

TECHNICAL PRE-FEASIBILITY ANALYSIS AND PRELIMINARY CORRIDOR DESIGN OF BUS RAPID TRANSIT (BRT) LINE-02 (GABTALI TO AZIMPUR)

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ABSTRACT

Dhaka, being one of the busiest cities in the world has yet to have a comprehensive organized mass transportation system. The daily increase in traffic demand leads to an increase in congestion which results in unbearable traffic jams. The existing mass transport facilities are insufficient to solve the growing traffic demand and congestion problems in different routes. The present contribution of mass transit is only 31% of the passenger trips whereas mass transit should share around 80% of the total trips to provide an efficient transportation system. In this study, BRT Line-2 route has been considered from Gabtali to Azimpur through Zahir Raihan Sharani Road and its pre-feasibility analysis is conducted according to Strategic Transport Plan (STP)-2004. During survey, primary data was collected to crosscheck with secondary data. From the technical design, number and length of flyover and overpass along with the length of the below-grade section was determined for different corridors. The study will give an overall scenario of the proposed BRT Line-2 to policymakers for detailed analysis.

Keywords: *BRT Line-2, BRT, Strategic Transport Plan (STP)-2004, Corridors.*

1. INTRODUCTION

People have turned this metropolis into a shoal of residential, commercial, and business hubs due to lack of effective planning and supervision over land use activities. Congestion has occurred due to a rapid increase in the number of inhabitants in the city, as well as an increase in motor vehicle ownership and non-motorized vehicles on the streets. Currently, the megacity's transportation scenario demonstrates that existing mass transportation systems are unable to meet rising demand of traffic. In truth, there is no scheduled bus service or any type of mass rapid transit in this city right now. The present contribution of mass transit is only 31% of the passenger trips whereas mass transit should share 80% of the total trips to provide an efficient transportation system (STP, 2005).

The existing bus system could not solve the transport problems of Dhaka city because now a day bus itself creates jam in different routes. So, it is inevitable to consider the improved mass transit system. Under this consideration, three BRT lines have been proposed in the recent approve Strategic Transport Planning (STP) to meet the future demand in Dhaka Metropolitan city. One of these is the BRT Line-2. The actual BRT-2 route from Gabtali to Sayedabad was planned through Zahir Raihan Sharani, but in this study, the route was examined from Gabtali to Azimpur.

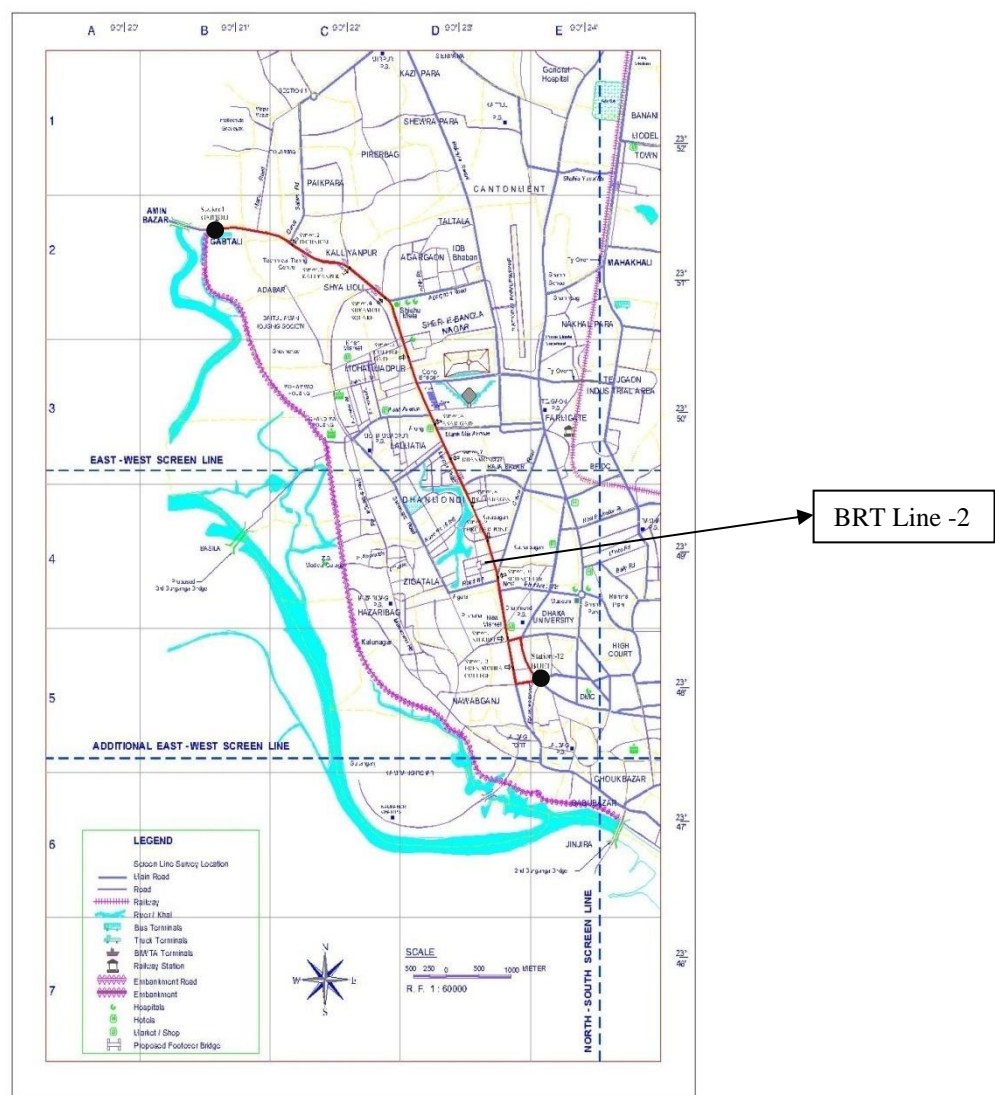
Bus Rapid Transit (BRT) is a high-quality bus-based transit system that provides metro-level services in a timely, comfortable, and cost-effective manner.(Machler & Golub, 2012) It accomplishes this by providing dedicated lanes, with bus lanes and landmark stations often located to the center of the road, off-board fare collecting, and quick and frequent service. (Wirasinghe et al., 2013)BRT is far more dependable, convenient, and faster than ordinary bus services because it has features akin to a light rail or metro system. BRT, with the correct characteristics, can eliminate the delays that plague ordinary bus services, such as getting caught in traffic and having to queue to pay on board. BRT may be selected as the desired transit mode to serve a corridor or it may be utilized as part of a corridor development strategy with higher order transit modes considered for the future. (Wirasinghe et al., 2013) Not only these, it also helps improving the fuel efficiency and technology of buses by reducing vehicle emissions and alleviating harmful environmental effects. So, the importance of bus rapid transit in such a vast city with such high travel demand cannot be overstated. By considering all of these issues, building BRT Line -02 now demands time for the betterment of the people of Bangladesh and for this a well-thought-out strategy is required.

