Deficiencies of Existing Road Network in Dhaka Metropolitan City

S.M. Sohel Mahmud¹ and Md. Shamsul Haque²

ABSTRACT: Dhaka is one of the fast growing metropolitan cities with a highly dense and increasing population in the world. Haphazard urban expansion with a minimum attention to the living environment has been the most common scenario here and existing transportation system has become hazardous for the entire city system due to its inherent transport as well as road network deficiencies. Although, the city mainly depends on road-based transportation system, the amount of road network is far apart from the minimum requirements. Only 9 percent of roadways and 6 percent of pavement area is available, in which 62 km functional primary and 108 km secondary and 221 km connector road serve the city transport service. It is evaluated that bus service plays the dominant role in providing public transport facilities (58 % passenger by only 8% trip) but lack of proper land use and transport planning, uncontrolled development and due to post planning approach, about half of the area do not have the bus service facilities. In this study, the authors tried to quantify the existing road network with various dimensions viz. length, percent of road and pavement area, categories with different functions and width, density, accessibility, per capita road network etc. for the whole city and for different zones using statistical methods. This study also points out the inherent weaknesses of Dhaka’s road network in particular relation to road quantity, road orientation or layout, functionality and operational and management aspects.

Keywords: Transportation deficiency, Road alignment, Regulatory measures, Functional deficiency.

INTRODUCTION

The nature and efficiency of the transportation system determine the magnitude and distribution of economic and demographic activities in an urban area. On the other hand, integrated and balanced transportation system and efficient land use are the two major prerequisites for the smooth functioning of an urban area. Indeed, it is an integral facet of urban life. As the city grows, demand for the vehicles and new roadway facilities and new routes also arise. Dhaka being the capital city of Bangladesh plays a vital role on overall transportation network in the country. Dhaka’s transport system is predominantly road based. But the road condition of Dhaka city is quite far from satisfactory. The city is affected by a lot of problems regarding transportation as well as road transport system. Within Dhaka City, the primary orientation of the major roads is in the north-south direction. The lack of sufficient east-west connections and capacity creates the need to travel longer distances, thereby overloading existing roads, unnecessarily. The road network is highly irregular with narrow and twisted, with a very rough east-west and north south orientation of roads. Crisis in the transportation system has considerably affected the physical form and functional performance of the city. It is progressively deteriorating the entire social and physical environment causing suffering and inconveniences to the people. In future the situation would likely to be out of control unless effective measures are taken right now. In the City Corporation area,

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there are only 1286 km of road which is nearly 6 percent of overall the city area. This smaller amount of road is not properly arranged and functioned at all. On the other hand, there have so many geometric and regulatory deficiencies. In the paper the authors try to identify the deficiency of existing road network in theses point of view. Finally, a set of recommendations have been adopted for regulating and controlling the growth pattern the land use and transport system and to reach a glowing future as a mega city.

HISTORY OF CITY TRANSPORT NETWORK

Prior to 1864 the roads of Dhaka had no names. Only mohallas had names, such as Kasaitoli, Patuatoli and Mughaltoli. It was only with the establishment of the Municipality in 1846 that the roads in this town began to be named. In 1961-62, there was a total of 110 miles of municipal roads of which 44 miles were tarred or cemented, and 50 miles brick metalled, and 16 miles kucha fair weather roads. After the partition in 1947, Dhaka became the provincial capital of East Pakistan. Size and population of the city increased rapidly. Thus a faster vehicle, rickshaws, was introduced. Through some motorcars were available at that time, they were few in numbers. “Privately owned bus system was introduced in the city in 1950. This was insignificant to meet the demand of the people. Thus the government introduced EPRTC (East Pakistan Road Transport Corporation) in 1961. The combined fleets of” EPRTC and private buses were operating in the following routes, Sadarghat-Rampura, Gulistari-Banani, Gulistan-Mirpur, Gulistan-Deinra, Gulistan-Mohammadpur. Later routes like Gulistan-Adamjee and Gulistan-Agargaun were introduced. (Firdous, 1984).

The war of Liberation in 1971 caused huge damage to the fleet. After the independence, city size and population grew in an unprecedented speed. Numbers of buses could not keep pace with the increased demand of the increased population. All types of vehicles increased very rapidly. Transport system gradually turn on road based and demand on road network increases rapidly. But with the increasing demand, planed road network was not expanded to fulfill the requirement. Start writing the main body of your paper here.

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of buses</th>
</tr>
</thead>
<tbody>
<tr>
<td>1965</td>
<td>98</td>
</tr>
<tr>
<td>1970</td>
<td>141</td>
</tr>
<tr>
<td>1980</td>
<td>173</td>
</tr>
<tr>
<td>2003</td>
<td>2488</td>
</tr>
<tr>
<td>2006</td>
<td>5070</td>
</tr>
</tbody>
</table>

Source: BBS, BRTA

DEFICIENCY OF EXISTING ROAD NETWORK

The development of the existing road network in Dhaka is an amalgam of actions and inactions that have evolved over a long time in distinct and often disparate ways that prevailed at such times. For the causes of unplanned and ad hoc base development in the city, so many deficiencies take places in entire road network overall the city. Such deficiency can be categorized in four parts like quantity, alignment, functionality and geometric & regulatory. Each of deficiency is described below in brief:
a. Deficiency in the Amount of Road Network

In general, it is said that a city should have 25% roads of its total area. But it is not the
universal truth that 25% road is enough for a city for sustainable and comfortable
transport. Various types of factors must be included with this because space is limited
but travel demand increases day by day, increases density of population, increases no of
vehicle, level of motorization, no of trip etc. where’s Dhaka is the most densely
populated city in the world. Excluding that factor, if it is consider that 25% road is
enough for this city, but the city road space is far apart enough from that requirements.
Total space occupied by roads and streets of Dhaka Metropolitan City is only 9% of its
total space while that of other mega cities cover approximately 25%. Though 9% of
road area of the city is available, pavement area is only 6% of total area (Table 1).

