often prefer not to use underpass or over-bridge even when it is safer to do so (Tiwari, 2001). So, modern public transport stations, if grade separated, are equipped with elevators or escalators; which obviously increase costs.

Quality of pedestrian path

Modal interchange area should have a good environment for walking to ensure a convenient change. However, in many developing cities most of the roads do not have pedestrian refuges or footways and even if they exist they are often narrow or unusable due to encroachments or obstructions of non-traffic activities (i.e. trading), potholes, and high kerb heights (see Sahai and Bishop, 2010; Lorenz, 2002). Hence, Sohail and Maunder (2007) argue for ensuring safe and secure bus stops with provision of shelter for passengers and designated areas for vendors. Passengers prefer waiting for a trip in conditions of comfort, safety, and protection from the weather (Paulley *et al*, 2006); similarly, user groups in Dhaka suggested BRT stations should be provided with a passenger shade (Rahman *et al*, 2012).

The required width of the sidewalks depends on the flow of pedestrians and the level of service (LOS) (Pitsiava-Latinopoulou *et al*, 2008; NelsonNygaard, 2005); however, the width needs to be adjusted according to the available width of rights-of-way (ROW) of road. Rahman *et al* (2012) showed the widths of the existing footpaths in two locations of Dhaka were about 5-6 feet (1.5-1.8 m) and 11 feet (3.35 m) respectively, which the passengers group suggested should be widened to 10 feet (3.05 m) and 12 feet (3.65 m) respectively for easy movement of pedestrians. In Dhaka, to create more comfort while walking, passengers wish to have a clear footpath (free from shops or other non-traffic activities) and more natural shade (trees) along the walk-ways, particularly at the interchange area (Rahman *et al*, 2012).

3.2. Organizing (queuing) rickshaws at station

Rickshaws often wait in a disorganized and chaotic fashion, particularly in and around public transport stations or shopping malls for picking-up and dropping-off passengers. It has been suggested (see Rahman *et al*, 2012) that providing several stands for waiting rickshaws surrounding the public transport station would help to segregate the flows of passengers to/from BRT. It is important to have discipline among the rickshaw-pullers as well as the passengers: rickshaw waiting areas should be properly maintained with rickshaws forming a tidy queue at public transport stations. Rahman *et al* (2012) suggested placing a physical barrier (through fencing or concrete pillar) for channelization of rickshaws in a queue at the BRT station in Dhaka. Such fencing for channelization of traffic or protecting entry of other vehicles into BRT lanes is available in Chinese cities. However, the rickshaw-pullers of a

case study conducted in Dhaka also think that an advocacy program to raise their awareness about the benefits of forming queues at station may help for queuing voluntarily (Rahman *et al*, 2012). Nevertheless, effective enforcement is also needed along with infrastructure provision or awareness generation for queuing rickshaws at public transport stations.

Providing physical barrier or fencing would help effective enforcement of organizing rickshaws such as pullers must follow a tidy queue while waiting; however, this would require extra investment for providing infrastructures. Moreover, this measure is not flexible to change over the time if traffic situation in the modal interchange area changes; will not ensure that the maximum number of rickshaws permitted to wait at a particular rickshaw stand is followed by pullers. On the other hand, awareness generation among the pullers may encourage them forming a queue voluntarily, and if they do, potentially it would be less expensive compared with providing physical infrastructures. However, awareness generation does not give any guarantee that all the pullers would follow willingly or effective enforcement of organizing rickshaws. Nevertheless, organizing rickshaws at BRT station would involve potential difficulties such as: creating space for rickshaw stands at narrow roads, rickshaws may wait at unauthorized place, waiting more than allowable number of rickshaws at a stand, space for rickshaw stand is occupied by others.

3.3. Fare integration of rickshaws

Rickshaw fare is usually determined through a bargaining process between the user and puller before the trip is initiated. This is why, even if the interchange area is designed to ensure convenient transfers to/from rickshaws; “without fare integration of rickshaws with the formal public transport there would not be the ultimate benefits or convenience for public transport users” (Rahman *et al*, 2012: p.11). Because, a passenger may have to approach many pullers (one after another) until he finds one willing to carry him with his desired rate; which will create crowding and congestion in front of station, delay in transfer trip, and inconvenience of passengers. There is no publication available on integrating rickshaw fares with public transport systems. However, it is certain that unless a pre-determined fare structure is established for rickshaws, it would be impossible to implement an integrated fare system for journeys involving both rickshaws and public transport.

