PROVISION AND NECESSITY OF RAPID RAIL SERVICE IN DHAKA CITY AS A PART OF STRATEGIC TRANSPORT PLANNING: AN EXTROSPECTION

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ABSTRACT

Dhaka, the capital of Bangladesh is one of the least motorized mega cities in the world with a current population of over 16 million at annual growth rate of nearly 4.3 percent. The rapid rise in population along with increased and versatile urban land use patterns has generated considerable travel demand as well as numerous transport problems in Dhaka. It has resulted in deterioration in accessibility, service levels, safety, comfort, operational efficiency and urban environment. The congestion and pollution problems are rapidly growing due to the combined effects of rapid motorization and urbanization. There is now an ever-increasing urgency for mitigating the complex transportation problems in Dhaka by augmentation of mass transit modes. It is observed that share of mass transit is very low which is only 27 percent of vehicular trips and walking still remains as the dominant travel mode with nearly 62 percent of total person trips. In the absence of a dependable and adequate public transport system, major share of road space remains occupied by the small capacity vehicles. The existing mass transit system in the form of bus has not been able to increase its share of catering demand for its service deficiencies like crowded condition, long waiting time, lack of easy transfer, large distance of bus stops from origin, long boarding time. There is an urgent need for augmentation of present mass transit system to cater for such service deficiencies. In this paper an attempt has been made to venture for a standard mass transit system to provide the desired service characteristics. As a potential mass transit option in Dhaka, rail based mass transit system tramway has been highlighted with description of its inherent benefits of cost and service characteristics with particular reference to the prevailing socio-economic context and in the light of major themes of different studies.

Keywords: Mass Rapid Transit (MRT), Strategic Transport Planning (STP), Gross Domestic Product (GDP), Gross National Income (GNI), Storm Water Management and Road Transit (SMART).

INTRODUCTION

Dhaka is the capital city of Bangladesh. It is the largest and most industrialized city in a nation of 166 million people. Dhaka is the administrative, commercial and cultural centre of the country and continues to serve as the traditional centre of the wholesale trade. The population of the city is estimated to be 17 million people (2004). Over the last 10 years, the population of Dhaka has more than doubled. This growth has exceeded the demand for service in all sectors of society and the quality of life has been deteriorating. In terms of transport infrastructure and service, the city is in a "catch-up" situation and is now facing a crisis point when even small increases in activities and minor events cause wide spread confusion, time wastage and potential danger to the people of the city. The Government is committed to providing better living conditions for the population and one of the main sectors in which action will be taken in urban transport. From a present population of around 17 million in greater Dhaka area, it is anticipated that the population in 20 years will reach approximately 36 million.

Dhaka is one of the least motorized cities in the region approximately 32 motorized vehicles per 1000 residents. Only 14% of mechanized journeys are made by automobiles and about 60% of people travel by buses. The use of motorized traffic is still in its infancy in Dhaka and there are a large number of ways in which to plan for the future increases. In future, wider roads will be planned and better public transport services implemented. As a result of these differences, it is likely that there will need to be a control of automobile access to the older parts of the existing city with higher accessibility being planned in the newly planned areas with some areas being designated as car free zones. Rail service may be one of the potential sectors that can be incorporated to minimize the sufferings of the commuters.

SCOPE OF THE STUDY

It is observed that rickshaws and other non motor transport account for 50% or more of the overall traffic flow on roads. After pedestrians, the rickshaw is the most preferred mode of transport in Dhaka. About 60% of trips are on foot while almost half of the remaining trips are on non-motorized vehicle. Rickshaws in the metropolitan area account for over 40% of passenger trips, and 5% of freight by weight. About 40% of loaded rickshaws are used either by women, children or people with goods. Other available modes are so crowded that the dwellers are not able to use them anyway. Across all modes of transport average trip lengths for non motorized mode is about 1.3 km (36 minutes) and for motorized transport is 9 km (45 minutes). Which produces huge traffic congestion?

Traffic has grown in Dhaka from several hundreds to hundreds of thousand motorized and non-motorized vehicles; the road network remains virtually the same for the last two decades. There have been cosmetic changes here and there, and beautification of some roads, road islands and road dividers, but net increase to road mileage has been very negligible. Therefore, when there is a pressure on a major road due to some reason, there is hardly any alternative road to take. This is the reason of sever congestion during peak hour. Delays due to congestion in different intersections is considered to estimate the economic value (the delay cost) of the delays. This cost can be aggregated to the economic viability of the modal shift of transport.

The provision of augmentation of mass transit system is an urgent necessity to ensure mobility need, road safety, and livable urban environment for Dhaka city in future. Rail based rather than road based mass transit system seems to be more appropriate with desired service quality of trip makers of Dhaka.

ORGANIZATION OF THE STUDY

This study is based on Strategic Transport Plan (STP) for Dhaka. Then the Rapid Rail service in development cities are studied. Then the comparison of the factors with Dhaka city is done. Suitability of Rapid Rail in Dhaka city is studied. Finally recommendations and future study is drawn.