**Table 1:** Different Types of Road Length, Pavement Area and Road Area of DCC

<table>
<thead>
<tr>
<th>Classes of road</th>
<th>Length (km)</th>
<th>Percent of road length</th>
<th>Pavement area (sq. km)</th>
<th>Percent of pavement area</th>
<th>Percent within all area</th>
<th>Road area (sq. km)</th>
<th>Percent of road area</th>
<th>Percent within all area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary</td>
<td>61.45</td>
<td>4.78</td>
<td>1.46</td>
<td>16.47</td>
<td>1.08</td>
<td>1.89</td>
<td>15.67</td>
<td>1.41</td>
</tr>
<tr>
<td>Secondary</td>
<td>108.20</td>
<td>8.41</td>
<td>1.86</td>
<td>21.05</td>
<td>1.39</td>
<td>2.41</td>
<td>19.94</td>
<td>1.80</td>
</tr>
<tr>
<td>Connector</td>
<td>221.35</td>
<td>17.21</td>
<td>1.68</td>
<td>19.04</td>
<td>1.25</td>
<td>2.47</td>
<td>20.42</td>
<td>1.84</td>
</tr>
<tr>
<td>Local</td>
<td>573.75</td>
<td>44.61</td>
<td>2.93</td>
<td>33.17</td>
<td>2.18</td>
<td>4.25</td>
<td>35.19</td>
<td>3.17</td>
</tr>
<tr>
<td>Narrow</td>
<td>321.27</td>
<td>24.98</td>
<td>0.91</td>
<td>10.28</td>
<td>0.68</td>
<td>1.06</td>
<td>8.78</td>
<td>0.79</td>
</tr>
<tr>
<td>Total</td>
<td>1286.02</td>
<td>100.00</td>
<td>8.84</td>
<td>100.00</td>
<td>6.59</td>
<td>12.09</td>
<td>100.00</td>
<td>9.01</td>
</tr>
</tbody>
</table>

Source: RMMS

Table 1 show that the total road length of the DCC area is 1286 km among them the lengths of primary, secondary, connector, local and narrow roads are 61.348 km, 116.404 km, 219.543 km, 569.868 km, and 318.271 km respectively. There are four types of road surfaces available in the city among them, 70% bituminous road, 25% concrete road, 3% brick and rest 2% earth is road.

Many of the urban transport experts have argued that Dhaka City has enough road space for its functioning. But the thing is only true for two factors. Firstly, level of motorization in Dhaka is very low which does not represent actual demand of trips made by the city dwellers avoiding non-motorized vehicles. Secondly, travel demand is
not evenly distributed through the city rather has heavy pressure on certain few links of the network. The situation was sharp change. Increasing rate of demand is very high at present. A principal reason of such a rapid growth is over concentration of maximum activities and development works in the city and little improvements in other cities, towns and villages in terms of infrastructure development and economic activities. Improved road communication in the country further made it easy to converge on the capital for searching employment and better quality of life. So, it is highly required to expand the functional road area overall the city. But, most of the area of Dhaka city is build up even road side, as the density of the city is very high, few area which is more than 0.1 million per sq. kilometer like Lalbagh thana. There is a very few provision to increase the road area of the city without destroying the road side development. That is very difficult and burden of our fragile economy. So, this weakness will be carry until the city will be sustained.

b. Lack of Sufficient Functional Road in Different Zones
Total length of the road network of DCC is 1,286 km. The road lengths under jurisdiction of different zones have been shown in the following Figure:

It can be seen from the above chart that the length of roads in Zone-1 is 170.221 kilometer which is highest compared to other zone and the length of roads in Zone-10 is 62.446 km which is just reverse. On the other hand, the highest primary road in the zone 5 (14.7 km) and second highest zone 7 & 9 (11.1 km) where as in zone 2 & 8 only 0.5 and 2.5 km of primary road respectively.

c. Inadequate Road Space in Different Zones
Again the availability of major roads in terms of either km per thousand populations or km per square kilometer of area is too low as compared to the other cities of developing countries.

The density of roads in terms of length per square kilometer of area and per capita road rate, the scenario is so inferior. Table 2 show that, Zone-2 is the highest density of the roads (22.98) and Zone-8 has the lowest density of roads (5.52) as compared to the others zone. In the city, there are only 2.15 km of road is available for 10,000 of population and pavement space available only 0.015 sq. km (Table 3).
### Table 2: Percent of Road and Pavement Area and Density per Square Kilometer in Different Zones