As the rickshaw journey has no specific fixed route, and also because means are not readily available to measure the distance for each trip, it is a challenging task to have pre-determined and fixed fares for rickshaws. Furthermore, rickshaw fares for a certain distance may vary depending on different aspects such as weather and time of the day, availability of rickshaws, willingness of the puller for a trip, destination (location) of the trip, number of passengers travelling, quality of the road surface (of intended trip), traffic congestion, and the bargaining capacity of the two parties, etc. Rahman *et al* (2012) reported that if the rickshaws operate only within a locality or neighbourhood for short distances, then a ‘pre-determined fixed fare structure’ for rickshaws would be possible based on an agreed predetermined (tentative) distance between two locations. Fazilka Ecocabs, a charity NGO for rickshaws based in India, operating with a pre-determined fare structure based on distance (km) of trip within/between locality (Asija, 2012). On the other hand, Wipperman and Sowula (2007)

suggested to determine rickshaw fares based on the travel time of a journey takes: a chart of pre-determined fare rate (previously set by the managing authority) would be available in each and every rickshaw, all the rickshaws would be nationalized and the passengers would pre-pay by purchasing 'tokens' for using rickshaws. However, there are potential risks of this system where the speed of a rickshaw varies due to quality of rickshaw and age (or physical strength) of puller: passengers may prefer to travel with young and strong pullers only; pullers may drive much slower than the average speed; pullers may ask for cash instead of tokens; and the passengers may forget to buy tokens before the trip so offer cash money. Also as Rahman *et al* (2012) claimed, the rickshaw-pullers of Dhaka want to receive their wage in the form of hard cash just immediately after finishing the trip.

After determining the fare structure for rickshaw trips, the next issue concerns integrating this with the tickets of public transport: what would be the mechanism for integrated fares and how to collect the fares as well as what would be the mechanism for distributing the revenue among different modes (particularly to the rickshaw pullers). The fare integration with rickshaws should be backed with smart planning, regular monitoring and enforcement, awareness generation of rickshaw-pullers, and wide publicity campaigns. However, fare integration would not consider any variation of fare rates for peak and off-peak time, any discount on advance/pre-paid or weekly/monthly purchase of tickets etc because these would be more complicated (almost impossible) to implement and enforce for rickshaws. Furthermore, the fare structure of rickshaws also needs to be updated regularly (Rahman *et al*, 2012; Wipperman and Sowula, 2007).

3.4. Enforcement issues

Various aspects of enforcement such as whether rickshaws wait in designated stands, not exceeding the permitted limit of rickshaws allowable to wait in a given time at a particular stand, follow a tidy queue while waiting, pullers are following the specified fare rate etc would be crucial for integrating rickshaws with public transport. Role of pullers and their acceptability is vital for effective enforcement of the above mentioned aspects. Forming an association of pullers at neighbourhood/local level may help them to become aware and to take some responsibility for implementing and enforcing themselves. Local authority (e.g. *ward* of the city corporation or *paurashava*) could take the responsibility of enforcement and practicing their administrative power within their jurisdiction. Cooperation between local authority and the pullers association may provide excellent result in effective enforcement.

4. RESULTS FROM THE CASE STUDY IN DHAKA CITY

This section gives the results derived from the case study into the possible integration of rickshaws with public transport, particularly the proposed BRT system, in Dhaka. An in-depth interview and discussion with transport professionals were done to explore their opinion on various selected topics related to integration (i.e. convenient distance for modal change, at-grade crossing or grade separation at interchange area, the facilities needed at BRT station, organizing rickshaws at BRT station, and fare integration). 21 transport professionals ranging

from BRT implementing agency, academia, city authority, policymakers, and advocacy groups were interviewed in Dhaka between September 2011 and March 2012. The discussion was face-to-face, following a loosely or semi-structured open-ended questionnaire covering the generic aspects as well as aspects particularly concerned with in Dhaka.