Strategic Transport Plan for Dhaka (STP)

Primary goals

As Dhaka moves forward into a future that is expected to include rapid continued growth and development the vision is to create a safe, efficient and effective multi-modal transport system that serves the needs and interest of everyone. This forward planning concept creates an ultimate vision of where we want the city to be in20 years. The primary goals which help define the strategic plan have been identified and refined over a long period of consultation process included informal meetings and more formalized workshops and round table seminars. The following eight primary goals were identified:

Efficiency

Ensure that the maintenance, operation, reliability and expansion of the transportation sector service and facilities occur in an efficient and effective manner with emphasis on maximizing the use of the full potential of the existing resources and investments.

Mobility and Accessibility

Provide a basic level of mobility and accessibility for all segments of society to ensure reasonable access to employment, educational, health, social and other programs services and opportunities.

Safety

Develop and implement a coordinated and comprehensive set of safety improvement measures addressing all aspects of the transportation system to reduce the number of transportation related deaths and the number and severity of transportation related injuries and property damage.

Affordability

Ensure a suitable balance between the transportation sectors financial requirements for maintenance operations and capital investments and anticipated financial resources.

Achievability

Develop transportation operations and capital investment projects and services that fit with in the skills capabilities and constraints of the institutions responsible for implementation and have a higher probability of implementation and operational success.

Economic Development

Support economic growth and competitiveness domestically and internationally.

Social Development

Support programs and efforts directed toward the alleviation of poverty and the promotion of self sufficiency and the provision of opportunities ad services that serve the requirements of both women and men equally.

Environment

Minimize the transportation sectors negative impact on the environment and create increased transportation related environmental awareness in society.

Transportation strategie

The first step in the process as used in the STP was to identify a limited set of discreet transport strategies. These initial strategies represented a broad range of ways in which the development of the transport sector could proceed. The four transport strategies selected at this early stage were characterized as follows:

Transport Strategy One (TS1) - Auto/Roadway Emphasis.
Transport Strategy Two (TS 2) -Bus/Transit E emphasis.
Transport Strategy Three (TS 3) -Auto/Roadway and Bus/Transit Mix.
Transport Strategy Four (TS 4) -Continuation of Current/Recent Practices.

Figure shows the relationship among the first three strategies. The figure depicts each of the three strategies in relation to the varying levels of auto/road emphasis and bus/rapid transit emphasis. For example Transport Strategy One (TS1) has a high level of auto/road emphasis and a low level of bus/rapid transit emphasis. Transport Strategy Two (TS2) is the reverse with a high level of bus/rapid transit emphasis and a low level of auto/road emphasis. Transport Strategy Three (TS3) is a mix of both auto/road and bus/transit, albeit each at only a moderate level of emphasis.
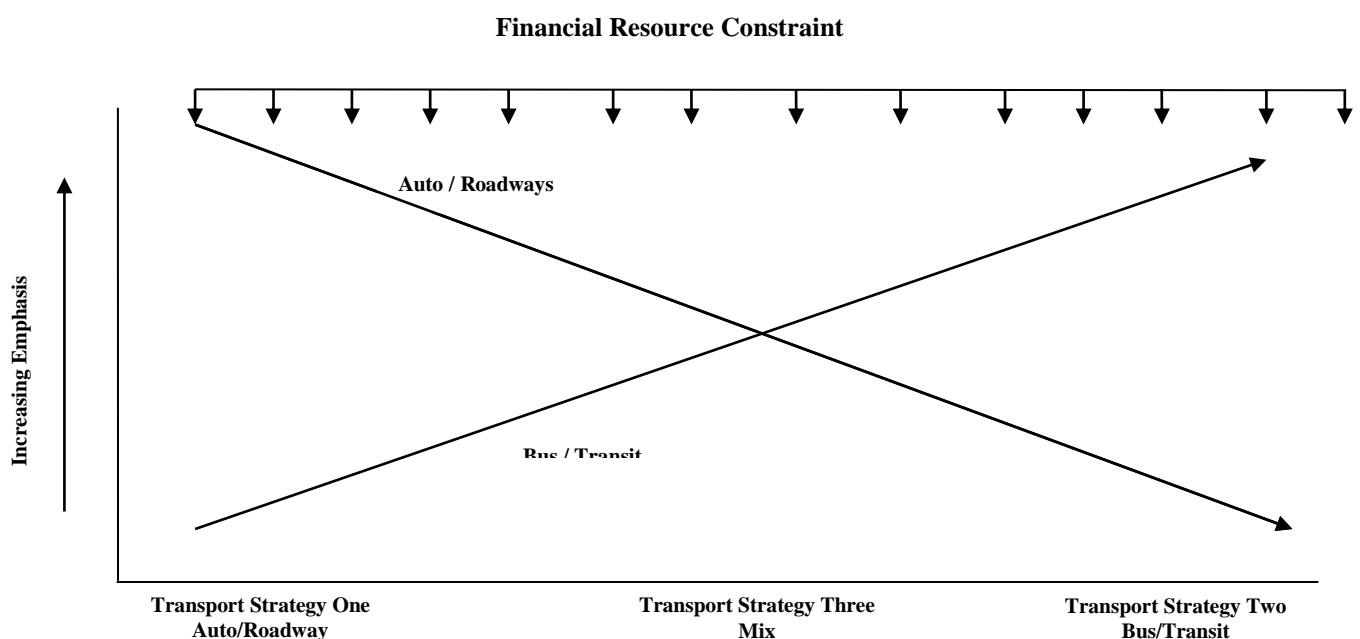

Table 1. Financial Resource Constraint of Bangladesh.