<table>
<thead>
<tr>
<th>Zone</th>
<th>Area sq. km</th>
<th>Total Road Length (km)</th>
<th>Pavement Area (Sq. km)</th>
<th>Road Area (Sq. km)</th>
<th>Percent of Area</th>
<th>Density km per sq. km</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>9.02</td>
<td>170.990</td>
<td>0.827</td>
<td>0.974</td>
<td>9.164</td>
<td>10.796</td>
</tr>
<tr>
<td>2</td>
<td>4.39</td>
<td>100.866</td>
<td>0.525</td>
<td>0.559</td>
<td>11.964</td>
<td>12.739</td>
</tr>
<tr>
<td>3</td>
<td>7.10</td>
<td>98.149</td>
<td>0.500</td>
<td>0.592</td>
<td>7.039</td>
<td>8.339</td>
</tr>
<tr>
<td>4</td>
<td>16.59</td>
<td>166.263</td>
<td>1.227</td>
<td>1.534</td>
<td>7.396</td>
<td>9.248</td>
</tr>
<tr>
<td>5</td>
<td>15.73</td>
<td>125.089</td>
<td>1.535</td>
<td>1.893</td>
<td>9.761</td>
<td>12.037</td>
</tr>
<tr>
<td>6</td>
<td>13.38</td>
<td>120.102</td>
<td>0.833</td>
<td>1.212</td>
<td>6.228</td>
<td>9.058</td>
</tr>
<tr>
<td>7</td>
<td>14.73</td>
<td>135.627</td>
<td>0.976</td>
<td>1.111</td>
<td>6.627</td>
<td>7.540</td>
</tr>
<tr>
<td>8</td>
<td>28.79</td>
<td>159.046</td>
<td>0.908</td>
<td>1.331</td>
<td>3.153</td>
<td>4.624</td>
</tr>
<tr>
<td>9</td>
<td>20.38</td>
<td>147.350</td>
<td>1.184</td>
<td>2.078</td>
<td>5.080</td>
<td>10.194</td>
</tr>
<tr>
<td>10</td>
<td>4.15</td>
<td>62.541</td>
<td>0.330</td>
<td>0.807</td>
<td>7.944</td>
<td>19.442</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>134.26</strong></td>
<td><strong>1286.023</strong></td>
<td><strong>8.844</strong></td>
<td><strong>12.091</strong></td>
<td><strong>6.587</strong></td>
<td><strong>9.006</strong></td>
</tr>
</tbody>
</table>


### Table 3: Road per 10,000 Populations in Different Zones

<table>
<thead>
<tr>
<th>Zone</th>
<th>Area sq. km</th>
<th>Pop. 2004</th>
<th>Density</th>
<th>Road per 10,000 Population</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Road Len.</td>
</tr>
<tr>
<td>1</td>
<td>9.02</td>
<td>671,416</td>
<td>74,436</td>
<td>2.55</td>
</tr>
<tr>
<td>2</td>
<td>4.39</td>
<td>489,409</td>
<td>111,483</td>
<td>2.06</td>
</tr>
<tr>
<td>3</td>
<td>7.10</td>
<td>528,828</td>
<td>74,483</td>
<td>1.86</td>
</tr>
<tr>
<td>4</td>
<td>16.59</td>
<td>933,531</td>
<td>56,271</td>
<td>1.78</td>
</tr>
<tr>
<td>5</td>
<td>15.73</td>
<td>621,792</td>
<td>39,529</td>
<td>2.01</td>
</tr>
<tr>
<td>6</td>
<td>13.38</td>
<td>462,468</td>
<td>34,564</td>
<td>2.60</td>
</tr>
<tr>
<td>7</td>
<td>14.73</td>
<td>777,679</td>
<td>52,796</td>
<td>1.74</td>
</tr>
<tr>
<td>8</td>
<td>28.79</td>
<td>845,172</td>
<td>29,356</td>
<td>1.88</td>
</tr>
<tr>
<td>9</td>
<td>20.38</td>
<td>623,620</td>
<td>30,600</td>
<td>2.36</td>
</tr>
<tr>
<td>10</td>
<td>4.15</td>
<td>74,789</td>
<td>18,021</td>
<td>8.36</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>134.26</strong></td>
<td><strong>6,028,704</strong></td>
<td><strong>44,903</strong></td>
<td><strong>2.13</strong></td>
</tr>
</tbody>
</table>

### d. Lack of Continuous Functional Road

There are only 107 kilometers road for which width is more than 24 meters (Table 4). Among them Airport Road and Mirpur Road are continuous road in one direction but other roads like Rokeya Sharani, DIT road are not continuous. One of the basic requirements for high occupancy vehicle is sufficient wide continuous road. So, there is a very few option for BRT or any other high occupancy vehicle in the Dhaka city.