4.1. Role of rickshaws as feeder services of BRT

All the respondents interviewed mentioned that rickshaws could play a vital role of feeder service to BRT; even, two of them argued for incorporating rickshaws within the BRT project to increase BRT ridership. It was suggested that rickshaws should operate in neighbourhood roads but not in major roads where need high capacity buses or minibuses. However, it is a challenge how to keep rickshaws outside the major corridor. On the other hand, 8 interviewees argued for having a cap (only up to a certain number) on rickshaws for the city; emphasising on only having rickshaws of the allowable amount permitted by license and the extra illegal ones should be removed from roads. In a similar vein, it was mentioned to have a cap within the neighbourhood or the number of rickshaws should be minimized on corridor. However, one respondent opposed for any cap because claiming that demand supply of market would determine the number of rickshaws whilst the remaining had no comments.

Nevertheless, rickshaws to be served as a feeder of BRT system would require a BRT station to accommodate rickshaws for convenient modal changes, organizing rickshaws at BRT station, and fare integration for the convenience of passengers; are discussed below.

4.2. Modal interchange area: BRT station

The distance needed to walk at a modal interchange area will depend on the availability of space surrounding BRT station where rickshaws could be accommodated for dropping and picking up passengers. Figure 1 shows the respondents opinion about the acceptable walking distance for modal changes at BRT station.

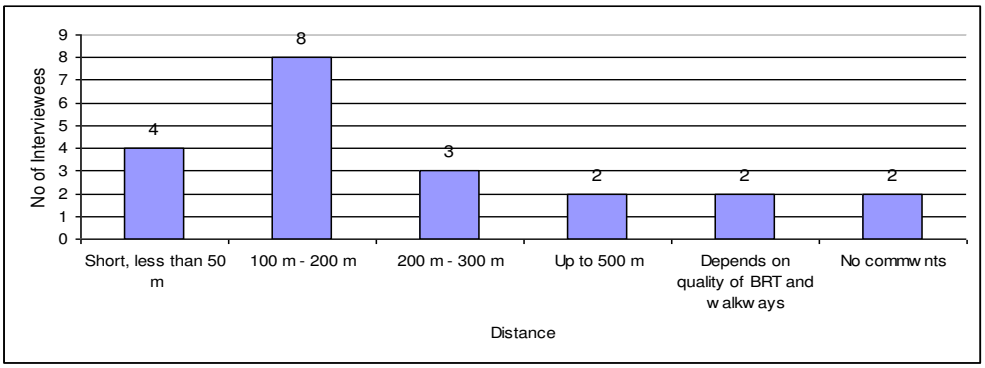

Figure 1 – Respondents Opinion about Acceptable Walking Distance for Modal Change at BRT Station

It was argued that 2 to 3 minutes or even up to 5 minutes walk at interchange is acceptable and about a quarter of a km is possible to walk within 5 minutes. Even, up to 0.5 km has been said acceptable walk between two modes provided that rickshaws are available

everywhere. However, the distance between modes should be short, otherwise instead of taking a rickshaw as access/egress legs passengers may walk straight to BRT station or look for other alternative modes for the entire trip length. Nevertheless, it was reported that the distance of walking at interchange will depend on the quality of BRT system and walkways; if the BRT service is very good (fast and reliable) then it would be worth walking to get the benefits and if walking paths are pleasant people might be wiling to walk a longer distance.

It was reported by all the interviewees that as a general principal, at-grade is the best option for pedestrian road crossings and then underpass and lastly overpass. Table 2 reveals that the respondents diverged about pedestrian road crossing to access BRT station or safety at modal interchange area in the case study locations of Dhaka.

Table 2 – Interviewees Response about Options for Pedestrian's Road Crossing to Access BRT Station