Alternative Transportation Strategies

Based upon an initial assessment of the output from the travel demand model, ten alternative transportation strategies were identified. These strategies include a broad range of road investment, transit investment and various mixes of both road and transit investments, together with other multi-modal transportation components.

The ten transportation strategies developed and tested are mixtures of different levels of Road investment and different combinations of mass raid transit systems. In effect, the roads components represent successively higher levels of investment. The "Roads" level refers to the committed projects mostly defined in the DUTP project and comprising a basic 13 projects "Roads +" is an investment in highways over the 20 years period amounting to 42 projects of differing importance. The "Roads ++" package adds a further 8 highways projects and strengthens the developments in the fringe areas. Finally "Roads +++" adds an elevated expressway system in order to represent a high-end auto-orientated strategy. In terms of Mass Rapid Transit (MRT), the Bus Rapid Transit (BRT) element refers to a modern medium capacity system of express buses operating largely at-grade and within the right of way of existing and future roads. The Metro element refers to a grade separated (elevated or below ground) electric train operating in high capacity mode. Where both BRT and Metro are included, the mass rapid transit network uses the best of both aspects to create a blend of systems.

Table 2. Ten Alternative Transportation Strategies.

Ten Alternative Transportation Strategies				
Alternatives	Roads	BRT	Metro	Cost $
Base	Roads	No	No	149 m
1 a	Roads +	BRT	No	3.0 bn
1 b	Roads +	BRT	Metro	5.5 bn
1 c	Roads +	No	Metro	6.7 bn
2 a	Roads ++	BRT	No	3.3 bn
2 b	Roads ++	BRT	Metro	5.8 bn
2 c	Roads ++	No	Metro	6.9 bn
3 a	Roads +++	BRT	No	4.2 bn
3 b	Roads +++	BRT	Metro	6.7 bn
3 c	Roads +++	No	Metro	7.9 bn
3 d	Roads +++	No	No	3.2 bn

The following logic was used in order to eliminate strategies and gradually arrive at the final selection:

Stage 1

The majority of the populace in the city relies either on non-motorized travel (walk, cycles, rickshaw etc) or on public transport for its mobility. As a result strategies without an emphasis on public transport are not favoured. Although Strategy 3d has a low price tag on it [$2.2 bn] and is within the anticipated budget, it shows more time used in operations [1067000 Person-Hours compared with 835000 for 3a for example]. Also Strategy 3d has a lower average speed (13.4 kph) than all other strategies .This low operating speed is occurring because of the absence of a high quality public transport provision. Both of these factors will mean that the strategy has fewer benefits than most others.

Conclusion 1

Eliminate Strategy 3d.

Stage 2

It is a fact of life that there are never, or hardly ever, unlimited resources. In Bangladesh, this lack of resources is particularly evident. The STP team made an estimate of the likely availability of financial resources for transportation infrastructure in Dhaka. Taking account of the Government provisions, the team

estimated a figure of approximately USD$100m per year. Hence over the 20 year life of the project, there would be a likely sum of USD$20 billions available. Allowing however, for additional funding from the Government and keen interest from the private sector, the figure can be increased say by 100% to total of USD$4 billions. Allowing for this increase, it is considered that any strategy which requires more than 25% above this figure [i.e. about $5bn or more] will be difficult to mobilize.

Conclusion 2
Eliminate Strategies 2c ($4.8 bn), 3b ($5.3 bn) and 3c (5.3 bn).
Stage 3
Of the remaining six strategies [1a, 1b, 1c, 2a, 2b, and 3a] contain just the Road+ package which does not contain construction of the Eastern and Western Bypasses which are part of the Road++ package. Since it is considered that these are key links in developing the Growth pole Scenario it is believed that the additional US$ 282 millions contained within Roads+++ is worth the investment.

Conclusion 3
Eliminate Strategies 1a, 1b and1c in favour of 2a and 2b due to the need for additional roads infrastructure in the fringe areas particularly the Eastern and Western By-passes.

Stage 4
Two of the remaining three strategies (2a and 3a) have a common theme which is an extensive mass rapid transit system based on BRT technology alone. There is no Metro system in these strategies. The variant is the level of investment in roads. Although the overall planning emphasis has been rightly placed on public transport, it is also certain that there is a need for an improved road system in the city. The main difference in the two strategies is that in 2a the package includes 50 road projects totaling almost $ 1 bn .Strategy 3a then adds a large package of elevated expressways at an additional cost of about $1 bn .

Conclusion 4
Eliminate Strategy 2a in preference to Strategy 3a since the assessments show that the addition of the larger roads package proves to be beneficial in operational terms and provides the city with a third level of super highways.

Stage 5
Of the remaining two Strategy 2b and Strategy 3a the argument is principally one of the need and demand for mass rapid transit. It is argued that to place all the reliance on one system only (namely the BRT system) could place the city at risk. It is better to have the flexibility provided by more than one system. Hence a blend of BRT and Metro is preferred.
The STP stops at the year 2024 at a target population level of 36 millions, the cities growth will not stop then. Almost certainly, as BRT system capacities are exceeded, the ultimate system will need to include a Meter system. In order to plan for this phase of the STP 20 year period so that when the time is right, design can be completed and resources identified for the introduction of the Metro system. As the reviews of the STP plans are made (a review every 5 years is recommended), so should the reviews of the mass rapid transit system. For this reason the planning of BRT, MRT and Expressway systems should be considered in an integrated manner from the outset so as not to prejudice any of the three subsystems.