### Table 4: Length of Different Width of Roads of Different Zones in D.C.C.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Road Length (km) Under Diff. Width Types</th>
<th>Total Rd Under Zone</th>
<th>Accessible Rd (w&gt;=4.75)</th>
<th>% of Acc. Rd</th>
<th>% of Narrow Road</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&gt;24.5</td>
<td>1.60</td>
<td>1.20</td>
<td>43.75</td>
<td>56.25</td>
</tr>
<tr>
<td></td>
<td>&gt;18&lt;=24.5</td>
<td>6.10</td>
<td>6.45</td>
<td>43.75</td>
<td>56.25</td>
</tr>
<tr>
<td></td>
<td>&gt;8.25&lt;=18</td>
<td>17.23</td>
<td>18.64</td>
<td>43.75</td>
<td>56.25</td>
</tr>
<tr>
<td></td>
<td>&gt;4.75&lt;=8.25</td>
<td>49.89</td>
<td>51.49</td>
<td>43.75</td>
<td>56.25</td>
</tr>
<tr>
<td></td>
<td>&lt;4.75m</td>
<td>96.18</td>
<td>97.68</td>
<td>43.75</td>
<td>56.25</td>
</tr>
<tr>
<td>2</td>
<td>0.31</td>
<td>13.37</td>
<td>13.93</td>
<td>43.75</td>
<td>56.25</td>
</tr>
<tr>
<td>3</td>
<td>0.59</td>
<td>23.60</td>
<td>24.17</td>
<td>43.75</td>
<td>56.25</td>
</tr>
<tr>
<td>4</td>
<td>21.43</td>
<td>47.13</td>
<td>47.91</td>
<td>43.75</td>
<td>56.25</td>
</tr>
<tr>
<td>5</td>
<td>25.57</td>
<td>66.47</td>
<td>67.67</td>
<td>43.75</td>
<td>56.25</td>
</tr>
<tr>
<td>6</td>
<td>9.27</td>
<td>46.26</td>
<td>47.68</td>
<td>43.75</td>
<td>56.25</td>
</tr>
<tr>
<td>7</td>
<td>15.10</td>
<td>78.96</td>
<td>80.58</td>
<td>43.75</td>
<td>56.25</td>
</tr>
<tr>
<td>8</td>
<td>9.17</td>
<td>67.67</td>
<td>69.69</td>
<td>43.75</td>
<td>56.25</td>
</tr>
<tr>
<td>9</td>
<td>20.53</td>
<td>53.74</td>
<td>56.00</td>
<td>43.75</td>
<td>56.25</td>
</tr>
</tbody>
</table>
Figure 3 & 4 represents the overall road and pavement area of different width of road in the city. From the Figures it is seen that 3.43 sq. km of road area is available in the city for which width is more than 24 meters, in terms of pavement area it is 2.54 sq. km only.

e. Lack of Accessible Road

The road in which at least one four wheeler motorized emergency vehicle like Ambulance or Fire brigade vehicle can easily move is termed as accessible road. In Dhaka city, there is a lack of sufficient accessible road. It is estimated that among the existing road network about half of the road lacks sufficient width to accommodate motorized emergency vehicles. From Table 5, it is observed that in the 1, 2, 3 and 7 zones more than 50% of road is inaccessible to large sized vehicles particularly to public transports. In Dhaka city out of 1286 km road about 821 km of road is found to be accessible (if road width is equal and more than 4.5 m) to motorized vehicles. Area wise, road and pavement constituted 5.49 and 7.83 sq.km respectively and road density per sq. km area is only 6.12 (Table 5).

Table 5: Accessible Road Length, Area and Density per sq. Km in Different Zone

<table>
<thead>
<tr>
<th>Zone</th>
<th>Area sq-km</th>
<th>Total Accessible Road Length (km)</th>
<th>Pavt. Area (Sq. km)</th>
<th>Road Area (Sq. km)</th>
<th>% of Road Under Area Pavt. Area</th>
<th>Road Area</th>
<th>Density km per sq. km</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>9.02</td>
<td>74.809</td>
<td>0.550</td>
<td>0.670</td>
<td>6.094</td>
<td>7.429</td>
<td>8.29</td>
</tr>
<tr>
<td>2</td>
<td>4.39</td>
<td>43.840</td>
<td>0.365</td>
<td>0.387</td>
<td>8.321</td>
<td>8.812</td>
<td>9.99</td>
</tr>
<tr>
<td>3</td>
<td>7.10</td>
<td>48.147</td>
<td>0.362</td>
<td>0.440</td>
<td>5.100</td>
<td>6.196</td>
<td>6.78</td>
</tr>
<tr>
<td>4</td>
<td>16.59</td>
<td>99.793</td>
<td>1.022</td>
<td>1.314</td>
<td>6.159</td>
<td>7.918</td>
<td>6.02</td>
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<td>5</td>
<td>15.73</td>
<td>97.222</td>
<td>1.433</td>
<td>1.792</td>
<td>9.113</td>
<td>11.390</td>
<td>6.18</td>
</tr>
<tr>
<td>6</td>
<td>13.38</td>
<td>96.120</td>
<td>0.764</td>
<td>1.124</td>
<td>5.710</td>
<td>8.400</td>
<td>7.18</td>
</tr>
<tr>
<td>7</td>
<td>14.73</td>
<td>56.670</td>
<td>0.689</td>
<td>0.821</td>
<td>4.674</td>
<td>5.571</td>
<td>3.85</td>
</tr>
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<td>8</td>
<td>28.79</td>
<td>105.311</td>
<td>0.716</td>
<td>1.126</td>
<td>2.489</td>
<td>3.910</td>
<td>3.66</td>
</tr>
<tr>
<td>9</td>
<td>20.38</td>
<td>137.260</td>
<td>1.152</td>
<td>2.040</td>
<td>5.654</td>
<td>10.009</td>
<td>6.74</td>
</tr>
<tr>
<td>10</td>
<td>4.15</td>
<td>62.441</td>
<td>0.329</td>
<td>0.807</td>
<td>7.937</td>
<td>19.434</td>
<td>15.05</td>
</tr>
</tbody>
</table>
f. High Quantity of Narrow Road
According to RMMS classical classification there are 321.27 km of narrow road which is 25 percent of total road in the city. But, according to width base analysis, the length of narrow road (width less than 4.75 m) is 464.4 km (36.1%) which is very high with regard to other roads. Highest Narrow road is in the zone seven 58% about 79 kilometers among the 136 kilometers road. After this, zone 1 and 2 narrow road level 56 and 57 percent respectively (Figure: 6).

g. Deficiency of Road Alignment

No Road Network Pattern
The aim of a planned town is to seek the efficient road system to cope with conditions of uncertainties and to enable traffic to enter or leave the town rapidly and safely or to circulate freely within it. Thus an efficient road pattern should satisfy the criteria like flexibility and adaptability, application to different sites according to size, topography etc., ease of design and construction, efficiency of movement and required traffic capacities. In this regard the pattern may be as: orthogonal, orthogonal with superimposed diagonal streets, concentric streets, radial streets, radial and orthogonal combination, irregular medieval streets system, topographical street system, combination of rectangular and irregular street systems. As road network of Dhaka City evolved haphazardly without any plan and always to meet short term travel need, the total road network does not show any well defined configuration. Instead, it is expanded eccentrically in the north-south direction and allowing uncontrolled ribbon development.