2. BACKGROUND OF THE STUDY

Dhaka is the only city of its size without a well-organized, regularly scheduled bus system or any other form of mass rapid transit. Low-occupancy transport modes, such as autos and cycle rickshaws, grew at a significantly faster rate than high-occupancy modes, such as buses and minibuses, according to trends. Rickshaws, an outmoded method of transportation in a densely populated and rapidly expanding metropolis, accounted for 53.3 percent of total vehicles. (Mahmud & Anwar, 2012, Mahmud, et. al., 2013). As a result, small capacity vehicles, particularly NMTs (70 percent), continue to occupy the majority of road space (STP, 2004). There are no priority procedures in place for buses on the road, and buses are the only mode of public transportation available in the city. On the road, there are no priority measures for buses, whereas buses are Dhaka's only mode of public transportation. Road space occupied by rickshaws (non-motorized three-wheeler) is 73%, and by cars and buses is 19.7% and 4.4% respectively (Mahmud & Anwar, 2012). Among the modes, car occupies the highest space for carrying a person which is 75.8%. Rickshaw occupies 21.9%, and bus 8.7% (STP, 2005). As a result of this transportation condition, traffic congestion, travel delays, and accidents have worsened, while accessibility, comfort, safety, operational efficiency, and the environment have all deteriorated.

The current passenger transportation scenario in metropolitan Dhaka demonstrates that existing mass transportation systems are insufficient to meet rising demand. Dhaka has a share of 1% of Bangladesh's land, but is home to 10% of its total population and 30% of urban population. The huge population in a small area with limited transport infrastructure and services poses a challenging situation for the transport sector.(Mitra & Khan, 2019) Furthermore, this service is ineffective, unproductive, and risky.

Passengers are frequently facing long waiting times, delays in plying, over-crowding, lack of comfort, long walking distance to bus stops as well as between bus stops and destination. Again, a well-planned city's road network should occupy 25% of the whole area; however Dhaka's road network occupies only 9% of the total area (Mitra & Khan, 2019). As a result, the capacity of these routes in relation to total transportation demand is significantly lower. The number of vehicles on the road is rapidly increasing, while the number of roads and area available for new road construction is extremely restricted. As the road facilities have not been developed at the same pace of population and size, the city is notorious for traffic jams every day with the resultant effects of delay and concentrated vehicular emissions. Several attempts to ameliorate Dhaka city's traffic problem have been made, but they all fall under the category of short-term management measures. Long-term plans are required to keep the city movable and livable in the future. To deal with the city network's physical and infrastructural state, a well-organized, rapid mass transit system such as BRT or MRT is urgently needed. With the right features, BRT and MRT are able to avoid the causes of delay that typically slow regular bus services. But separate dedicated bus lanes must be provided in order to maintain desired travel speeds and on-time vehicle performance. The objective of this paper is to check the technical requirements and design possibility of BRT Line-2.



