

Circular Water Transport System of Dhaka City: Analysis of Existing Condition, Inherent Problems and Future Prospects

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Introduction

Dhaka, the administrative, commercial and cultural capital of Bangladesh, is the largest and most industrialized city in the country. Its success as the primary city of Bangladesh, however, depends very much on the efficient delivery of a range of urban services, of which transport is a key element. The transport sector of Dhaka city is characterized by horrendous congestion and delays, inadequate traffic management, poor coordination among agencies, and also lack of integration between different transportation modes. Dhaka is perhaps the only city of the world of this size without having a well-organized and scheduled mass transit system. The traffic condition of the city has presently reached a crisis situation. The ever-increasing chaos and congestions, high rate of accidents and rapidly deteriorating environmental conditions calls for immediate considerations of an alternative transport option that could efficiently reduce the loads on road transport.

Dhaka city is surrounded almost in all sides by five rivers Burignaga, Balu, Tongi, Turag and Lakhya. The western periphery of Dhaka is skirted by Buriganga and Turag rivers for about 26 miles following a zigzag course (BIWTA, 2001). The river acts as a major linkage between a portion of Keraniganj Upazila and the old city of Dhaka. Under the circumstances, the river Buriganga may be a potential transport option for the city, provided there has been an organized and efficient water transport network along the waterways (Mitra, 2003).

Objectives and Methodology of the Study

The main objective of this study is to investigate the existing situation of the waterway transportation; explore the problems and prospects of the waterway; and recommend necessary measures to enable river transport play a greater role in the transportation system of Dhaka. In this research, secondary information is mainly used, but a field level observation was also conducted to know the actual condition of circular waterway.

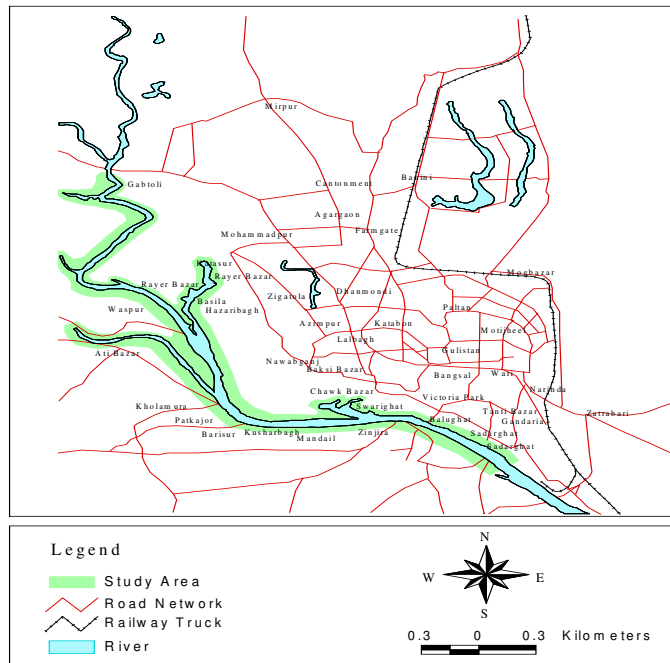
The Study Area: Dhaka city (the water ways of the city) is selected as the study area. In Dhaka city there are 110 kilometers of waterways consisting of the river Buriganga, Turag, Shitalakkha and Balu (Figure 1).

Water Transport System Related Actions for Dhaka City

There are several on-going projects to improve the river transport system in Dhaka city. In this section, the major transportation related plans and their recommendations regarding water transport and also some on-going projects which have with the study are discussed.

Greater Dhaka Metropolitan Integrated Transport Study (DITS): The DITS has made a number of both short term and a long term recommendations including institutional and policy reforms and physical investment to improve urban transport environment of Dhaka. The DITS final report (volume-1) recommended the strategic direction for the Transport Development Strategy (DTS) to develop waterways for water based transport of inter urban personal travel in Dhaka. Besides a ring road, generally following the alignment of the flood

protection embankment is also recommended in DITS (1994) to ensure an integrated transport network among different modes. Salient points discussed in this working paper regarding the waterway are as follows:



Source: Mitra et.al, 2003
Fig. 1: Location of the Study Area.

- The waterway ring encircling Greater Dhaka (including Narayanganj in the south and Tongi in the north) does not have its potential for carrying waterborne traffic fully bulky exploited. This is particularly so in the case of fully low value materials. The best example is that more use should be made of the river North of Dhaka as far as Mirpur where cargo handling facilities could usefully be developed.
- Within the ring, greater Dhaka remains interfaced with waterways, but these are now very largely discontinuous bodies of water of little present or even future value for transport purposes.
- Those that are continuous are frequently interrupted by physical friction (over-bridges) or physical obstacles (shallow depth narrowness). As such they are largely non-navigable.
- Construction of the flood protection embankments has already isolated the khals to the West of Dhaka from the ring.
- The two planned flood protection embankments to the east of Dhaka will isolate all other of Dhaka's khals from the ring unless navigable locks are to be incorporated. Construction of locks is not the present intention.
- The proposed development in definite prospect of the waterway of Greater Dhaka is that a shipping container terminal is to be constructed on the south bank of the Buriganga River downstream of the China Friendship Bridge.

The DITS final report (Volume 2) identified some potential projects for the integration of waterways with land transport and also to use the existing waterways along greater Dhaka in an optimal fashion. Some of these projects which have their acquaintances with the concerned areas are as follows:

Outer Dhaka Ring Road following Alignment of Flood Protection Embankment: Under the project, the embankment road provide access to most of the landing stations along Buriganga and acts as the major linkage of waterway transport with the road transportation system of the city. The DITS (1994) also recommended public transport routes along the embankment road. When implemented this would encourage the use of waterway and would have a positive effect on improving the traffic situation of the old Dhaka as well.

Upgrade Waterways Ring and Selected Khals: This project was supposed to continue with an initiative by BIWTA to upgrade the rivers and canals which form a ring route around the Dhaka urban area. The first phase of the project was initiated by BIWTA in 2000 and it was planned to be finished by 2005. The project includes the dredging of river ways to improve navigability and also the development of 12 landing station on both sides of the Buriganga and Turag rivers.

Other Waterbus and Water Taxi services: Although the opportunity to introduce waterborne transport services is being eroded by the drainage management and flood control works, the project for water taxi services was supposed to be an attempt to realize the objective of some policy makers to bring back waterborne services particularly for passenger travel. No projects, however, has been initiated in this regard, and no feasibility studies have been made as yet.