Recommendation
Strategy 2b is recommended as the Selected Strategy because , in the Consultants' views it represents the best balance between public transport provision and individual transport to serve the future needs of Dhaka and also offers the optimum flexibility in mass rapid transit bearing in mind full knowledge of the context of reasonably expected financial resources.
In order to obtain the resources to enable Strategy 2b to be successful, the following actions should be considered by the Government:

An increase of the share of budget allocated to transport in the Dhaka area by a minimum of 50% over previous years.

Pursuit of an increase in its applications for donor funding to target at least a 50% increase in previous funding in the transport sector.

Aggressive pursuit of private sector funding sources especially for construction and operation of the elevated expressways and the mass rapid transit system.

Introduction of a special levy in the form of a government surcharge to be allocated for transportation investment.

Floatation of government bonds and the identification of restrictions (if any) which would be placed on the persons buying them.

Rapid Rail Service in Developed Cities

England (London)

The London Underground is a metro system serving a large part of Greater London and neighboring areas of Essex, Hertfordshire and Buckinghamshire in the UK. It is both the world's oldest underground railway and the oldest rapid transit system. It was also the first underground railway to operate electric trains. It is usually referred to as the Underground or the Tube—the latter deriving from the shape of the system's deep-bore tunnels—although about 55% of the network is above ground. The earlier lines of the present London Underground network, which were built by various private companies, became part of an integrated transport system (which excluded the main line railways) in 1933 with the creation of the London Passenger Transport Board (LPTB), more commonly known by its shortened name: "London Transport".

Table 3. Short Description of London

| Subject	Description
Area	Greater London, Chiltern, Epping Forest, Three Rivers and Watford. About 400 sq.km
Population	10.5 million
Population density	986 persons/km²
Growth Rate	0.45%
GNI Per capita income (Millions of USD)	2,804,437
Transportation modes	Bus, Taxi, Private car, Metro.
GDP	
MRT fare	.13 British Pound per Km
Construction cost of MRT	

Picture 1: underground rail network of London

United State Of America (Network)

Metro Rail is the public transit rail system in New York, USA; it is operated by the Niagara Frontier Transportation Authority, or NFTA. The system consists of a single, 6.4-mile (10.3 km) long line that runs for most of the length of Main Street in the City of Buffalo, from HSBC Arena in Downtown Buffalo to the south campus of the University at Buffalo in the northeast corner of the city.

Table 4. Short Description of New York [17]

| Subject	Description
Area	Crisscrossing New York city. Total 1355 sq km
Population	15.8 million
Population density	3256 persons/Km²
Growth Rate	0.98 %
GNI Per capita income(Millions of USD)	13,807,550
Transportation modes	Bus, Taxi, Private car, Metro.
GDP	
MRT fare	
Construction cost of MRT	
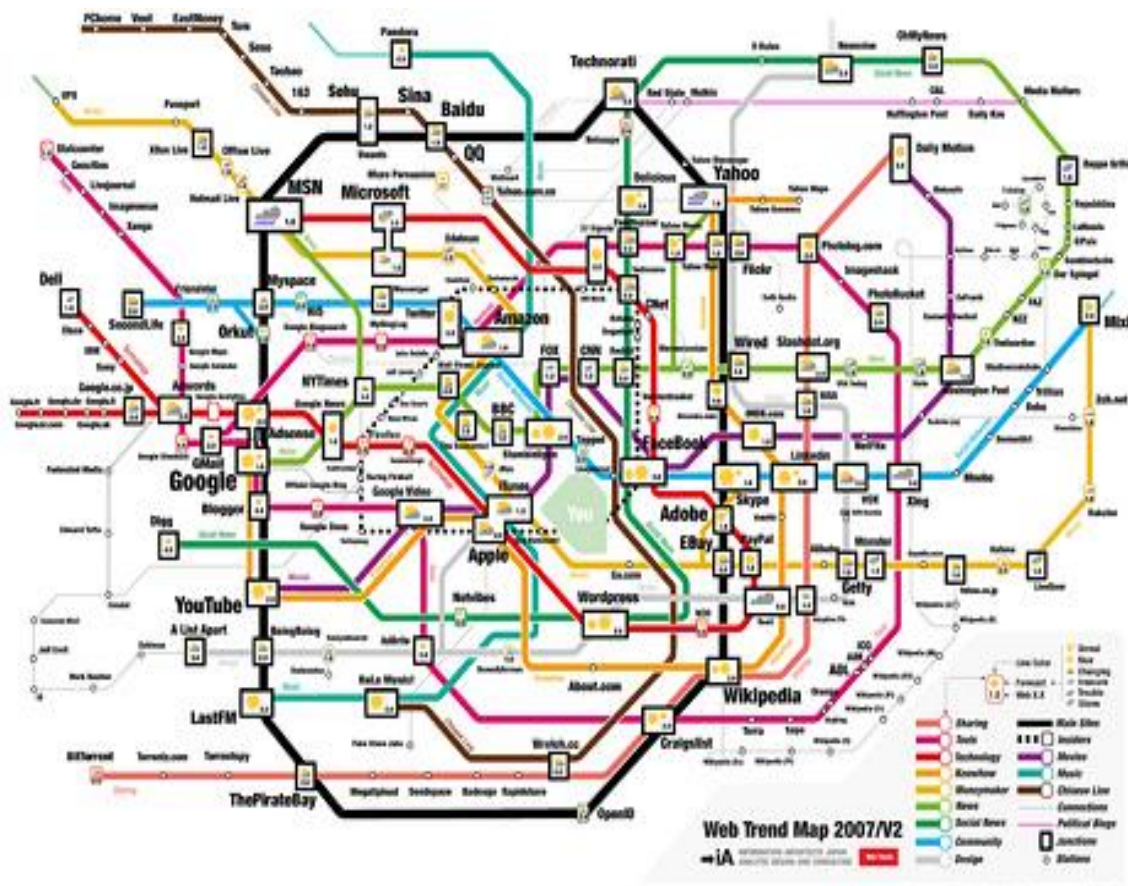
Picture 2: Under ground rail network of New York