Unorganized and Non-Integrated Road Network
Dhaka mainly depends on road-based transportation network system. Road has been evolved due to topography of the city, technical advantage, past network development trend, availability of foreign aid etc. Continuous focus on road based network system has weakened potentials of other types of transportation system like rail or water transportation system. Hence there is no such inter-linked and mutually dependent multi-modal transport network system for Dhaka City. As a result, no other alternative for the movement of people and goods can be found to meet increasing and diversified demand of the urban community. The situation becomes worst in case of any disruption of road network, particularly the major links of the City.

During last twenty to thirty years, significant road development has been taken place to cope with sudden transformation of the city from provincial town to the capital of a
sovereign country. But most of the transport developments have been driven by ad hoc considerations having no explicit focus on analysis of existing demand or future requirements. As a result, the road network of the city is not organized and integrated in terms of connectivity. Many strategic links are missing in the network and many areas have inadequate accessibility to it. Large amounts of residential and commercial development both by public authority and private agencies have taken place after the independence. In most parts of the city, the road network has emerged with relatively wide primary and secondary roads (termed mostly on the basis of road width only) built by public agencies, but narrow tertiary and access roads due to lack of planning and building controls. Consequently, with the exception of a few planned residential areas, in most of the areas the road network is too narrow and alignment is poor to accommodate motorized vehicles, especially the public transport modes. This also poses a serious problem to provide other network infrastructures for utility services.

**No Through and By-Pass Road**

When a through road or a main road passes through the congested portion of the town, there is sharp reduction in the speeds of vehicles and the smooth flow of traffic on through roads is seriously obstructed. To maintain easy flow of traffic on through roads and to give convenience and comfort to the users of such roads.

Here, Tongi Ahsulia may be an example by which the vehicle which come from Khulna, Barishal and Rajshahi division can divert from Dhaka Aricha to Tongi, Airport road and as far as north bangle without interrupting the city centre. Not only this, if another such kind of road or proposed eastern bypass would available then through vehicle from Dhaka Aricha highway could move to Dhaka Chittagong Highway without affecting city road and vise versa. By which direct connection would be established with eastern part of the country to western part without interrupting the capital central city congested road network, freight vehicle would be able to move easily by which entry restriction losses could be reduce.

**No Ring or Distributor Road**

It is a type of by-pass road traffic approaching the town from all the directions. All classes of wheeled traffic will be admitted on the outer ring road and the pedestrians should be excluded. The outer ring road should be maintained clear of all existing development and it should be so designed as to compensate for a longer route by unbroken passage and high speed. The object of an inner ring road is to divert from the town centre all local traffic and other traffic which have no business in the town centre. Such an arrangement will relive

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![Figure 8: Example of bypass road](image)

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![Figure 9: Typical arrangement of radial and ring road](image)
congestion of traffic in the town centre. The inner ring road should have minimum junctions and it should afford a faster passage than on a direct road through the town centre.

For the absence of outer ring road, the user who wants to go the opposite side or right angle side from his incoming direction, doesn’t find any alternative to reach their destination avoiding CBD. As a result, increase travel time, trip demand and extra burden on CBD and causes congestion around the CBD and other part of the city. To overcome this serious problem by reducing the travel demand, flood embankment around the city should converted as an embankment cum road which will act as suitable outer ring road. New Circular Road, Outer Circular Road, New Eskaton Road, Kataban Road, Zahir Raihan Sharani, S. Kamruzzaman Sharani might turn as a inner circular road around the CBD. But for the lack of planning, functional definition it is separated from each other by missing link or unacceptable bend. Now these roads act separately for which loses its functionality.

*No Principle Arterial for Inter District through Traffic Movements*

A capital city is the center of a country and it will be thoroughly connected with the different part of the country with different corridor. This corridor will be only for through traffic which will move regional town to capital city centre or on region to opposite region over the capital city. This should be uninterrupted, fully excess control and free from mixed traffic. This principle arterial road should be kept clear of all obstacles access, parking places, loading and unloading areas etc. Actually for maximum capacity and for safety, the arterial roads should be properly designed. In large cities and towns, where traffic flows are huge, grade separation and motorway status should be considered. With this specification there is not a single road in Dhaka metropolitan city.

*No Alternative Corridor to Connect Other Part of the City*

There are only three corridors to connect the other part of the city. That’s are the main highways, which are also the main radial roads, are

a) Connecting to the north: Airport road

b) Connecting to the south via Chittagong highway: Hatkhola, Fuiharia and other roads

c) Connecting west and north-west via Dhaka Aricha Highway: Mirpur road.