Dhaka Metropolitan Development Plan (DMDP): The DMDP is composed of three components. These are Structure Plan, Urban Area Plan and Detailed Area Plan. The main objective of DMDP is to provide the long term strategies for the guided development of all parts of Dhaka. Both structure plan and urban area plan provide some policies and strategies for the areas adjacent to Buriganga River and also for Keraniganj Upazila which are of immense importance for the future expansion and development of the study area. This policies and strategies have been discussed in the following section.

Volume 1- Structure Plan: Transportation would play a major role for Dhaka's growth both for the structural plan strategy and also for the alternate options. Water transport component has been prepared in Dhaka Metropolitan Development Plan (1995-2015) to efficiently utilize the natural opportunities with a view to:

- Develop navigability of the encircling water way.
- Install new berthing points.
- Disperse traffic loads of water transport.
- Reduce congestion in Dhaka metropolitan area.
- Develop inter-city water transport system.

The whole component includes dredging of channels and canals and installation of berthing points. Navigability of the encircling waterways will enliten the old heritage of Dhaka and enhances the riverine recreational facilities in a great way. Besides these, bulk goods can be transportation cost of different consuming goods will thus be reduced and people will get the benefit.

Volume 2 - Urban Area Plan: In this volume, two projects have been mentioned that have the direct impact upon the waterways. These are:

1. Western link road connecting Amin Bazar with Kamrangir Char.

2. Keraniganj Port and access road.

The implementing agencies are RHD and BIWTA respectively. But it was recommended by DMDP, 1995 to relocate the container port from Keraniganj to DND triangle.

Dhaka Urban Transport Project (DUTP): The GoB, with assistance of international development association has implemented a major transportation improvement projects for the DMA- the urban transport project. The total estimated cost of the DUTP is US\$ 140 million, which includes US\$ 100 million of civil works (Rahmatullah, 2005). One of the important components of DUTP is the preparation of a long term (20years) strategic transport plan (STP) for the DMA that establishes a multimodal transport plan based an assessment of the inter-relationship between land use and transportation. There has been no recommendation regarding the improvement of water-borne transport.

Studies on Recently Undertaken Waterway Projects: The major waterway projects currently ongoing are as follows:

Sadarghat Terminal (Dhaka Port): Dhaka port is located at edge of the City of Dhaka, the capital of Bangladesh and faces the Buriganga River at Sadarghat. It is one of the liveliest inland ports in Bangladesh. The Government of Bangladesh has requested the Japanies Government to provide technical co-operation to assist with the development planning of the Dhaka Port. A Master plan of the Dhaka Port was prepared for the period up to the year 2005(BIWTA, 2001).

Inland Container Terminal at Pangaon Cargo Jetty at Hasnabad (Dhaka Port Development Project): On the basis of the result of the SAPROF study in September/October 1992 under OECF financial aid, a project composed of a container Terminal and a general Cargo Jetty was recommended, which was called the “Dhaka Port Development Project” to be located in Pangaon along the south bank of Buriganga river (BIWTA, 2001).

Development of New Passengers and Cargo Terminal: For a number of years, Sadarghat terminal has become very busy and congested (BIWTA, 1998). The terminal is isolated from the main road network and inaccessible to other public transport mode. There is no public transit to the terminal areas. Terminal lacks adequate parking facilities and vulnerable to flooding where overall traffic in the inland waterway system is increasing every year (BIWTA, 1998). Sadarghat share in their increase both passengers and freight is decreasing. According to the concerned officials, it is not possible at this stage to improve the facilities at Sadarghat because of the congestion and unavailability of land for further development. To overcome these entire problems, recommendations have been made to construct a new terminal for passenger and cargo at Alibahar Char (BIWTA, 2001).

Introduction of Waterway around Dhaka City: The objectives of the project are:

- To develop navigability of the Buriganga and Turag river from Sadarghat to Ashulia Bridge by dredging.
- To provide modern cargo and passenger facilities at four major landing stations. and only modern passenger facilities at four landing stations along the water way

The project involves the following major components:

- Land acquisition.
- Dredging.
- Construction of dyke, approach road, bank protection etc.
- Construction of landing facilities.

Evolution of Transportation in Dhaka City

The pattern and evolution of the transport system of Dhaka city has taken the present shape through dynamic and systematic changes occurring from remote past to the recent time. However, very little statistical information on early network and movement pattern is available. During the 16th century, Dhaka was extended over a small area around the present Bangla Bazar and old Dhaka on the northern bank of the river Buriganga. The city was then spread over less than three square miles as shown in the Figure of Mughal and Pre-Mughal period. From 1608-1717, Dhaka had a population of about 1,000,000. As the city extended from the left bank of the Buriganga to the north, it had most of its traffic with the interior of the country handled by water transport (Hamid, 1985).

Mughal Period: During the Mughal time, city streets were narrow, tortuous and unmetalled, among the means of transport, apart from human back, shoulder and head, pack animals which included horses, mules, elephants, cows and bullocks were dominant. Push carts, bullocks' carts, horse driven carts and palanquins were also extensively utilized. Carts and horse carriages are found in the city in use even to-day. The earliest incentives to road improvement came strongly from military requirements and profit making concepts of the builders than for providing better traffic facilities. This is apparent from fact that strategically the city of Dacca was most attractive for external aggression and its surface roads and waterways offered best means of transport for the retreat of invading army who after their invasion had improved upon the road conditions. Even for internal subjugation or maintaining peace and stability, the necessity for good communications within the city was felt as imperative. Persons who were ordered from the Delhi Government to control this area found Dacca as the best strategic location. With the coming of Shaista Khan in the 17th century, vigorous improvement and constructions of roads, canals and waterways took places. During Shaista Khan's rule, (1663-77) an artificial canal around the city, the Dholai Khal by name was excavated for two purposes : (1) Intra-urban movement of goods and passengers, and (2) protection the city from external aggressions. Dholai khal, as a water way encircled the old Daccan, joining the Buriganga River at Mitfort Hospital and Mill Barracks. It acted as the heart line of communication within the city. At present, the Khal is being filled up, and in its place a broad dual carriage road is in the process of construction to ease the increasing metropolitan problems (Hamid, 1985).