India (Calcutta)

The Calcutta Metro or Calcutta Metro is the underground rail network in Calcutta, India. It is considered to have the status of a zonal railway but is not a zone. It is run by the Indian Railways. It was the first underground built in India with service starting in 1984; the New Delhi Metro, which opened in 2004, is the second. The line begins at Dum Dum in the north and continues south through Park Street, Esplanade in the heart of the city till the southern end in Tollygunge.

Table 5.: Short Description of Calcutta

Subject	Description
Area	DumDum, Shealdah, Tollygonj. Total15.11 km
Population	87,35,075
Population density	9634/ km²
Growth Rate	4.1
GNI Per capita income (Millions of USD)	1,100,695
Transportation modes	Bus, Taxi, Private car, Riksha, Trum, Metro.
GDP	6.1%
MRT fare	3 Indian Rupe per Km
Construction cost of MRT	USD 1500 per km

Total route length	16.45 km
Stations	17 (15 under ground, 1 on surface and 1 elevated)
Gauge	5 ft 6 in (1676 mm) gauge
Coaches per train	8
Maximum permissible speed	55 km/h
Average speed	30 km/h
Voltage	750 V D.C.
Method of current collection	Third Rail using 750V DC
Travel Time: Dum Dum to Tollygunge	33 min
Each coach can carry	278 standing, 48 sitting
Each train can carry	2558 passengers (approx.)
Interval between trains	7 minutes in peak hours & 10-15 minutes at other times
Total estimated cost of the project	Rs. 1825 crores (approx.)
Environment control	Forced ventilation with washed and cooled air
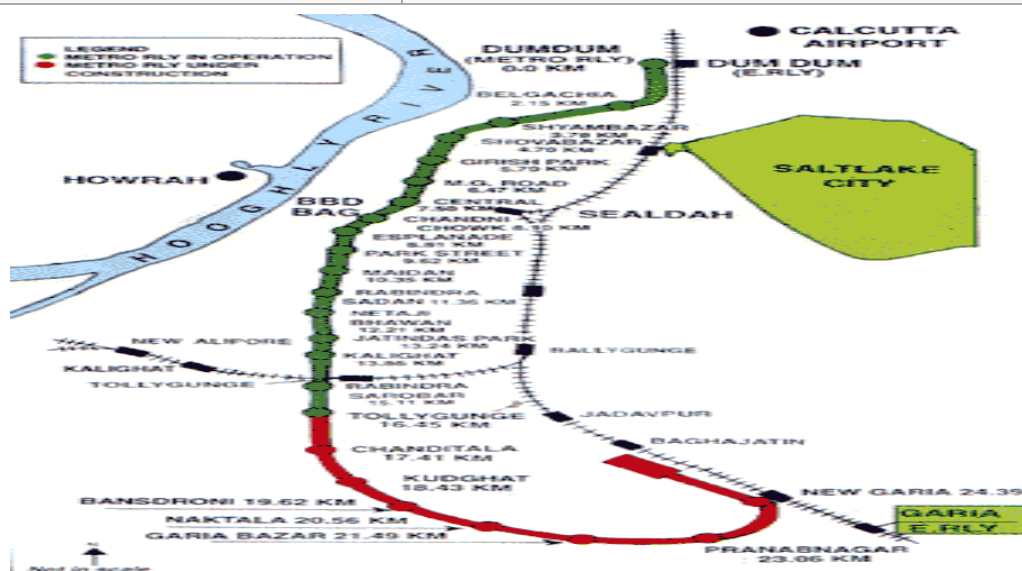
Picture 3: Under ground rail network of Calcutta

Comparison of Factors With Dhaka City

There are about 325,000 motorized vehicles on the Roads in Dhaka. This excludes some 300,000 to 500,000 estimated rickshaws in the City. Currently there are 330 Km of Primary Roads in the City carrying bulk of this traffic. This quantity of Primary Roads for this volume of traffic has proved to be totally insufficient. Further, the traffic volume, particularly the motorized traffic is increasing at the rate of 10% [31] per year on average. There are twin problems facing the transport sector in Dhaka. On one hand the volume of traffic is increasing every year as noted. On the other hand new areas of human settlement, business and commerce and industry are also opening up. So to solve the problem there will be an acute need to build more roads and add better connectivity within the built up areas and also add more arterial and primary roads in the new and projected built up areas as well other viable modes of transportation.