Category of Respondents	Descriptions	Number of Respondents	Reasons for Opinion
Pedestrian friendly respondents	At-grade pedestrian crossing: along with zebra-crossing a pedestrian prioritized signal light 'puffin crossing' should be provided.	9	▪ Underpass or overpass are inconvenient and some people (i.e. disabled or elderly or if carrying luggage) cannot use them. ▪ Foot-overbridge will not be useful for the cyclists. ▪ Efficiency and ridership of BRT could drop as over or under-pass is very inconvenient for pedestrians. ▪ Transportation is not the movement of vehicles but movement of people; so at-grade pedestrians should get priority and cars could be delayed.
Car friendly respondents	Grade separated pedestrian crossing: underpass or overpass. For the convenience of people carrying goods or older and disabled: - Escalator or elevator or ramps should be provided; Or - They will wait in a designated area and traffic police will escort them to cross without using overpass after stopping the vehicles.	6	▪ At-grade pedestrian crossings would slow down BRT speed and road capacity may reduce, may increase delay/congestion in mixed-traffic lanes as vehicles have to stop in about every 2-3 minutes interval at signals. ▪ Not providing any option for at-grade crossing because people will think "as it is possible to cross at grade so why should I go on overpass"? ▪ Both men and women are using Kawran Bazar underpass; women feel safe if there are many people (in busy hours) but the problem comes when it is quiet time and dark. Underpass would be a part of BRT management or operation to keep it clean and safe.
Neutral respondents	Choice of option for pedestrian road crossing should vary case to case: depending on road space (width), location, and traffic situation.	6	▪ Somewhere in Airport Road (like a motorway standard) an underpass might be suitable but a place somewhere in Old Dhaka (very crowded, many rickshaws and slow vehicles, lack of space) underpass may not be suitable but at-grade.

Almost all the interviewees mentioned the modal interchange area should be in such a way that it becomes user friendly and convenient for the pedestrians. The walkways should be even and smooth, clean, and should not have any potholes or should not be slippery or narrow. Width of the walkways is very important for the convenient walk. Five of the

respondents mentioned to have at least 3 m wide footpaths. However, the width would depend on the volume of pedestrians or demand. Another interviewee advised not to have a fixed width of footpath; arguing for only the minimum width of 2 m but not the maximum width (maximum will be based on actual pedestrian demand).

Concerning the facilities needed at BRT station modal interchange area, almost all the interviewees suggested the need to provide a toilet, a shade at BRT station to give shelter for passengers against heat of sun or rain and to provide a ticket counter, and a few shops so that passengers would able to buy small items (i.e. drinks, chips, etc). However, the Dhaka BRT consultants mentioned they are not thinking to provide toilets at BRT stations. Arranging ticketing facilities on footpaths (outside BRT station) and allowing access in the station only to people having a valid ticket was suggested by two respondents whilst three others mentioned having a simple or easy system of ticket collection because majority of people are illiterate. If there are technical ticketing arrangements, the public should be educated and informed. It was reported that the shops could ensure security to passengers as well as generate extra revenue from advertising. If a shop or hawker is placed in the station/interchange area it will not become isolated and the passengers will feel safe. About security, a need to deploy security guards and to install hi-tech CC Cameras at BRT station was mentioned by 5 and 2 interviewees respectively whilst 2 others mentioned to have both. However, 3 others opposed these; instead of security force and the expensive CC Camera system, they argue for simple multi-purpose interchange area incorporating people. Nevertheless, the NMT specialist mentioned he is not worried about facilities at BRT station but he is worried about pedestrians' access to station. He mentioned as the demand would be very high, probably the station platform of BRT will be overcrowded soon, so crowd management would be important; otherwise there would be chaos. He also added that, as rickshaws are very flexible and demand responsive, it would be better not to provide any permanent infrastructure facilities for rickshaws. If facilities for rickshaws are provided, probably they would be placed in a wrong location because soon after providing rickshaws may not be using that or not waiting in that place and started waiting in a new location.

4.3. Organizing (queuing) rickshaws at station

All the interviewees reported a need for organizing rickshaws to function in queues in a more systematic way at BRT station. It was suggested that there should have 3 to 5 designated specific places (surrounding the BRT station) for rickshaws for dropping and picking of passengers at BRT station. It was further mentioned that the rickshaws should be in systematic queues, in each of the place should be limited to a certain number of rickshaw spaces (i.e. 5 or 10) to wait at a time and more than that number should be removed through enforcement. Three of the interviewees added that an empty rickshaws should not wait there for long time; they will just come to rickshaw-bay, drop off the passenger and then pick up passenger (rickshaw should go anywhere where the passengers want to travel) and leave the place. Almost everybody emphasised on regular monitoring and strict enforcement of the rickshaw waiting places. Furthermore, if the fare of rickshaw trips is fixed the passengers could board on first available rickshaw waiting in the queue without any hesitation.