British Period: With the setting up of British administration, a change was found within the city area. The Mughal life slowly transformed and was superseded by the European taste and fashions. With European emergence, there took place a general broadening of roads, clearing the fifth and dirt of the city. A gradual increase of population found from 1867 onwards. In 1901 the city population was 1, 04,000 whereas in 1911 it was 1,25,733, an increase by 20%. This unusual increase of population had shattered the transport system of the city. From 1931 to 1941, there was even a greater increase of population from 1,61,922 to 2,39,722, which was an increase of nearly 48%. By 1951 city population rose to 4,11,000 a rise of 71 percent. An analysis of census data, as such, reveals that there was tremendous pressure on limited transport facilities over time. After the First World War, new roads were constructed and the city started extending towards Ramna area, although even during this period, animal driven carts, palanquins or Bajra and Panshi over Dholai Khal remained the principal media of city transport. New types of boats, especially dingy for ferrying and moving over short distances with a very few people and mal nauka carrying goods from a ton to more than 15 tons were found to be used for communication with the interior parts of the country. Prior to 1947, Dacca Municipality had 110 miles of roads of which 44 miles were tarred or cemented, 50 miles thick metalled and 16 miles kacha fair weather roads. Movement by bi-cycles and a few motor vehicles were also found. In mid forty's, there had been bus services between

Dacca and Narayanganj. In 1947, Dacca was made the provincial capital of the then East Pakistan (Hamid, 1985).

Pakistan Period: During this period, much emphasis was given on construction of roads and buildings. A great number of people from the rural area as well as migrating from other countries came into the city for employment, business or better provision for life. A small number of buses, cars and motor cycles were imported by the government to ease the transport problems of the Dhaka city. The new shape of the city took place during the early fifties. Movement of service holders, businessman and other professionals necessitated the expansion of the city, but lack of physical expansion kept their movement confined within a radius not extending beyond 5 miles from the city center. This created the great problem of congestion introducing pedestrians, bi-cycles, rickshaws and small number of cars moving on the limited number of narrow roads without adequate footpaths or zebra crossings, bus stops, car parks, etc. During this period, there were 2324 motorized vehicles of all types. Apart from the introduction of large number of additional baby taxis, buses, and trucks, Dhaka Motor Vehicle Association (DMVA) imported 140 private buses, among which 80 used to ply on the city's main road. The East Pakistan Road Transport Corporation (present BRTC) was established in 1951. Road length of different widths was increased by 48 miles (Hamid, 1985).

Post Liberation Period: With the emergence of Dhaka as the capital of an independent Bangladesh in 1971, there has been a great influx of people to the city, and the population of the city by 1974 increased to 16,79,572. This was an increase of more than 200 percent over a period of 14 years (Hamid, 1985). The pressure on the already strained transport system has been tremendous resulting in the creation of many intricate transport problems.

Role of Buriganga in the Water Transport System in Dhaka City

The Buriganga is notable distributaries of the Dhaleswary River and following a zigzag course for about twenty-six miles, skirting the edge of the old alluvium before rejoining the large stream. It takes off south of Savar and flows past Dhaka. It gave the old metropolis its water connection in the past and was easily navigable, so that the great Mughal fleet (the Nawara) could often anchor near the town. It has been showing signs of silting up and there is a considerable growth of water hyacinth even at Dhaka. The river is, however, of great advantage to the capital and there is a regular route to Narayangong, Chandpur, Barisal and Khulna (BIWTA, 2001).

Throughout the history, it reveals that Waterways play an important role in the sphere of metropolitan transport. Maximum flow is found along the banks of the Buriganga, from Shambazar to Shawarighat, within this area lied about 15 ghats. During Mughal time, as already mentioned, Dholai Khal played a major role in handing city traffic. Despite the filling of the Dholai Khal in Pakistan time, movement by water transport has not totally ceased as people find it cheaper and easier to move goods, usually of bulky nature from one ghat to another for a distance of half a mile and above along the banks of the Buriganga by non-mechanized country boats than by road vehicles. The major drawbacks of water transport are the difficulties of transshipment and the process involved in loading and unloading of goods. However, the location of these water routes had facilitated development of linear industrial and commercial settlements along them. For example, the glass factory, dockyards, aluminum factories and other industries were found along the side of the river Buriganga. The main commercial settlement attributable to water transport was, of course, the Sadar Ghat river port and Buckland Bund which acted as a hub of city transaction. Buckland Bund extends from Badamtali Ghat to shambazar Ghat having a length of 4700 feet (Hamid, 1985). The ghats

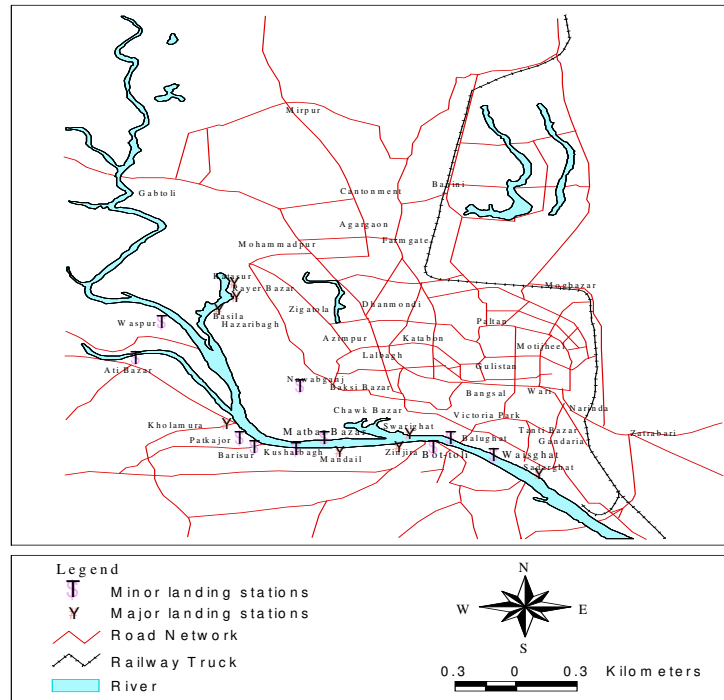
other than the terminals remained busy throughout the day by day ferrying passengers from both the banks usually by small boats. There were six prominent ghats on the Buckland Bund e.g. Shambazar Ghat, Kaliganj Ghat, Nawabbari Ghat and badamtali Ghat (Nabi, 2006). About 10,000 passengers entered and left the city through this river port and another 10,000 by different ghats between Swarighat to Shambazar Ghat. (Hamid, 1985). Generally the impact of this large number of passengers falls on other modes of transport, especially on road vehicles. Added to these, there was innumerable number of people who entered the city through other smaller ghats. They were all an integral part of busy urban life and were inseparable constituents of everyday city traffic. It must be mentioned here that some specific ghats served the purpose of some specific hinterlands. For example, fishes from Sylhet, Chittagong, Chandpur, Barisal, Bhola, Tongi, Aro-bill (Nawabganj) arriving at Machua Ghat during early morning hours were unloaded quickly, and consumed, all around by the city dwellers. Pan Ghat was famous for waste broken glasses which in large quantity come from different places, especially from the coastal districts of Khulna and Barisal. Dhambazar was mainly famous for all kinds of vegetables. Various types of vegetables reaching this ghat are stocked over here by *arotdar* and then carried to different city markets by country boats along the Buriganga or by road transport (Nabi, 2006).