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Figure 1: Proposed 'BRT Gabtali-Azimpur' route in this project

3. METHODOLOGY

The pre-feasibility study takes into account the current situation in this study. The Gabtali to Azimpur route, via Zahir Raihan Sharani Road, was chosen for this study. According to STP-2004, the BRT line-2 will service Dhaka's western corridor and will operate between Gabtali and Saidabad Terminal.

4.1 Data Collection

On May 25th, 2019, a survey of the route was conducted, beginning at the Gabtali bus terminal and ending at Azimpur. During the operation, the current roadway condition was noted. The number of lanes, traffic conditions, side road placements, hospital sites, drainage conditions, and other factors were recorded during the survey. A good station location for BRT Line -2 was chosen mostly based on the information. The traffic volume values of the intersections were investigated for the purposes of this study's design. To quantify traffic volume, both direction traffic data was collected for one hour at the Technical Junction foot over bridge and near Shahid Swarwardi Hospital. Reaching New Market traffic condition including pedestrian movement were observed.

Following the collection of primary data, secondary data such as annual average daily traffic (AADT), drainage condition, road length, and traffic condition were obtained from the Greater Dhaka Urban Transport Improvement Project BRT: Gazipur- Airport (Under-Construction) of the Roads and Highways Department, Dhaka Public Transport Improvement Project BRT- Airport- Mohakhali (Proposed) of the Roads and Highways Department, Economic Circle of the Roads and Highways Department (RHD), and Dhaka Transportation Department Relevant information for this project was gathered from under construction BRT: Gazipur- Airport projects, such as a feasibility study, an approved project plan, costing information, and drawings. The whole route of BRT: Gazipur-Airport was inspected with the help of project staff in order to have a detailed picture of the data collected.