Table 6. Short Description of Dhaka

Subject	Description
Area	1529 sq km
Population	10.0 million
Population density	6545 persons/km²
Growth Rate	4.2%
GNI Per capita income (Millions of USD)	US $ 500 and about 73,689
Transportation modes	Bus, Taxi, Private car, Maxi, Tampo, Rikshaw.
GDP	5.3 % US $4.8 Billion
MRT fare	Proposed 10 taka per Km
Construction cost of MRT	Proposed cost U.S. $ 2.1 billion

Picture 4: Proposed Under ground rail network of Dhaka [33]

## Suitability Of Rapid Rail in Dhaka City

The big cities of the world, which have become successful in solving the transportation problem, have, at first, adopted the strategies to restrain the growth of population in the cities. At present, the population of London is 10.5 million and the population is not increasing for the last 35 years; the population of New York is 15.8 million and the population is not increasing for the last 25 years; the population of Tokyo is 12.0 million and the population is not increasing for the last 20 years; the population of Paris is 8.75 million and the population is not increasing for the last 30 years.

It is not automatic that the growth has been stopped in these cities, Rather it is through deliberate planning that the growth has been controlled. When the growth of the cities is controlled, then it becomes easier to solve the problems of the city. Figure below showing the growth of Dhaka city and subsequent present congestion.

Picture 5: Present traffic condition.

MAP OF DHAKA CITY IN 1859
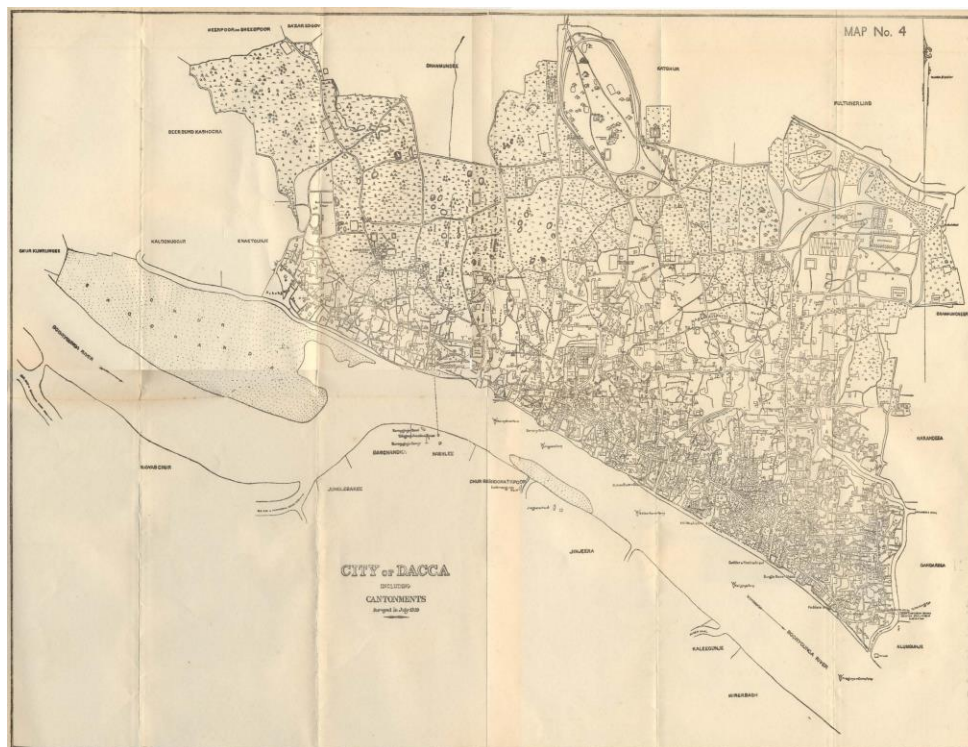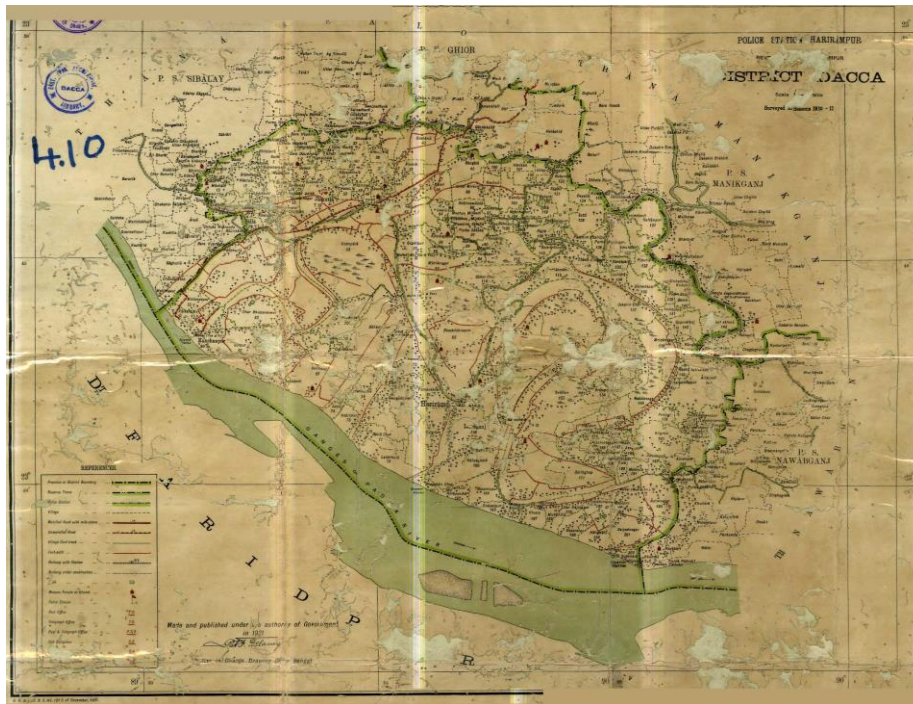