In the 20th century, with rapid improvement of road transportation system, road became the major mode of transportation for the city dwellers, and the water way gradually lost its importance. At present Buriganga is doleful situation. The river front of Dhaka once acted as the gate way of the city is now used as the back way of the gutter. The areas along the river have become an image of the sharp degradation of the Buringa River and the riverfront. The river is being treated as a dumping location, while most of the river side locations are under threat to unplanned occupation (Mitra et.al, 2003).

As a means of transportation, The Buriganga River still plays a vital role in connecting the people of both banks of the river. Everyday hundreds and thousands of people use the river to reach their destinations. The river is still the major means of transportation of products and goods of enormous commercial settlements and small industries on both banks of the river, but over usages and poor maintenance, along with high congestion on riverside roads and other land uses make the situation worst. The river has lost all its attractions and so has the river transportation system. Buriganga has lost its ecological balance long before and has now become a source of health hazards. The river Buriganga has been the biggest asset, not only for the surrounding area but also for the city as a whole. But unlike other great cities where rivers and canals play a dominant role in city planning and city transportation, Buriganga has been neglected all along (after the end of Mughal rules) for the same.

Overview of the Existing Condition of Water Transportation

The rivers of Buringanga and Turag within the study area have a considerable number of landing stations on both banks. Some of them generate huge volume of passenger and freight transport everyday, while some others have no significance. The location of the landing stations are shown in Figure 2 with their existing facilities. Table 1 shows the location and name of landing stations in the study area.



Source: Mitra et.al, 2003

Fig. 2: Existing Landing Stations in the Study Area

Table 1: List of Landing Stations in the Study Area.

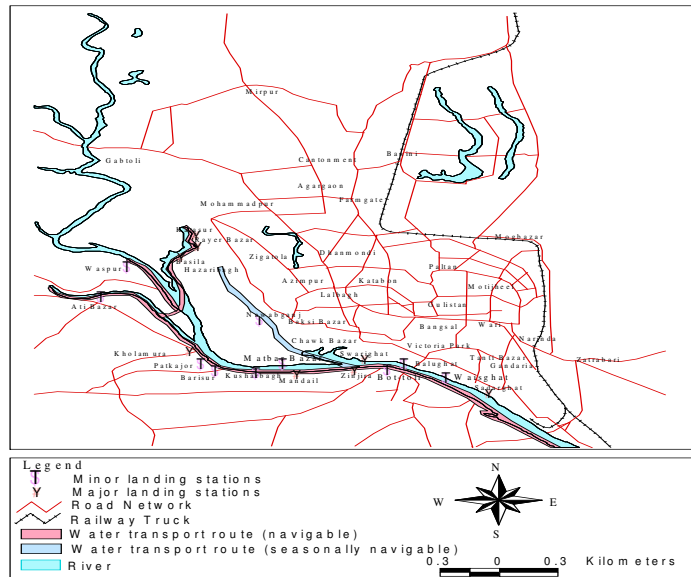
Serial No.	Name of the Landing Stations	Location
1	Amin Bazar	West Bank
2	Gabtoli	West Bank
3	Rayer Bazar	East Bank
4	Katasur	East Bank
5	Waspur	West Bank
6	Basila	East Bank
7	Nawabganj	East Bank
8	Ati Bazar	West Bank
9	Kholamura	West Bank
10	Patkajor	West Bank
11	Barisur	West Bank
12	Kusharbagh	West Bank
13	Matabbar Bazar	East Bank
14	Mandail	West Bank
15	Zinjira (Godarghat)	West Bank
16	Bot-toli	East Bank
17	Swarighat	East Bank
18	Balughat	East Bank
19	Waisghat	East Bank
20	Sadarghat	East Bank

Source: BIWTA, 2001

Water Transport Route in the Study Area

According to BIWTA, the water borne passenger traffic and the cargo in the study area mainly follow three major routes (Figure 3), which are:

- Pagla-Shampur-Sadarghat (Buriganga River)
- Sadarghat-Swarighat-Zinzira-Barishur-Kholamura (Burigabga River)
- Sadarghat-Swarighat- Nawabganj-Hazaribagh (Char-Kamrangi Khal)



Source: Mitra et.al, 2003

Fig. 3: Existing water route in the Study Area.

Project on Circular Water Transportation System in Dhaka City

The project work on circular water transport system of Dhaka city was completed in two phases by the Government of Bangladesh. First phase was completed in 2005 and the work of the second phase in 2010.

Development in the Phase I

The first phase development of circular water transport system in Dhaka city was launched between July 2000 and December 2004 (completed in 2005). An amount of Tk. 36 crore was spent to develop 29.5 km of waterways. Ten landing stations were built in this phase. These are Swarighat, Kholamura, Basila, Rayerbazar, Nawabbagh, Shinnirtek, Birulia, Aminbazar, Mirpur and Asulia. The objectives of the project were as follows:

- To provide circular water ways around Dhaka city.
- To develop the transportation system of Dhaka city and reduce traffic jam.
- To develop irrigation system and fisheries cultivation.
- To develop tourism industry.
- To develop environmental condition of Dhaka city.

Four two-storied terminal buildings, 3 one-storied terminal buildings, 2 stairways, 2 passenger sitting places, 12 pontoons, 12 steel gangways and 24 steel spades were built in this phase. About 80% works of the project is the dredging of waterways. The project work included dredging of 17.50 lacs of cubic meters.