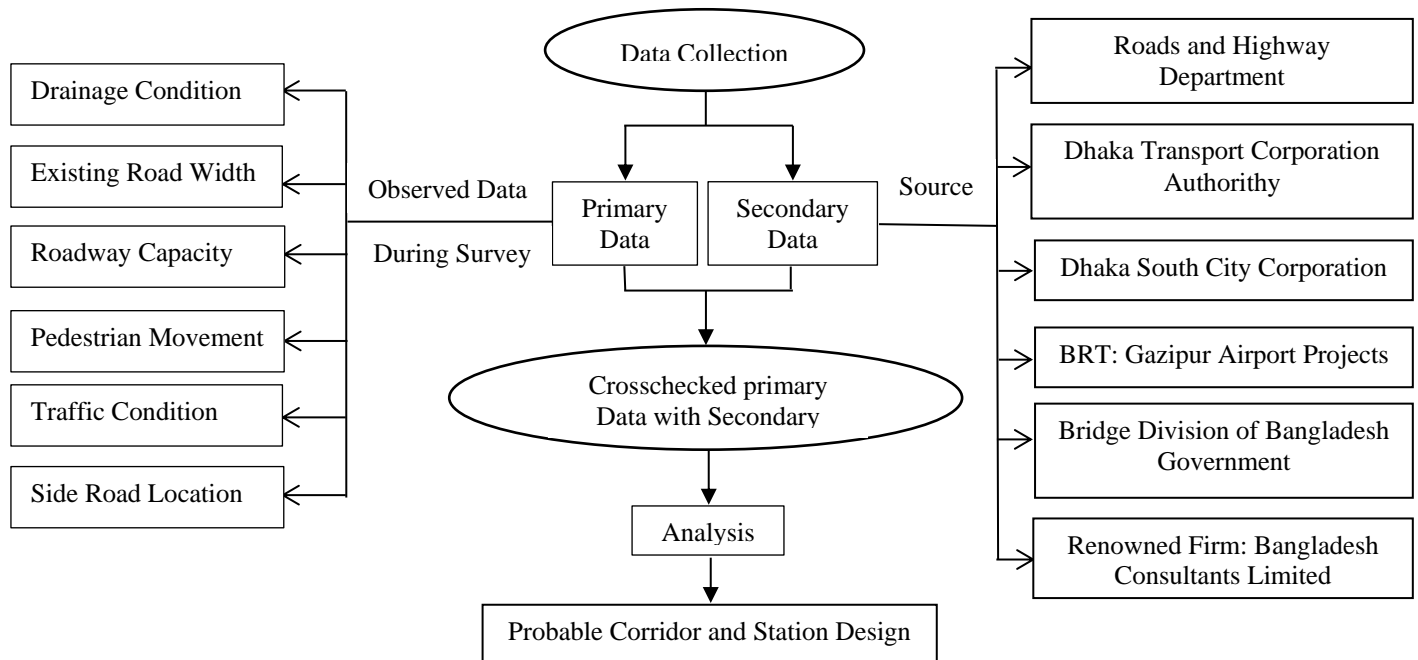


Figure 2: Methodology of the project

4. ANALYSIS AND RESULT

The provision of a distinct lane along the route is the first and most critical need for establishing BRT. Figure 2 depicts the land required for BRT deployment, as recommended in STP, 2004:

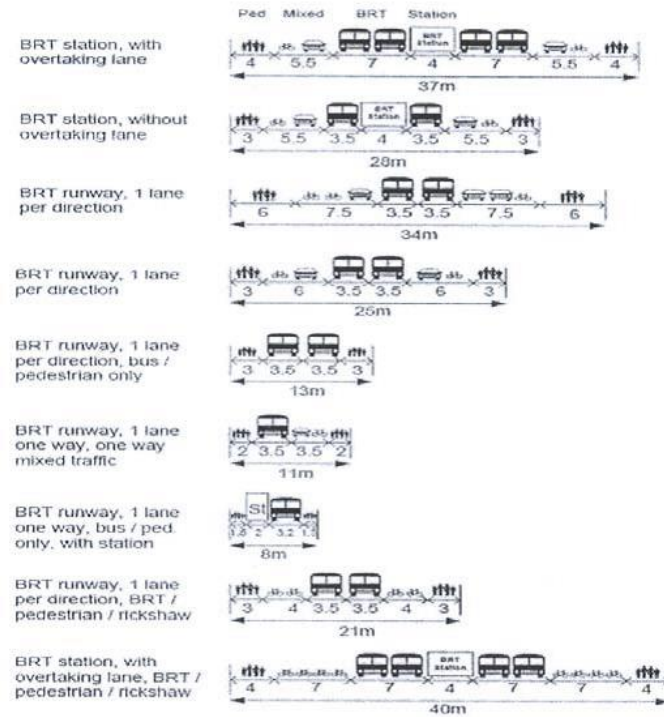


Figure 3: Land requirement for BRT implementation

Figure 3 shows that a BRT station with an overtaking lane requires a minimum road width of 37 meters. The required road width for a BRT station without an overtaking lane is 28 meters, while the needed road width for a BRT runway with one lane in each direction is 25 meters. According to survey data, the proposed route's maximum road width is 33.5 meters. As a result, a staggered BRT station with an overtaking lane is feasible. Three corridors make up the whole BRT Line-2 route. Figure 4 depicts the location and length of corridors 1, 2, and 3, as well as the places of stations, which are indicated by legends.

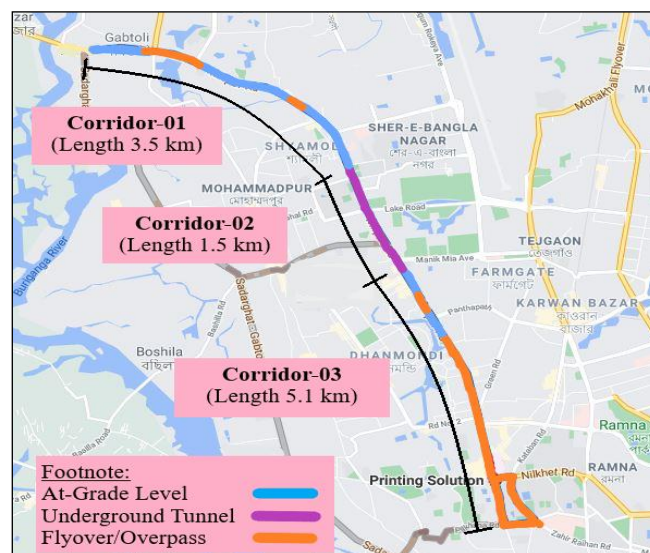


Figure 4: Proposed BRT Corridors in this project

4.1 Corridor Design

Between Gabtali and Shyamoli Square, the Corridor-01 is considered. This 3.5-kilometer circuit has four stations along with it. The average road width of this corridor is 32m. The normal laneway width is 3.7 meters, according to the "Roads and Highways Department of Bangladesh". Therefore, eight lanes are now accessible in this corridor. As a result, there is no need for a road expansion or land purchase. In this route, there will be three overpasses: two for BRT vehicles and one for regular traffic. At Technical Intersection and Shyamoli Gastola, BRT overpasses will be provided. The overpasses will be 750 meters long and 150 meters long, respectively. Gabtali will be the location for the Bus Depot. The BRT bus will travel to the depot after arriving at Gabtali station, where the front side of the vehicle will be turned back to the corridor. To minimize conflicts between BRT buses and regular traffic, an overpass for normal traffic heading towards Savar will be built at Gabtali; specifically, Gabtali Bus Depot. The bridge will be 150 meters long.