These three main arterial roads/thoroughfares are the only alternative to collect traffic from outside the city and to distribute them throughout the city, and at the same time these are criss-crossed by hundreds of roads of varying right-of-ways (ROW). The main radial road which is only for through traffic and it will be thoroughly connected with the city centre without any level crossing. But in this city, there has not any particular road which is only for through traffic, all of the radial corridor local traffic and through traffic mixed up among them local minibus, taxi, three wheel vehicle even non motorized vehicle like rickshaw included with this in particular radial road. For the lack of alternative road, if in case that particular road cannot survive properly for any cause of incident, the road connectivity would disconnected from that particular region.
Absence of East-West Continuous Road
In the city, there is not a single continuous main road in east-west direction. The road which are existing in this direction all are formed as a connecting road or link road. For the causes of discontinuity of the road, huge number of T and Staggered junction develop on the layout of the city. So vehicle cannot move thoroughly in that direction. East-west connections have suffered because of fragmented responsibilities for road planning and construction (e.g. between RAJUK, DCC and private sector actors) and the many barriers e.g. the large cantonment area (including the former airport site), in addition to the large tracts of low lying, flood prone land. Absence of east-west connection has become the major problem for the entire road network of Dhaka. Presently, such requirements are meeting by relatively narrow and poorly aligned roads, which are far beyond to meet the existing demand in terms of capacity, speed and level of service.

Huge Number of Link Missing
Development in the absence of a strong planning framework results many discontinuities in the entire road network of the city. For this discontinuous between two ling creates so many link missing like:

- Agargoan Road to Mohakhali Gulshan Road,
- Dar-Us Salam Road to Kamal Atarturk Avenue,
- Bijoy Sharani to Gulshan Avenue,
- Embankment road to Sat masjid Road to Pantha Path and Pantha Path to DIT Road,
- New Eskaton Road to Mirpur Road to Sat masjid Road,
- Gulhan Avenue to New Airport road,
- Embankment to Road No. 16 (old 27),
- Asad Avenue to Embankment road
- Road No. 2 to Embankment road,

At present, most of the space between two links is highly buildup. So connecting road between that is very difficult and costly. For the construction of connecting road there will be damage many building, high rise building, property except under ground road. Which is very intricate for our under developed country. Like, at the time of construction of Pantha Path, at least 6 numbers of buildings was destroyed which was more than 5 stories. Present condition is more devastating than that.

Presence of Large number of Staggered Junctions
For the unplanned and piecemeal development of road network, there are many unwarranted staggered T-junctions formed in the main road. In this type of junction, a vehicle is forced to make two successive right turn within a short segment of road and thereby make junction operation very complicated. Few of these junctions are listed below:

- S.S. Nazrul islam Sharani and kakrail road
- Kakrail road and DIT road
- New Elephant Road and Road No. 2
- Road No. 16 (old 27) and Manik Mia Avenue
- Manik Mia Avenue and Asad Avenue
• Airport road and Mohakhali Gulshan Road
• Bijoy sharani and Airport Road
• Shaheed Yousuf Road and Kamal Ataturk Avenue
• Ring Road and Agargaon Road

No Classical Road Hierarchy
From the observation of overall city network, it is seen that there are a wide lack of Classical Road Hierarchy in the Dhaka city. DITS and RMMS classically divided the road of the city in five categories and definitions of each classification also provide by DITS, but that are only in papers. In real sense, in terms of mobility, accessibility, geometric condition and operation there are extensive lack of classical classification of road.

Right Angle Bends on Main Road or L-Turn
It’s not a common type of junction. But it is one of the most complicated and distinctive point in the road network and causes hindered in the normal flow of traffic.
• B.B. Avenue in front of Baitul Mukarram
• Toyenbee Circular Road and R.K. Mission road, near Ittefaq Bhavan
• Road No 2 and Sat Masjid Road, Rifle Square
• Begum Rokeya Sharani and Indira road,

Lack of Continuity of Main Road
In Dhaka metropolitan city there are many main roads that are ended at an inappropriate location. For which the road loses its functionality, causes T-junction and thereby loses continuity. Few examples are given below:

Rokeya Sharani: it is a north south directional functionally primary road which is three lanes divided by median and nearly straight. Started from the city centre in khamarari creating a T-junction and ended mirpur cantonment as a dead end.

DIT Road: It a north-south directional primary road serves a major demand of the city but the road is fully discontinuous. Started creating a staggered junction with kakrail road and ended in the bishaw road with airport road by not only a T-junction but also level rail crossing.

Dar-Us-Salam Road: Dar-Us-Salam road is one of the major secondary roads, started creating a T-junction with mirpur road and ended by a right angle bend in mirpur-14.

Sat Masjid Road: It may acts as a parallel road to the mirpur road by proceeding to the north-south direction. But both side of the road meet with the mirpur road by a right angle bend and T-junction in mirpur road.
Pantho Path: it’s a east-west connecting road which connect three main arterial in the city of north south direction. But the road is ended creating T-junction in both side with the Mirpur road and Shaheed Tazuddin Road.

Bijoy Sharani: Bijoy sharani-lake road also a connecting road which connect Mirpur road, Rokeya Sharani and Airport Road. But the road is closed in this area by creating T-junction in both sides. It may be proceeds in both directions, Turag River to DIT road and then will acts as east west continuous road. But it becomes so difficult for the causes high built up front space of that alignment. Besides these there are other roads which are discontinuous like Manik Mia Avenue, Cantonment Road, DIT Avenue, etc.