Development in the Phase II

In the second phase of the circular water transport system, 40 km of waterways was included for development. The project period was July 2007 to June 2010 and an allocation of Tk. 47.50 crore was made to complete the project. The objectives of the project were as follows:

- To develop the transport system of Dhaka city.
- To reduce the traffic jam.

Three landing stations are built in this phase. These are Katchpur, Isapura and Kayetpara. This phase also included Dredging of the waterways.

Problems Associated with the Circular Waterway System

The following sections point out some of the major prospects and problems that might affect the quality and reliability of the existing water transportation system. Some problems were identified by direct field survey and some were identified by the previous reports, magazines etc. recently undertaken.

Distribution of Passenger's Trips: The present distribution of waterway trips is very much inefficient. About 25000 persons make their trips everyday on an average through the river Burigang and Turag within the study area. Of the total volume, about 6500 persons reach the city by Katasur and Rayer Bazar landing stations, about 7000 enter the city through Sadarghat and Waisghat and the rest (about 12000) through the five identified and many other minor and informal landing stations (Nabi,2006). The other major landing stations on the eastern bank of Burigang also face somewhat similar types of problems.



Source: Field Survey, February, 2010

Fig. 4: Poor physical condition of Sadarghat landing station.

Physical Condition of the Landing Stations: Physical condition of a landing station proves its acceptability through good passenger handling facility. But the physical setting of the

landing stations of the study area is very poor. Most of the landing stations are deprived of any structural setup. Other landing stations such as Rayer Bazar, Mandail, Waisghat etc. also possess the same condition. In most cases passengers and goods are loaded and unloaded on the slope of the embankment and there is no provision of sheds as well. As a result, in the rainy season the passengers have to suffer miserable condition. Moreover, there is no standard form regarding the size and quality of the landing facilities according to the passenger's volume generated. For example, Kholamura generates a high volume of passengers every year (20.92 lac) but there is no permanent berthing facilities provided at the landing stations and passengers are handled through wood and bamboo made temporary structures.

Poor Access to the Landing Stations: One of the major problems of the existing water transport system is the poor access to the landing station by road in the west bank of the river and most of the access ways are Kutcha and narrow. In the landing stations of old Dhaka, the access roads are narrow and highly congested. None of the landing stations have parking facilities either for passenger or for service vehicles. The access of Swarighat, the most traffic generated landing station remains submerged during the rainy seasons. The most acute problem regarding access is the lack of linkage to the public transport network. Almost all the landing stations that generate high passenger traffic (Kholamura, Swarighat, Waisghat, Sadarghat) have no efficient linkage to the public transport system. Though there exist some road transport services from some of the major Ghats, these fail to provide linkage to the overall mass transport system efficiently.

Lack of Organized Routes: The water borne passenger traffic in the study area and its surrounding follow three major routes are Pagla-Shampur-Sadarghat (Buriganga River), Sadarghat-Swarighat-Zinzira-Barishur-Kholamura (Burigabga River) and Sadarghat-Swarighat- Nawabganj-Hazaribagh (Char-Kamrangi Khal).



Source: Field Survey, February, 2010
 Fig. 5: Narrow and Kutcha access road at the Waisghat landing station.



Source: Field Survey, February, 2010
 Fig. 6: Too many boats create chaotic situation at the Waisghat landing station.

During reconnaissance survey, the Char-Kamrangi Khal was identified as seasonally navigable due to rapid sedimentation which becomes unusable during the dry season. The second route carries the highest volume of passengers. This route includes Kholamura (18.1%) and Zinjira (28.1%) which are the most trip originating landing stations in the study area under concerned (Mitra et al, 2003) Patkhajor, Barishur, Kusharbagh, Mandail, Zinjira,

Waisghat and Sadarghat are some other Ghats along this route all which are important from the strategic point of view. But the other landing stations lying upstream in this succession like Waspur , Basila, Ati-bazar) are not well linked to the preceding ones. Though they generate large volume of traffic (which also represent their level of growth), the trips made from these places are principally concentrated in the northern directions like Rayer Bazar and Katasur. From Kholamura to Atibazar and the upstream, there is a route of passengers by mechanized country boats. These missing links needs proper consideration as they can enable people living in upstream to travel southwards and also have some potentials of vertical transport.

The scopes for vertical movement through river also exist along the western bank of the river from Kholamura to its downstream up to Zinjira. As the existing road network is poor water can be a prospective option to travel vertically to the neighboring areas. On the other hand, in the east bank of the river, the scope for vertical movement is limited, as there exist a well developed embankment road along the riverside and people prefer roadways which are faster than traveling through water.

Presently, there exists no water transport network in true sense. Vehicles commute from origins towards various destinations. As a result, lots of boats are required to serve the passengers who make their trips to so many destinations. This creates congestions of boats at the landing stations. The boats compete each other for fast loading and unloading of passengers. This makes the whole system inefficient, unsafe and unmanageable. Moreover large number of boats traveling to various locations through the river creates a haphazard condition with in the river adding to the risk of accidents and also making the riverside unpleasant.

Type and Quality of Vessels: Mechanized country boats (MCB) are the major means of travel at present and they ply between all of the landing stations and in all routes. These MCBs can carry approximately 30 passengers at a time and are not safe. There is no arrangement in these boats to get rid of the rain water. Thus they are never reliable in rainy season i.e. about five or six months of the year. As there exists no regular network of services and also the passengers capacity of the boats is quite low during off peak period the users have to wait for a long time.

Only in one route Kholamura to Swarighat, Mechanized Launches provide waterway services but the service lacks proper regulation and quality control in respect of carrying capacity and berthing facilities. Because of inadequacy of the MCBs in busy hours, many of the trip makes use small country boats to cross the river. These are functionally inefficient as they can carry only 5 to 6 persons at a time and are very slow as they are not powered by engines. These boats are quite risky and have dangers of accidents and sinking. The haphazard movement of these boats also restrains the movement of fast moving vehicles through water and increase risks of accidents.

For carrying goods through or within the study area mainly MCB are used. Sometimes medium sized cargo ships serve the purpose. The river ways could be having high potentials to carry high volume of freights across Dhaka City and there by reduce the loads on the roads within the city that are now created by through movement of goods. But vertical movement of freights can not be made through the study area by large cargo vessels beause of the lack of height clearance cause by the Buriganga Bridge No.2. Therefore, the river ways does not posses much potential for goods movement on a large scale only except goods may be created to or from the places upstream of Buriganga Bridge No.2. But through proper planning and management, goods movement can be encouraged in small scale to reduce the loads on roadways.