Muktijuddha Tower is the beginning of Corridor-02, which leads to Asad Gate. In this corridor, there are two stations: one at Muktijuddha Tower and another at Asad Gate. This corridor measures 1.5 kilometers in length. The Prime Minister's Official Residence (Gonobhobon) and the "National Parliament House" are both located in this location, some specific precautions must be observed in corridor 02 as well. For the safety concern, an underground tunnel has been proposed that runs from "Care Medical College" to "Manik Mia Avenue." The tunnel runs for 1.5 kilometers.

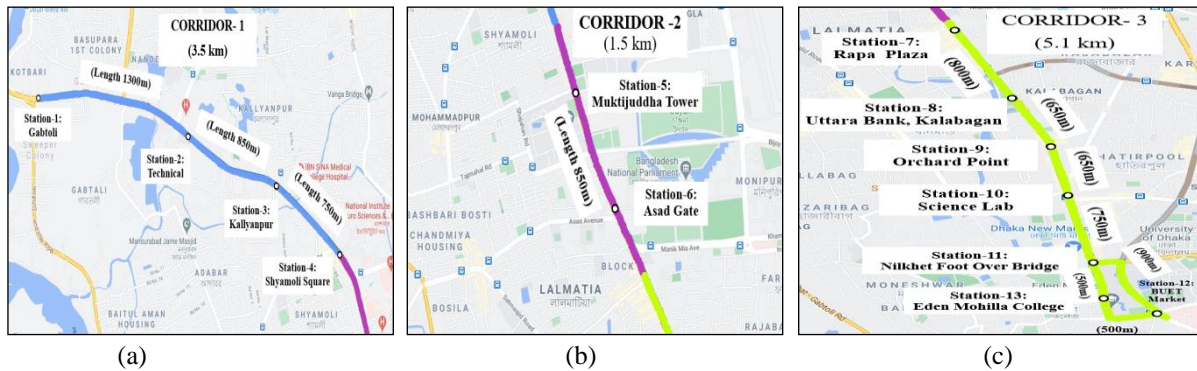


Figure 5: Proposed plan view of BRT Line-2 corridors

Rapa Plaza, Dhanmondi 27, is the starting point for Corridor-03. It continues towards Eden Mor, turning left from Nilkhet Mor and completing a loop that includes Bangladesh University of Engineering and Technology (BUET) Market, Eden Mohilla College, and Nilkhet Mor. In this route, near the Sobhanbag mosque, one overpass will be built. This overpass will be 200 meters long. From Dhanmondi 10, a two-lane flyover runs all the way to Nilkhet. The entire New Market area was found to be quite active, with a high volume of foot traffic. The existing road width was found 22 meters in Nilkhet. As there are no possibilities to enlarge it a single lane-flyover was proposed. The single lane circle flyover will return to Nilkhet after completing a loop through Zahir Raihan Road, and Eden Mohila College. The dual lane flyover is 1.8 kilometers long, while the single lane is 2 kilometers long. As a result, the entire length is 3.8 kilometers.