Area: 152 sq. Km   Population: About 700000 Persons
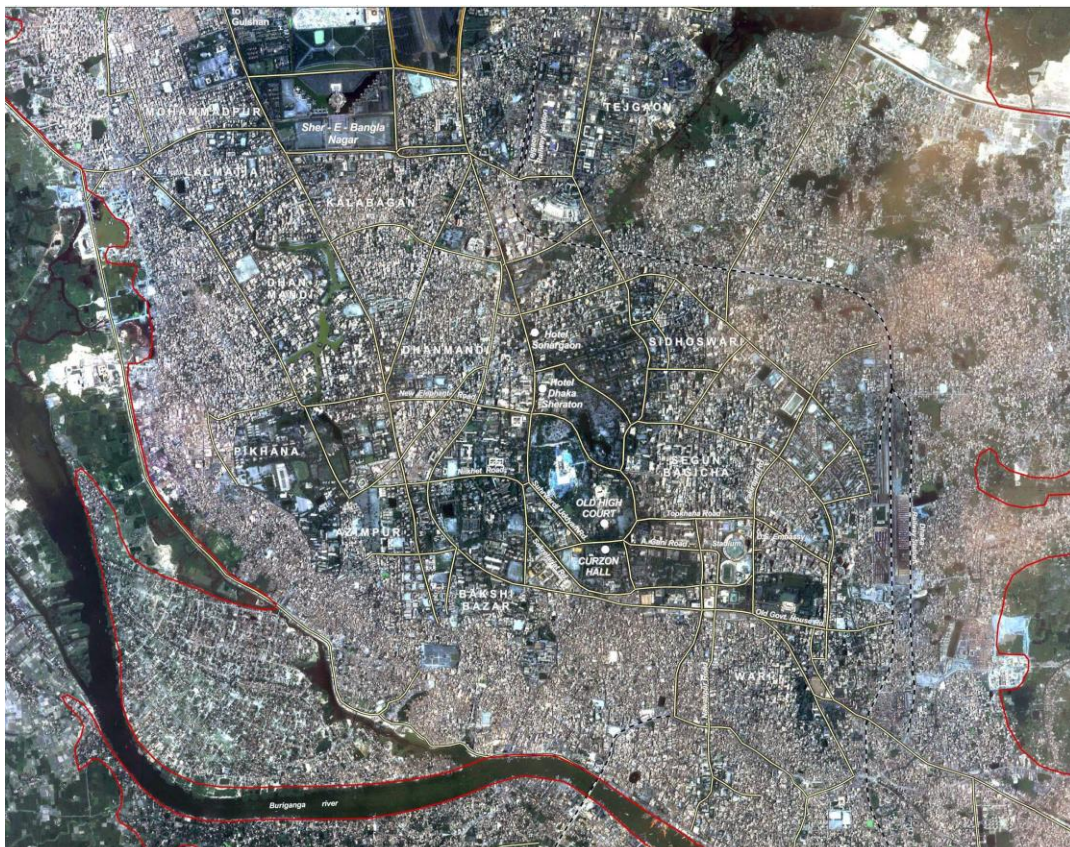
MAP OF DHAKA CITY IN 1921

Area: 213 sq. Km   Population: About 2300000 Persons

SATELLITE PICTURE DHAKA CITY IN 2007

Area: 1530 sq. Km   Population: 10 million

Picture 6 Growth of Dhaka city.

Dhaka being the least motorized mega cities in the world with a current population of over 10 million at annual growth rate of nearly 4.3 percent. The rapid rise in population along with increased and versatile urban land use patterns has generated considerable travel demand. There is now an ever-increasing urgency for mitigating the complex transportation problems in Dhaka by augmentation of mass transit modes. Having less growth rate and population density the developed and developing countries are adopting the mass transit for resolution. According to transport demand, population, growth rate and without having any recent deliberate planning to control the growth rate of the city mass transit is an urgent remedy for the transport demand of Dhaka.

The STP team has recommended a Metro System comprised of three Metro Lines at a total cost of U.S. $ 2.1 billion or Taka 14,500 cores. Estimation says the amount of fare will be 10 taka per Km. Which may regarded as expansive to some one's discussion. But considering the long term cost and working hour saving by reducing congestion is only enough to outcome the point. Besides the present bus fare in the city is nearer to proposed metro fare. The taxi cab and CNG tempo fare (Government + Drivers demand) exceeds the same. Even though in 2008 government licensed 5000 new CNG tempo which are now operating. So the adoption of metro system in Dhaka city will be cost effective.

The STP team has failed to recognize some major disadvantages of Metro system, such as, they are technically difficult and potentially unfeasible in a city prone to flooding. If the Metro system has to be safe for implementation and operation, then Dhaka City will have to be made completely flood-free for all time, which will be extremely difficult.

New York metro is affected by storm/flood water but Tokyo metro is not affected for better technology. Adopting appropriate technology the problem can be solved.