Toll Collection System and Maintenance of Landing Stations: In most of the landing stations, there are toll collection points at the entry point of the ghat. These are maintained on a leasehold basis by the City Corporation. Tolls are collected from both in coming and out going passengers. But the maintenance service that they should provide is completely absent. All the landing stations are dirty. However, the process of collection system, the maintenance of landing stations and the priced amount, all require proper organization and planned and functional provision.

Unauthorized and Illegal Installations Surrounding the Landing Stations: Almost all the landing stations are surrounded by illegal and unauthorized structures including the factories, warehouse, bamboo built structures, slums and squatters and cargo storage along the river bank. These illegal setups actually decrease the serviceability of the landing stations and deteriorate the land use day-by-day. If they are not present the port authority may find adequate space to expand their port facility for minimizing the congestion during rush hour and also to meet the future demand.



Source: Field Survey, February 2010

Fig. 7: No provision of facilities at Swarighat landing station.

Surrounding Land Use Pattern: Almost all the striving landing stations are surrounded by market places (Kolamura, Zinjira, Swarighat). The surrounding land uses generate high functional traffic which hampers the passenger convenience. Moreover there is much noise and chaos of roadside vendors and canvasser. This kind of situation discourages the users to use this landing station.

Close Proximity of Too Many Ghats: Along the river way several landing stations have been identified to exist in close proximity to one another. Rayer Bazar and Katasur, Mandail and Kusharbagh, Godarghat and Zinjira, Sadarghat and Waiseghat are some of the examples. In some cases the nearby ghats vary in their character. Sadarghat and Waiseghat handle traffic coming from two separate directions (south and north respectively). Again in case of Zinjira and Godarghat, the former is used for passenger of mechanized boats and later is for country boats. But in some cases, like Mandail and Kusharbagh, the neighboring landing stations possess the same character. These types of close proximity make the riverbank congested and haphazard. Moreover they require high maintenance cost and investment for future development.

No Provision of Fixed Facilities for Cargo Traffic: Most of the landing stations handle a large volume of freight traffic all through the year. But no one possesses any type of fixed

facilities for handling cargo. R.C.C pontoon, Cranes, Lift, Gangway etc are not provided for loading and unloading of goods.

Problem of Aesthetic and Surrounding Environment: Throughout the river course there exist too many ghats within short interval and with close proximity to each other. This situation together with unplanned arrangement of vessels and cargo-boats create worse condition. Since there are no fixed facilities, waterway vehicles are berthed in an unorganized fashion at and around the landing stations. Boats are also berthed by the riverbank all the way. Because of the shortage of the cargo sheds, the goods carried through water remain stacked up along the riverside. This unplanned distribution destroys the aesthetic qualities of the river bank and the environmental quality of the surrounding areas, especially from Zinjira to Sadarghat.

Inadequate Water Transport: Inadequate water transport is not certainly the only worry. Three basic things are needed for any waterway to yield results. They are ports and landing station and a water way and transport. If any one among these does not work, the entire system is bound to suffer. In the area, the most apparent short comings are inadequate public transport, but questions are also there concerning the waterway and the landing station as well.

Allegations are raised by many that it was done hastily without much thought being given on maintaining the required depth and width. More serious allegation has been raised about dredging. Maintaining the navigability could have to be another problem area in the future. The water flow changes from season to season and with it the width and the depth also vary.

Inaccessibility of the Landing Station: The landing stations are not free from problems. The landing stations do not appear to have the potential to attract a large number of passengers. If one lives in Tajmahal road and wants to catch a launch from the nearest landing station in Basila, he will have to hire a rickshaw for Tk 15 at first for going to Beribadh and then get in a tempo and pay Tk 4 more to reach Basila. Obviously such practical draw backs are major concerns of the people using the circular waterway facilities.

Incompleteness of the System: The system is not fully finished yet. Although the waterway is supposed to encircle the entire city, so far less than half of it has been completed. The waterway from Sadarghat to Aminbazar is the major part of the first phase of the project work. The second phase of the project from Ashulia to Kanchpur Bridge via Tongi has not even started. Though the first phase is completed, preparation for the circular waterway to be in full operation has not been completed. The BIWTA has not provided enough vessels for the route. There is only one launch service per day, one leaves Swarighat at 7.30 am for Shinnirtek and another starts from Shinnirtek at 2.30 pm for Swarighat. BIWTA does not have any ship on its disposal. The launch owners are reluctant to offer their services in this route, because they will not earn enough money, as volume of passengers is very poor. Thus passengers are not using this route mainly because of the lack of vessels.

Prospects of the Circular Water Transport System

Decreasing Pressure on Roads: The large volume of freights that are carried through different points by roads could be diverted to waterways. The cargo could be ferried to the landing stations nearest to the destinations. This would have two possible benefits:

- The transportation cost would come down
- The pressure on the city streets would decrease to some extent

Saving Cost: Communication by waterway usually costs half or even one third in comparison to road or railway transport costs. The water way has not only tremendous effect on the existing transportation system, but also helps to increase the scenic beauty of the area.

Provision of the Existing Linkage: The landing stations of Katasur, Rayer bazar has good access to road transport facilities, and are well connected to each other by road. They are well accessed to Mohammadpur and Rayer bazar through approach road in the form of embankment. There exist regular tempo services through the place in the route Nawabganj-Gabtoli. The access road of Sadarghat and wise ghat are also wide. Kholamora has developed access road and road transport network with the nearby areas and easy road communication can be established with the L.S to its North-Atibazar and waspur. Tempo services are also available in the route Kholamora-Amin bazar-Kalatia and Kolamora upazila Sader. Zinzira has access roads towards the thana though it is not developed. Yet Swarighat has congested access road toward the centre of the Old Dhaka. In the Sadarghat landing station no public transport service was identified in close proximity to the Ghat. The landing station is well accessed to Bahadur Shah Park. It has well linkage to many other strategic location of the city. DMDP also proposes the point to be a major focus of the public transport system with the provision of new bus routes and also the underground railway facilities. It was found that eight landing stations have well access road namely Katasur, Rayer bazar, Atibazar, Nawabganj, Kholamora, Zinzira, Waisghat, and Sadarghat. The landing station waspur, swarighat, Balughat also have moderate type access facilities. The available road transport facilities would help to ensure minimum expenditure of future development in the form of land acquisition and road construction.