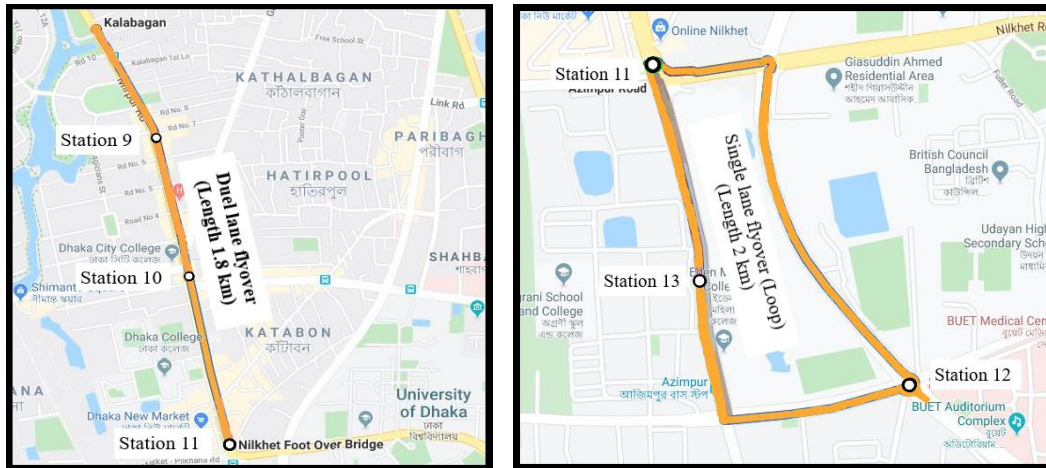


Figure 6: Proposed plan view of Dual lane and Single lane flyover

Here are some of the problems that were discussed. Because it is a single-lane flyover, any bus that does not run properly, has a malfunctioning engine, or has any other issue will require immediate repair. A pick-up vehicle will then arrive to remove the damaged bus away for prompt repair. Because it is an articulated bus, the pick-up vehicle will transport the bus from the front. It's conceivable that hauling from the back isn't doable. As a result, a location for bus maintenance is necessary immediately. It will be built above ground at the BUET Roundabout, with no other vehicles allowed to use it. The BRT bus may proceed to the next station following the repair.

Table 1: Details of Corridors in BRT Line-2

Division	Station	Distance Between Stations (m)	Avg. Road Width (m)	Station Position
Corridor-1 (3.5 km)	Gabtali	1300	32	At Grade
	Technical	850		At Grade
	Kallyanpur	850		At Grade
	Shyamoli Square	850		At Grade
Corridor-2 (1.5 km)	Muktijuddha Tower	850	33.5	Below Grade
	Asad Gate	650		Below Grade
Corridor-3 (5.1 km)	Rapa Plaza, Dhanmondi	800	22	At Grade
	Uttara Bank, Kalabagan	650		At Grade
	Orchard Point, Dhanmondi	650		Above Grade
	Science Lab	750		Above Grade
	Nilkhet Foot Over Bridge	900		Above Grade
	BUET Market	500		Above Grade
	Eden Mohilla College	500		Above Grade
Nilkhet Foot Over Bridge	500	Above Grade		

4.2 Cross Section of Proposed BRT route

The average roadway width of corridor 1, 2, 3, 7 (At-Grade) is 32 m. As NMV is not permitted in this route, after implementation of BRT the remained road will be used for mixed lane traffic. A typical cross section of proposed BRT Line-2 after implementation based on existing roadway condition is given below in figure 7 and figure 8:

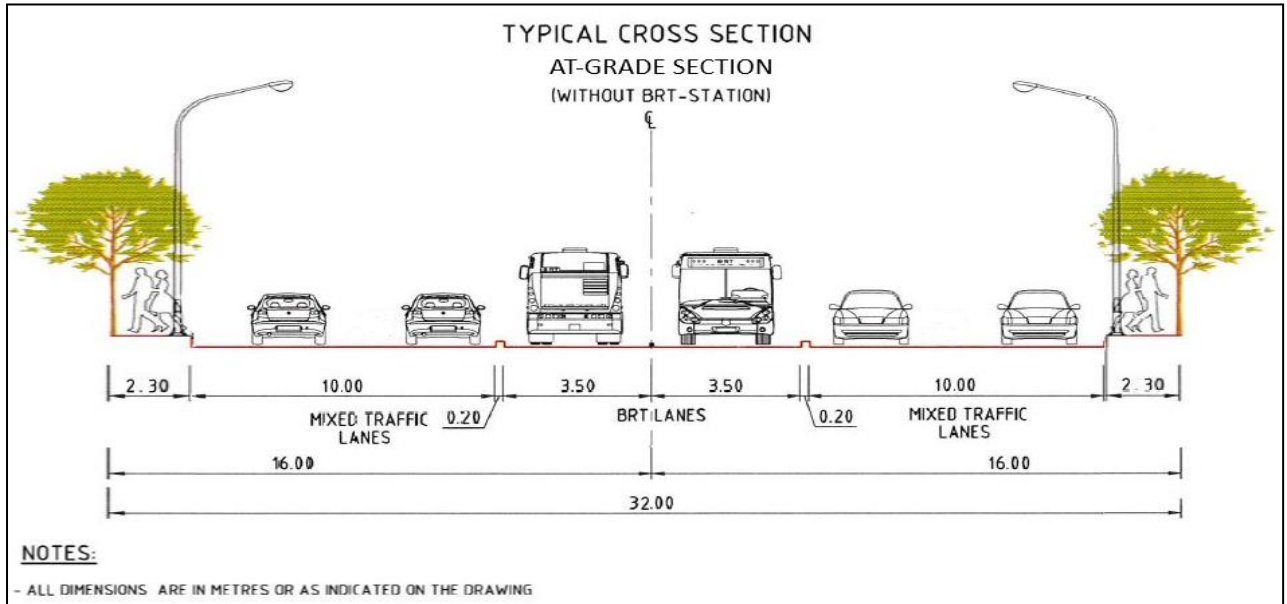


Figure 7: Proposed BRT Cross Section of Roadway to be implemented (without station)