But there are now the technologies that can solve these problems. As in Malaysia the Kuala Lumpur SMART system (Storm water management and road transit) serves as well as drainage of storm water of the city. SMART is an under ground road which allow only light vehicle, and After a certain water logged in the city the subway is closed for all type of transport and opened for the discharge of storm water. Thus the subway serves the duel role which can be very effective for Dhaka city.

Though it is not a metro service but in combination with problems of storm water management in Dhaka city and traffic congestion and metro service will make the effective use of underground area and be cost effective. It will as well as makes the metro safe from flood/storm water.

CONCLUSION

Transport plays an important role in the city life and assist in economical development. Economists have argued that for assisting overall economic development an appropriate transport planning will be needed. If the transport services are inadequate, the bottlenecks in the economy will curtail the overall growth process. This paper has presented that for the Dhaka city augmentation of mass transit system is an urgent necessity to ensure mobility need, road safety, and livable urban environment for Dhaka city in future. Rail based MRT in combination with BRT transit system seems to be appropriate with desired service quality of trip makers of Dhaka. The urgent issues like prevailing socio-economic context, the deteriorating environment

of Dhaka, serious urban road accident situation, scarcity of road space, population relocation, and future adaptability have been stressed for the introduction of a dependable mass transit system. Rail based MRT in combination with BRT with description of its inherent cost and service characteristics have been highlighted as a potential option for improvements of existing public transport system. More detailed study for its introduction has been suggested giving due emphasis on urban dwellers' characteristics, land user patterns, economic aspects of construction, traffic capacity, route selection and technical characteristics.

In addition to meet overall transport demand it is necessary to develop links and facilities for pedestrians and NMT that allows these modes to service short trips without needing to use the primary road network. If the small vehicles use feeder routes then the overall speed and passenger carrying capacity of the motorized transport will be increased. Existing bus services need to be developed and the locations of bus stops need to be relocated based on engineering measures, i.e. based on passenger demand.

RECOMMENDATION AND FUTURE STUDY

Finally, in order to solve the transportation problem of Dhaka City, the Strategic Transport Plan (STP) for Dhaka City was initiated in March, 2004 by Government of Bangladesh with the assistance of World Bank, and with Louis Berger Inc. as Principal Consultants and Bangladesh Consultant Ltd. as local partner. In August, 2004 an Advisory Committee comprising of some 32 members from different categories of professionals, engineers, planners, architects, academics and civil servants was appointed to guide and oversee the work of the consultants. The plan (STP) was completed in December; 2005.The Strategic Transport Plan (STP) has made some strategic recommendations to solve the transportation problems of Dhaka City. The major components of the Strategic Transport Plan are the following:

Mass Rapid Transit (MRT) system, which include the following components:

Three Bus Rapid Transit (BRT) Routes of total length of about 200km. at a total cost of U. S. $ 1.0 billion

Three Metro Lines with an estimated cost of about U. S. $ 2.1 billion, or Taka 14,500 crore 50 Roadway Projects including the following components

Three elevated expressways: Gulistan-Jatrabari Flyover; Gulistan - Mohakhali Elevated Expressway; and Moghbazar Flyover; and

Two Bypass Roads: The Eastern Bypass and the Western Bypass.

The STP recommendations total investment of US$ 5.52 billion or Taka 38,000 crores for its implementation.

RECOMMENDATIONS

The STP team has recommended a Metro System comprised of three Metro Lines at a total cost of U.S. $ 2.1 billion or Taka 14,500 crores. The total length of the Metro Lines is not known, but it will be about 70 km. in length. If we consider that people will walk down to Metro Stations from a distance of 1 km. to avail the Metro service, then the area-coverage of Metro service will only be about 140 sq. km. But, the total area of Dhaka Metropolitan City (RAJUK area) is about 1530 sq. km. Hence, the area-coverage of Metro Service will be less than 10 percent of total area of Dhaka Metropolitan City. This will not satisfy the transport demand of the city. Future study is required for detailing expansion of the metro system to coup with the present and future demand.

The STP team has not recognized some major disadvantages of Metro system, such as; the susceptibility of the Dhaka city with flood and the problems of drainage of flood water and storm water. These results in water logged in the city. Study required to introducing SMART system or other better technologies to overcome this problem.

STP study refers to only fuel-dependent transports ignoring the contributions of fuel-free non-motorized transports and pedestrians. Fuel-free non-motorized transport and pedestrian movements represent more than 50 percent of the total trips, and short trips constitute 76 percent of total trips in Dhaka City. Future study to be made giving emphasis to serve the majority of the population of the city.

When the population of a city increases, the volume of traffic on the roads also increases, and as the volume of traffic on the roads increases, the transportation problem also increases,. The Strategic Transportation

Plan for Dhaka City has been prepared for a population of 1,98,00,000 (within RAJUK area) in the year 2024. Beyond this period population of Dhaka City will grow at least at a growth rate of 3.0 percent per annum. Hence, the solution of transportation problem which has been given for a population of 1,98,00,000 will soon become ineffective at an increased level of population in the City. So future study is required to meet the future demand.

Along metro system cannot coup with the demand. It requires inclusion with smooth traffic and system management. The demand can be also minimized up to a certain limit. To coup with the transport demand, is a continuous process of offering supply, managing management and sound planning.

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