Navigation Condition: In the landing station Katasur and Raer Bazer, the water channel is navigable throughout the year and a little quality of dredging could ensure the landing of large vessels. All other landing stations along the water way remain navigable throughout the year except Nawabganj L.S. It is seasonally navigable. So, all the landing station has the potentiality in respect of Navigability.

Wage and Employment: Project would be labor intensive. Project would help to create huge amount of employment opportunity at the farm level and also in the service sector. A large number of people get a opportunity to involve in fishing, boating, farming etc.

Agricultural Output: This intervention will increase the agricultural output. Benefit will come from reduction in water logging damage and also changes in cropping pattern by land by land type. Irrigation project will be expanded in the area.

Culture of Fisheries: The present level of culture and capture of fisheries is significantly below in this area. Proposed intervention will helps to increase both type of fisheries.

Economic Livelihood: The proposed intervention is likely to have indirect and direct income effects at household's level. The household will earn income from water born navigation including boat owner, operator and user. The farmers will be benefited from reduction of early flooding and will able to produce and sell agriculture product. Due to the river dredging and water retention, the household who are engaged in fishing will be benefited.

Drainage: The proposed work will improve the drainage condition especially during pre-monsoon season. The dredging will accelerate the drainage flow resulting in elimination of crop damage caused by drainage congestion. The impact of drainage will facilitate early plantation in past monsoon. It will help to accumulate rain fall inundation.

Tourism and Recreation: Recreational uses may be encouraged in the Buriganga river. If favorable surrounding land use can be ensured, along with the reduction of traffic congestions in the access roads and improvement of the aesthetic and environmental aspects of the river

ways, these will surely act as added attractiveness toward recreation trips through the river Buriganga. There are a series of places of historical importance along the Buriganga river within the study area, or very close to the riverside, of which the Intellectuals Martyr Monument, the Lalbag Fort, the Ahsan Manjil are some of the mentionable..These may be utilized to increase tourism attraction of the river ways. Moreover, there is enough vacant land at the northern section of the study area which can be developed as recreational spots.

Recommendations

This section attempts at providing some solutions to the existing system of the water transport. Based on the findings of the former chapter, recommendations have been made to establish practicable and efficient water transportation system in the area under concern.

Waterway Services and Routes

At present, there is no organized water transportation network in the study area, which reduces both the reliability and the efficiency of operation and management of water transport. Therefore, formulation of a well organized circulation pattern and designation of appropriate routes is of utmost importance to make the waterways play its potential role. After a comprehensive study on the origin destination relationships and the expected volume of traffic on each route, proposals have been made for an organized and systematic water transport network. Four types of services are proposed on various routes as shown in Table-2.

Type 1: Direct Service: These are mostly long distance service carrying high volume of passengers. These will run between the origin and destination where a significant volume of passenger travels everyday and will be fast to reach the people to their destinations within minimum possible time. As they will have to carry a large volume, the vessels should be larger with high passenger capacity.

Type 2: Local Service: These are usually large vehicles with large passenger's capacity and good speed. These will run in both long distance and short routes and connect linearly various landing stations which generate low volume of passengers. This will reduce the needs for providing direct services between various origins and destinations where it would not have been feasible because of low passenger's volume. This type of services will also enable some sorts of vertical movement through water, where road networks are least developed and also with in Dhaka City where roads are so much congested.

Type 3: Connector Service: These are small vehicles with low passenger capacity, preferably slower, which will act as the connector between small landing station and major landing station. The principal purpose of these services will be vertical movement between neighboring locations.

Type 4: Ferry Service: These will run between the areas where trip generation is extremely high. Two types of ferries may run for vehicles and for passengers as there are some demands for crossing of roadway vehicles (principally trucks and covered vans) at this point. Though ferries are of slow speed, they may be efficient in this particular point as they will require less time to land and can carry a large volume of passengers at a time.

Table 2: Proposed routes and services

Proposed Route	Proposed Services
Amin bazaar-Gabtolli-Waspur	Direct and Local
Katasur-Rayer bazaar-Waspur	Direct and Local
Ati-bazar-Kholamura-Zinjira-Swarighat	Direct and Local
Waspur-Kholamura-Swarighat-Sadarghat	Direct and Local
Atibazar-Swarighat	Direct
Zinjira-Swarighat-Balughat-Waisghat-Sadarghat	Direct and Local
Kholamora-Patkajor-Barisur-Kusherbag-Mandail-Zinjira	Local and connector
Swarighat-Zinjira	Ferry
Kholamora-Zinjira-Swarighat-Sadarghat	Direct and Local

Physical Facilities

- There is no provision for parking facilities in almost all of the landing stations. Where the facilities exist it does not fulfill the required demand. So the facilities should be provided according to the demand. As most of the trips are made principally by the lower income group of people, the demand for parking of private vehicle is very low. So emphasis should be given on the parking facilities at the best possible locations for the Para-transport services and also for the rickshaw and other public vehicles. The near by open and unused spaces may be utilized for providing the facilities.
- An efficient water transport system should provide proper and effective linkage to the existing transport system. All the possible road transport options should be available at the landing stations from bus service to subway. The possible linkage should be provided between the landing stations and near by public transport facilities. The proposed bus services by DITS are likely to provide better accessibility of the ghats to the mass transport facilities. Para transport facilities should also be provided to connect the water way users to the nearest public transport facilities. This will also help to reduce the demand for the rickshaw and other private small vehicles. To determine the best possible linkages, vigorous studies should be conducted for assessing the actual demand of the required linkages. In order to cater the comfort and safety of the passengers while traveling by waterway and to ensure swift, safe and unhindered turning of vessels, modern landing facilities should be provided: The following measures can be adopted:
 - a. Passenger pontoon: Depending upon the nature and volume of cargo one and more still pontoons with facilities for berthing of vessels should be provided. Covered gangway should be provided which will act as shore connection to facilitated embarkation and disembarkation of passenger.
 - b. Cargo handling facilities: Different facilities for handling of cargo should be provided at different landing stations depending upon the nature and volume of cargo. R.C.C jetties with provision of mechanical handling equipment along with wooden jetties supported on timber piles should be provided. There should be a provision a godown, transit shed especially Amin Bazar, Gabtali, Sadarghat with adequate provision of movement and parking of trucks. Electricity and security should also be provided where necessary.
 - c. Additional physical facilities: Additional physical facilities such as ticket counter, post office, police box, passenger waiting room, prayer room and small shops should be provided at the landing station where required. The facilities will enhance the smooth, efficient and user oriented functioning of the ghats. The provided facilities may vary for

different landing stations and depend on the volume accumulated in each ghats. The facilities should be designed in the way that they don't hamper the circulation system, and at the same time be the focus of interest for the water way users and also for other peoples. Some of the facilities (like shops) may be good source of income to the authority.