Non Coordinated Transport System
The existing modes and sub-modes (bus-water-rail-NMT) are acting independently of each other. STP survey data shows that as a primary travel mode for all trips, only 31% are made by public transport of which most of trips are completed by using bus. Travel share of other transit system viz. rail and water are very insignificant. Nearly 70% of all trips are made either by walk, rickshaw or non-transit modes etc. It is to be mentioned here that the peak hour commuter movement of Dhaka city is mainly road based. Other alternative travel systems viz. rail and water has inherent weakness, as they are not aligned with the inner city commuter movement paths. For example, since the rail is eccentrically located in the Eastern side of the city and towards N-N directions it is not capable of providing service to the other parts of Dhaka city. In its present form, the rail system is neither a competitor nor a suitable alternative of the road based travel modes particularly in case of inner city commuter movements. Rather, to some extent, a large number of at-grate railroad crossing are acting as a great hindrance for efficient operation of road based travel system. On the other hand, since the proposed circular waterways are located at the periphery of the built-up areas, it is also not a viable alternative particularly at the fringe areas. In consideration of these, it is obvious that for certain areas of Dhaka city, physically as well as functional integration of different modes of public transport would be a very challenging job and feasibility of which needs a very comprehensive study.

h. Not Suitable for Application of Traditional Traffic Management Measures

One Way Operation
For one way operation, alternative parallel road is first and foremost requirement. For the lack of parallel road, the city road network is not fit for one way operation. Which has that’s are not traditional, enforcing except farmgate Indira and Kharmarbari road.

Right Turn Restriction
In the city road, most of the cross signalized junctions are four phases and T-junctions are three phases. Most of the cases, for the lack of alternative road even secondary road, there is not possible to reduce the signal phasing.

Signal Co-ordination
As the road network in the city is not any particular pattern and the difference between the two major roads is not chronological, the distance between the two intersections is varying on after another. So, it is difficult to provide coordinated signal in the intersection of the city.
DEFICIENCY OF GEOMETRIC AND REGULATORY MEASURES

a. Lack of Specification of Different Road Categories
Standard cross-sections of different categories of road have been developed on the basis of the road classification (slightly modifying the proposal of road classification appended in the final report of DUTP, Phase 11) (RMMS 2004). This development just in recent year and that’s under process until now. At the time of construction of present categories of road, no standard specification was available. Even until today, at the time of construction of new road standard specification is not followed considering the future travel demand, vehicle composition and other factors in the design period.

b. Less Productive Intersections
Intersection capacity is always reduced by the frequent stopping or public transit vehicles, especially buses, tempos and rickshaws, inside the intersection. Again there is no practice of clearways in Dhaka that severely inhibits the performance of intersections. According to most of the transport experts’ intersections of the city road network are major system deficiencies which inhibit mobility seriously in all types of roads and all parts of the city. Poor traffic management and design difficulties at intersections are the main contributor of congestion and delay. The performance of intersections are gradually deteriorating and becoming worse due to various reasons like high influx of non-motorized vehicles, especially rickshaws, turning provisions and tendency of vehicles, indiscriminate pedestrian crossing, inefficient signal control absence of appropriate channelization devices, roadside land use pattern uses of bus stop, Taxi/Tempo/Rickshaw etc stand, poor enforcement of law etc.

c. High Access Density in Main Road
A major problem of Dhaka city road is the high density of uncontrolled access. At the time of planning primary and secondary road network along with not to prepare side road entry plan to facilitate planned development of local road network and thereby to ensure accessibility. So, for the lack of proper pre-positioning of access, the owner who has plot on the side of road, constructs building without thinking the condition of behind communities. At this condition, the community people made connection with the main road haphazardly on the donated land. So, access is multi direction, thin and less productive.

d. Unacceptable Road Side Development
In Dhaka city, it is observed that there have been built so many multi-stored building, markets and shopping centers at the very near to roadside and without considering the resulting impact on through traffic movements. Here allowed high rise building construction based on road with consideration not the functional classification of road and super market are allowed considering only single entry based basement parking – not open parking lot. Junction corner point which is most complicated zone of the road network is developed without considering turning space. Even those few roads are ended or change direction for the construction of multi-stored build ahead of its alignment.

In light of these there should be a specific suggestion regarding future roadside development projects particularly those would be initiated by DCC and RAJUK with their own finance to adopt EIA and TIA studies before undertaking the project. Most importantly, in consideration of scarcity of road adjacent empty space as well as acute
shortage of different transport facilities within the built-up areas, in the first place DCC and RAJUK should be discouraged to construct any road adjacent commercial project on the government land before ensuring road widening works, providing adequate on-street parking facilities, bus-lays, para-transit waiting place etc.

e. Unacceptable Railway level Crossings
Almost 18 (eighteen) railway level crossing run through the Dhaka city creating interruption during passage of train on both side of rail gates for an average of 4 (four) hours in each day. Suspension of traffic flow due to closer of rail gates serves to compound the prevailing chaos. Everyday 52 outgoing and incoming train pass through the level crossing in the city, out of which 40 trains operate between 8 am to 10 pm. A period of 10 minutes of average is required to give a train its passage at each level crossing, creating convergence, with its fall out effects spreading all over the city (Field survey).

f. Inadequate Footpath Facility in the City Road Network
The existing footpaths of the Dhaka city are being improved physically in the recent years. New footpaths are also being constructed. But there are many kilometers of roads without walkway facility. Moreover, there are a lot of problems relating use of footpaths by the pedestrians. The most serious problem is the retailer traders and hawker problem. The hawker spreads their treads on the footpath and eventually reduces the effective width of footpath. Other causes of reduction of effective width of footpath are found as building materials on road and footpath, rickshaw stands, rent-a-car service parking, garages etc. Encroachment of footpath by building materials is a common picture in almost all over the city. Another problem exists in the city for the people seeking a living on the footpath. There are a lot of big size dustbins on the streets close to the footpath in many areas of the Dhaka city. At many areas of the city, people use the footpaths for toilet purpose creating problems in walking. In the streets of the Dhaka city, another serious threat to the safety of the pedestrian is posed by the ‘traps of death’. This refers to the open manholes on the roadways as well as on the footways.