Organizing or queuing of rickshaws at BRT station or interchange area could be done up to a certain level through engineering design and infrastructure provision. However, almost all the interviewees mentioned to educate and aware rickshaw pullers so that they could organize themselves and maintain queuing. In some areas of Dhaka there is already an association of pullers and association of owners; they are issuing rickshaw numbers within that area. This reveals, to a certain extent rickshaws are already organized and these associations could be strengthened more. Two respondents suggested that government could take initiatives so that NGOs come forward to help rickshaw pullers to form their association at community level so that they could regulate some aspects among themselves. The interviewee from transport regulatory agency mentioned representatives of rickshaw pullers and owners could be involved in city transport committees (which is dealing with fare determination or issuing license), and both DCC and traffic police could sit together with pullers association and owners association to determine the maximum number of rickshaws that should be operating in a certain road or area or locality. Furthermore, there is example of easybikes[1] operating in a few areas of Dhaka which have organized themselves and maintaining the queuing at stops. In a few fixed routes (i.e. Mirpur 10 to Parish Road, Mirpur 10 to Cantonment, Mirpur Purabi to Rupnagar) easybikes are operating as a public transport with a fixed fare; and the drivers themselves organized, determined the fare, and maintaining the queuing at station.

On the contrary, enforcement of administrative powers to make the pullers maintaining queues in disciplined manner at stations was emphasised by 2 interviewees. For instance, pullers should have a license which could be cancelled if they do not practice the organized queuing. However, given the reality of more than three-quarter of existing rickshaws operating in Dhaka or Delhi are without a valid registration (and most of the pullers do not have a licences to it), it is unlikely to make any positive impact. Nevertheless, if it proves possible to determine fixed/limit their numbers, it could be possible to issue the registration number and ID for each rickshaw and puller respectively (within community level), which could ensure more security of passengers (as they would be possible to identify easily).

4.4. Fare integration of rickshaws

While discussing on whether a pre-determined fare structure for rickshaw trips is needed or not, most of the interviewees talked about the necessity of controlling or regulating the fare whilst only 3 others argued it is not good to try to control the fare of rickshaws. The majority are claiming that rickshaw fare should be determined, and pullers should not be allowed to charge an exorbitant rate because: now a days pullers ask very high fares and passengers have no alternative except to pay the overpriced fare; due to high increase of fare, arguments between pullers and passengers are happening regularly; it is becoming difficult to afford for many people, especially for lower-middle income groups. Nevertheless, the issue for discussion was not controlling the fare; it is about whether or not having a pre-determined fixed fare structure for rickshaws.
Three interviewees mentioned having a fixed fare rate for rickshaws would give benefits; such as passengers would know their monthly travel cost as well as whether pullers were

[1] Size and design is similar to auto-rickshaw but lighter weight; can carry 5-6 passengers, runs with electric chargeable battery.

charging extra for a specific trip, pullers could know how long they have to work to earn a certain amount. Table 3 shows different methods of determining a fixed fare rate for rickshaws mentioned by 14 interviewees. Four of them were very optimistic and enthusiastic about it; saying this is happening in a few areas of Bangladesh, such as outside train station of Gazipur. They added that rickshaws already became delineated within the area or neighbourhood; in few cases, pullers also do not want to move out of the locality. On the other hand, a pre-determined fare rate for rickshaws was opposed by 4 other interviewees who think it would not be possible to implement because very difficult to enforce and to determine what should be the correct fare because the fare of a rickshaw trip depends on multiple aspects. Furthermore, rickshaw fare is constantly changing; if food prices go up then it must go up and the government could not be so responsive. In Bangladesh, economy is not stable and price of commodities are increasing so frequently that the fare should be revised in every 2-3 months. They argue that being a nature of para-transit it would not be wise to determine the fare for rickshaws; demand supply in market should do it. Most people know about the reasonable fare; if the pullers ask for more, then they could walk. Furthermore, doing a pre-determined fare structure for rickshaws would be hard work logistically, and a single integrated fare will involve administrative costs for fare collection and again distributing revenue to rickshaws.