- River channels frequently migrate because of fluctuation of water level, heavy erosion and accretion. To solve this problem following measures should be taken:
 - Maintaining the navigability of water route by dredging;
 - Without carrying out dredging, shifting of ghat according to the availability of navigable depth and construction of diverse roads; and
 - Combination of both options above
- To prevent the erosion of Basila landing station is necessary. For this break field located almost inside the river should be removed and dredging is necessary.

Management Aspects

- Market area around the ghats hampers the circulation of passengers and roadway vehicles. So, strict regulation on land use should be imposed for the proper functioning of the landing stations and the efficiency of the whole system. There should be a master plan for future land use of the surrounding areas of the circular waterway. No development that violates the plan should be allowed.
- Land use plan of the old Dhaka is also necessary. But the market places of old Dhaka should not be discouraged because they are important for the survival of the water transportation system. Renewal and redevelopment program maintaining the present characteristics may be taken for the areas. As Keraniganj and Kamrangirchar are very close to the city center and the land price of this area is relatively cheap, huge amount of people may migrate in this area and may promote new development. Any long term development that may hinder the flow of the flood water should be discouraged.
- The country boat, for the improvement of the transport services, should be modernized and mechanized. BIWTA should take the charter responsibility in this respect. The engine fitted in the country boat do not open match the boat size and as such optimal benefit from mechanization with minimum cost and risks are still to be desired. Therefore, BIWTA should take up the responsibility for increasing the efficiency and profitability of the country boats. Foreign donors (like World Bank) should be encouraged for providing support and financial assistance for the modernization and mechanization of country boat.
- Disorganized country boats owners and operators should be organized through formation of country boats owners and operators associations.
- The traffic department of the landing station should conduct traffic survey, collects and compiles traffic statistics and should bring out annual traffic report which will help to operation of water transport and traffic matter.
- BIWTA can not operate directly all the landing station under its management due to manpower shortage and other physical constraints. Some landing stations are, therefore operated by engaging licenses on annual basis. The activities of grader should be guided by the bilateral agreement with BIWTA. In this case, control should be kept on the hand of BIWTA.

- Arrangement of the cargo should be put in Launches in the same condition, as it was when it was in the trucks. It will help to make the business people confident that this goods will be put in Launches intact. In that case, they will be spread of the cost for security staff during loading and unloading.
- The city authority should set up certain restrictions on the use of certain roads, roads vehicles to promote the use of waterway. The authority may also provide some incentives to encourage the water transport services, say for example, some of the linking road ways services may provide by the authority with free of cost or water ways users will get a good amount of discount at restaurant and tourist spots.
- The present system of toll collection from the passengers should be changed. The ticketing system at the landing stations should be introduced rather than the present system of fares (section). Toll of the landing station may be charged with the value of ticket.
- The parked vehicle at the provided parking spaces should be charged an amount as the parking fee. This will help for the better maintenance of the parking spaces and also will provide source of income to the authority.
- The circulation of the para-transport system should be maintained by the authority. Incentives may be provided to encourage the use of these services. For example, the water way users may be carried to the nearby public transport facilities at half cost. This will encouraged the use of these services by the water ways users and reduce the demand of rickshaw and private vehicles. At the same time, such steps will encourage the use of waterway.
- There should be availability of adequate information of the various routes, fares and timing of the waterway services. The authority would be responsible for such publicity.
- Waterway services should be provided all near the prescribed routes. At present lack of control over the waterway services result in a haphazard (section) and hence to over come this, there should be a strict control over the circulation route of the waterway vessels. There should have a complete control over the licensing and issuing of route permits of the waterway vessels. No unauthorized boats should be in services. The quality and required standard of the vessels should be kept under regular monitoring to ensure the best possible services.
- The timing and amount of waterway services are to be determined based on comprehensive studies and on the average daily traffic, peak hour traffic and changes in trip pattern during different hours and the demand should be monitored on a regular basis to allow required changes.
- The overall system should be under continuous monitoring and evaluations. The passenger demand on various routes should be monitored regularly, and the service must comply with the trip demand. Continuous monitoring should also be done on the pricing of the services. Most of the waterway users are low income people. Thus, they should be charged according to their capability, at a rate which will at the same time be enough to render the project maintaining cost.

Alternative Use of the Waterway

Recreational facilities may be promoted along the river ways in the study area. As the waterway services are under the jurisdiction of BIWTA they should be responsible for the provision and maintenance of the same. However, private sectors may also be encouraged in

this respect to provide or maintain such facilities on a leasehold basis. If provided, this could be a handsome source of income for BIWTA and will be an added factor for the sustainability of the waterway transportation system. A variety of recreational and leisure package may be organized. Consideration should be made for all sections of people. Most of the waterway users at present come from lower income group and thus their affordability to such package should be ensured. The type and quality of boats made for the purpose may also vary. The type of boats or vessels may take different forms including the following:

- Large boats for low cost leisure trips of lower income group
- Small reserved boats for high cost recreational or leisure trips
- Boats (big or small) for ceremonial purpose which will be used for celebrations like marriage or picnic.

Conclusion

The traffic condition of present Dhaka has reached a critical situation. Serious congestions and delays have been the most common objections of the everyday life of the people live in or come to the city. The existing road transport system cannot meet the demand for trip making. Poor traffic management and inadequate condition, along with the absence of integration between different transportation modes have made the situation worse. Under the circumstance, the conducted study has been formulated with a view to find an alternative solution of the transportation problems of Dhaka city. Realizing the fact that Buriganga River, lying to southwest of Dhaka city could have potentials to be developed as an effective transport option and thereby induce growth on the western bank of the river Buriganga. So finally it can be said that Dhaka city is one of the most populated cities in the world and day by day its population is increasing in an alarming rate. So it is very important for Dhaka city to improve its circular water transport system to prevent the traffic jam and also provide good transport system for the increasing people. If the problems of the circular water transport system of Dhaka city can be solved then it will be a very effective transport system both for people and different goods.

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