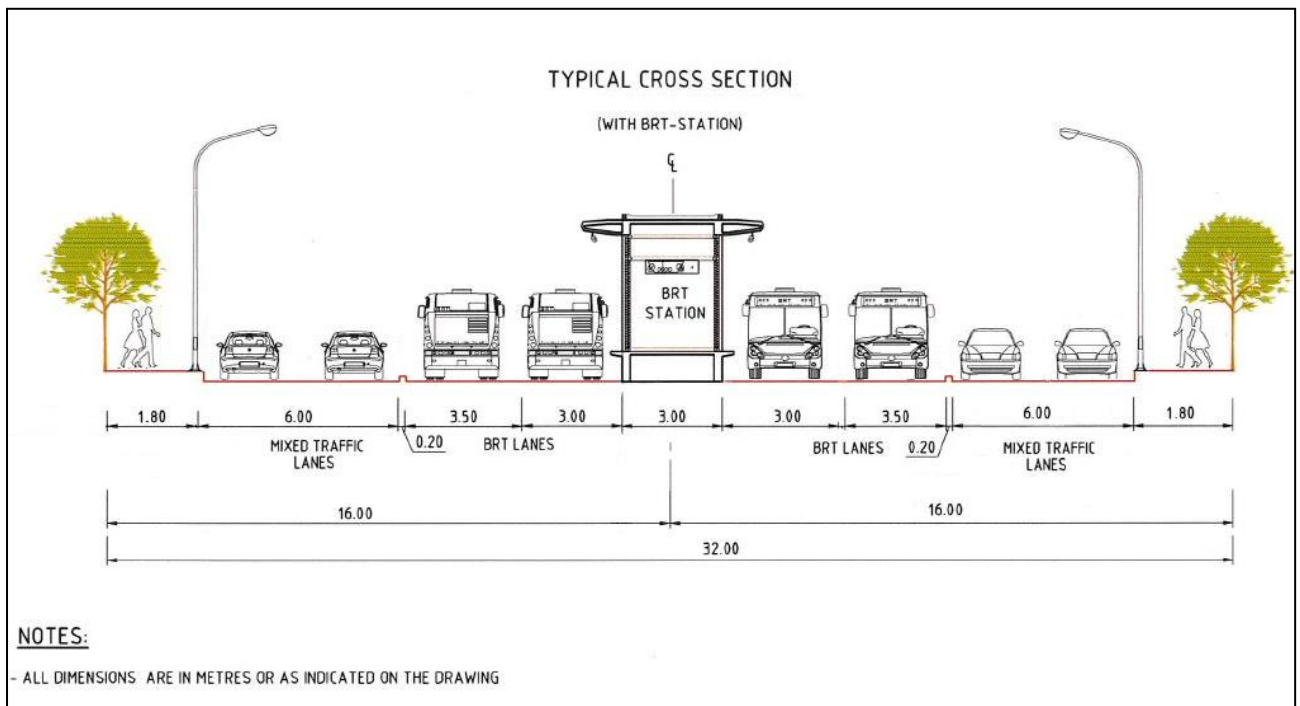


Figure 8: Proposed BRT Cross Section of Roadway to be implemented (with station)

Typical cross section of single lane flyover after implementation of BRT is shown below in figure 9:

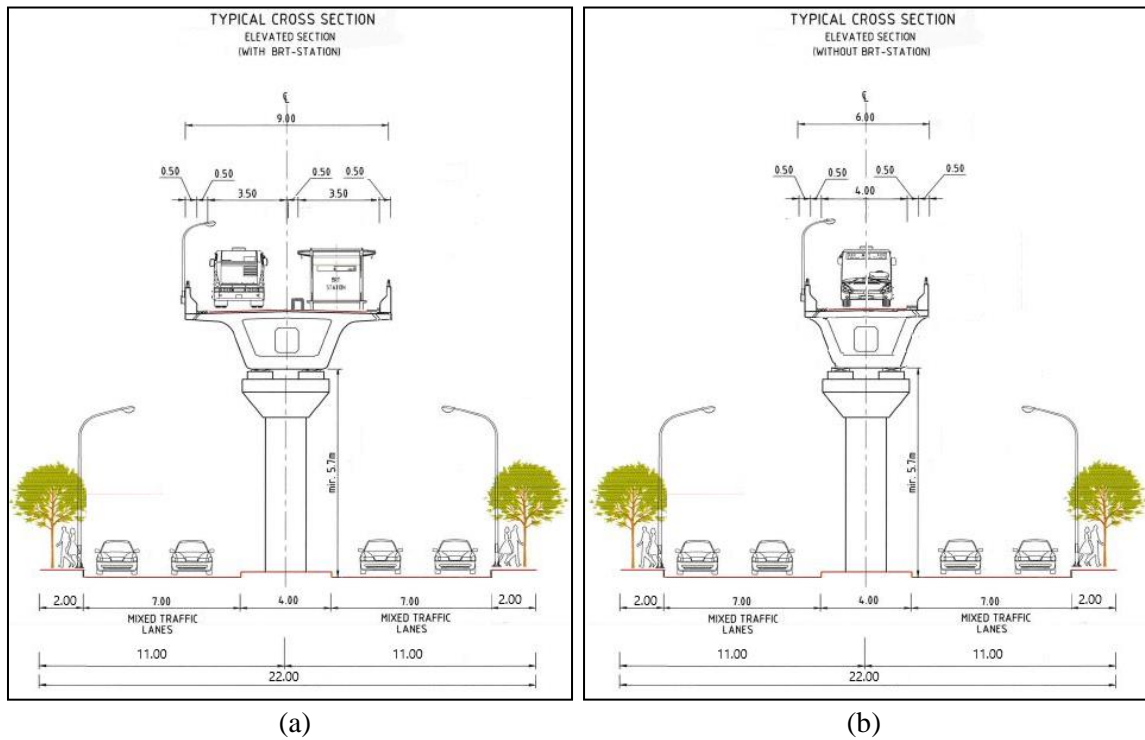


Figure 9: Proposed BRT Cross Section of Roadway (Single lane flyover) to be implemented (a) with station, (b) without station

A proposed Plan view of at Grade station is shown below in figure 10:

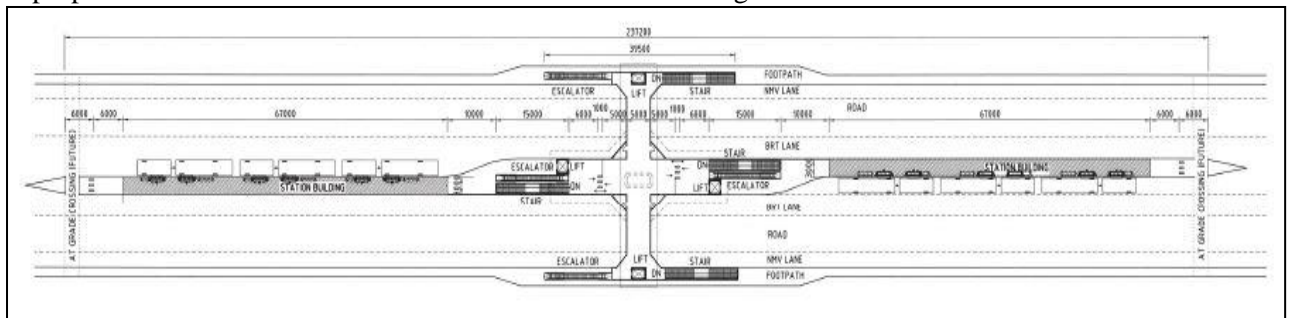


Figure 10: Proposed plan view of at Grade Station (staggered)

5. CONCLUSIONS

This research comprised a pre-feasibility analysis of BRT line-2's technical design. Based on road conditions, congestion, drainage, and key structures, the whole BRT Line-2 route was divided into three corridors. Following the creation of a technical design, it was found that by constructing flyovers/overpasses and tunnels, BRT may be operated along Gabtali to Azimpur. BRT may operate on current roads without the need for land acquisition or road expansion. This plan appears to be technically feasible, as the suggested design implies that BRT can run smoothly without any interruption.

REFERENCES

- Machler, L., & Golub, A. (2012). Bus Rapid Transit. *Green Cities: An A-to-Z Guide*. <https://doi.org/10.4135/9781412973816.n17>
- Mahmud, S. M. S., & Anwar, M. I. (2012). A Preliminary Feasibility Study of Bus Rapid Transit System

in the Context of Present Road Network in Dhaka. *SSRN Electronic Journal*, Hoque. <https://doi.org/10.2139/ssrn.2009988>

Mitra, S. K., & Khan, A.-Z. (2019). Transportation Infrastructure of Dhaka City : Status and Challenges. *400 Years of Capital Dhaka and Beyond Volume III: Urbanization and Urban Development, May 2011*, 1–11.

Strategic, & Transport Plan (STP). (2005). “The Strategic Transport Plan for Dhaka”, Strategic Transport Plan (STP). *The Louis Berger Group Inc Bangladesh Consultants Ltd, January*, Part. 1, pp. 4, 2005.

Wirasinghe, S. C., Kattan, L., Rahman, M. M., Hubbell, J., Thilakaratne, R., & Anowar, S. (2013). Bus rapid transit - a review. *International Journal of Urban Sciences*, 17(1), 1–31. <https://doi.org/10.1080/12265934.2013.777514>