Table 3 – Methods of Determining a Fixed Fare Rate for Rickshaw Trips

Option of Methods	Description	No. of Respondents
Based on area or locality	Delineating or demarcating neighbourhood and a fixed rate for trips within the area or outside the area	4
Based on time of the rickshaw trip	Measuring the time of rickshaw trip and determining a rate for per hour or minute	3
Based on distance of trip (locality)	Identifying tentative distance between two locations and determining a fare for that trip distance	7

Nevertheless, a more participatory approach in decision making process including the pullers and owners of rickshaws along with local representatives may help functioning the pre-determined fare rate of rickshaws. A strong enforcement as well as willingness of the pullers will be needed. If association is formed (i.e. owners), they could sit with local government and discuss about a fare to be determined. Local government could fix a rate for rickshaw fare and should revise regularly, once a year, particularly when price of commodities increase or fuel prices increase or salary of people are increased. Public representatives of each area could be involved to monitor and report if the fare rate is being violating.

5. IMPLEMENTABILITY

The barriers for implementation towards integrating rickshaws with BRT would be as follows: policymakers negative attitude towards rickshaws and negligence in providing supportive infrastructure for rickshaws; barriers concerning organizing (queuing) rickshaws at BRT station; creating space for rickshaw stands at BRT station; localized rickshaw operation or demarcating the local area for rickshaw operation; determining the fare rates for rickshaw

trips; collecting appropriate rickshaw fare and enforcement; overall cost for implementation of the system; and above all maintenance of the infrastructure at modal interchange area.

The above mentioned barriers need to be resolved for effective implementation of integrating rickshaws with BRT. Incentives for the pullers, proper marketing, and awareness generation among the pullers could help to resolve the barriers. Member pullers of Fazilka Ecocabs in India receiving various incentives such as free health and education for the puller's family, and training for the pullers (Asija, 2012). Advocacy programs for awareness generation among the pullers have been discussed earlier in section 3.2 about organizing rickshaws and in section 3.4 on the issues for effective enforcement. The results and discussion reveal that integrating rickshaws with BRT is possible if the modal interchange area is planned properly, rickshaws are localized, and the above mentioned barriers are resolved.

6. CONCLUSIONS

The paper gives a potential solution for a common problem (arguments between fast and slow transport or between non-motorized and motorized transport) of urban transport that exists in many countries. This solution involves providing a multi-modal integrated transport system where the formal mass public transport should get priority in the major arterials, with rickshaws (or NMTs and other para-transits) operating in other (narrow) streets to provide feeder services or access/egress legs of public transport.

Based on the review of existing literature the paper at first described the arguments 'for' and 'against' the rickshaw bans that have observed in many cities in the past decade; and then gave a 'generic' approach for designing a system where rickshaws could serve as feeder of public transport. The 'generic' system design covered the aspects of physical integration and fare integration; in terms of both infrastructure and general policies. There are good arguments that rickshaws should be planned in such a way that they could play a vital positive role in the modern city transport instead of restraining or prohibiting them. However, effective design or plan of the public transport station, particularly the modal interchange area, is very critical for integration of rickshaws with public transport to ensure easy and convenient modal changes for the passengers. Moreover, for such feeder services to operate efficiently, rickshaws should be well organized in queues at the waiting areas close to the public transport stations and the pullers should be aware about the road discipline to be able to feed the public transport. Furthermore, a pre-determined fare structure for rickshaws and then an integrated fare for trips involving both rickshaws and public transport would provide seamless public transport service and convenience for the passengers.

Finally, the paper reported the results of interviews from a case study conducted with transport professionals and policymakers in Dhaka City about a specific system designed for integration of rickshaws with BRT systems for the city. It was found that the rickshaws could play a crucial role as a feeder of BRT if they are planned effectively and they are organized at BRT station. A few of the interviewees mentioned to have an integrated fare structure and showed how to materialize this; however, on the other hand a few others opposed it saying that as rickshaws are informal para-transits they should not be controlled and the market

would determine herself the fare. Nevertheless, without having fare integration of rickshaws with BRT systems it would not be possible to have a seamless public transport or improved public transport services and the ultimate benefits or convenience for the passengers.

The outcome of the paper would be helpful for other cities with rickshaws that have (or are planning for) BRT systems how to integrate rickshaws with BRT. Although the main policy implications concern rickshaws, the insights of this paper could be helpful for formulating policy for other informal modes in developing cities that might, from the perspective of city transport managers, be operating in a disorganized and haphazard way. Further research could be modeling or simulation of the design of BRT stations to test the extent to which users benefit from different designs, as well as testing the transferability of the designs and policies described above for integrating rickshaws with BRT in Dhaka to other similar cities.

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