g. Lack of Bus Lay on Road
There is very few designated place for bus stoppage in road side of Dhaka city. Most of the bus stop in road side haphazardly with competition attitude and alighting and boarding passenger dangerously. This makes always crowed on road side and influence pedestrian to move on road as well as decreases the effective width of the carriage way.

h. Lack of Utility Service Space in Road Side
Most of the road in Dhaka city has not sufficient separate road side space for utility service line. So, for laying pipes and cables relative department cut the carriageway of the road even highly demandable road is not out of this situation. Lack of coordination among the department is another great problem on this regard. It has been observed that when the work of improvement is done, do not always care to level up the roads promptly. For the causes of that activity not only interrupt the traffic flow but also destroy the road structure permanently as well as surface smoothness.

i. No Sufficient Drainage Facility
Water logging is a common picture in Dhaka city. For the lack of sufficient drainage facility in the city, most of the road submerges within few minutes of raining, even flood. Beside this the drainage facility which are exist in the city, most of them are not
functioned for the causes of blocking. There are another drawback of the city road is the open drain on road side. Which is not only create nuisance at the wet condition but also reduce the effective with of the carriage way.

j. In Efficient Guard Rails & Median Barriers
Footpath barriers are mainly found near the intersections and in some high pedestrian activities areas (like Farmgate). A large percentage of the length of footpaths is without the facility. The physical condition of the footpaths is improved in the recent years but the provision of pedestrian barriers is still neglected. Most of barriers were made of grill type railing and some are of New Jersey type. But in the recent years, due to the beautification of Dhaka city, most of the grill type railing barriers is replaced by the temporary median barriers (bamboo framework). Another type of median barrier is also used in the city which is of steel frame. Due to this reason, there are a lot of spaces in the broken median barriers to give access the pedestrians to cross the roadway at mid-block.

k. Lack of Overpass & Underpasses
In DCC there are only 24 steel and 11 RCC foot over bridge is available. Besides these, there are 11 pre staged guarder foot over bridge a under crash program 3rd pilot project and 6 steel foot over bridge on construction. (DCC, 2006). In the city there are also 3 under passes. But, these number of over and under pass is very less compare to high demand. In addition, the over passes and under passes are not also free from problems. Some of the overpasses are encroached by the hawkers. The aesthetic condition of the overpasses is also not good enough. The underpasses of the city possess serious safety hazards especially at night time. Various unsocial and crime works take place in the underpasses at night time although there are lighting facilities. Generator service is also provided for the time of load shedding. But at many times, it does not work.

l. Poor Road Sign and Marking
Absence or poorly presented road signs and marking count to traffic disorder at many places. Enforcement of traffic rules is also difficult as road signs and marking are inappropriate and even non-existent at busy intersections. In the metropolitan Dhaka city, though there has not sufficient zebra crossings in the city mainly intersection, which exist that’s physical condition and visibility of them are very poor. Maintenance works are done periodically but the frequency is not suited with the deterioration rate of marking.

m. Insufficient Parking Space
Dhaka suffers from such type of problems due to inadequate parking facilities, both on-street parking and off-street parking. In motijheel commercial area which is the central business district of the city. Since the 1980’s, Motijheel's main roads have become heavily congested during peak hours (Ahsan 1990). Vehicles are parked all along them, and are often double and triple-parked. Other major business centers also posses’ similar problems. Insufficient parking facilities at shopping centers have remarkable impact on traffic flow in adjacent roadways. New Elephant Road is one of the main shopping streets in the city. Illegal on-street parking reduces at least one lane to its road width (field survey, 2005). Parking and associated maneuvering functions of vehicles at Old Elephant Road in front of Gausia Market almost close the street inhibiting its
performance as access road. Most of the recent shopping centers have also developed with shortage of parking facilities with respect to demand.

n. Deficient and Improper Place of Bus Terminal
Dhaka is served by three inter-city bus terminals which are conveniently located with respect to the corridors they serve: Saidabad- Southern Corridor, Mohakhali- Northern Corridor, Gabtoly North-Western Corridor. The areas at Gabtoli and Saidabad (3.15 and 4.10 hector) are very limited to comply with existing demand (DCC 2006). All terminals are poorly designed with respect to terminal system requirements. Many components of the system are totally absent along with some basic amenities. Utter disorder in using the terminal space, lack of management and indiscipline of drivers and passengers are other reasons for congestion at those inter-city bus terminals. Fulbaria Road is the main terminus for intra-urban buses, which also experiences extreme congestion, mainly induced by buses lying over the whole road haphazardly and absence of terminal facilities. Moreover, there is an acute shortage of bus stands with adequate facilities throughout the city (except recently introduced Premium/BRTC services). Hence buses frequently stop here and there affecting smooth flow of traffic. Objectionable Driver's behavior is sometimes responsible for further miseries particularly near intersections. Besides this there are so many deficiencies in regulatory measure like poor loading and unloading, on street ticket counter etc.

CONCLUSIONS
Dhaka is considered as one of the densely populated mega city of the world. Since the road network system of the city is not planned or built to cater to the needs of present days and future requirements, it becomes now difficult to upgrade roads with proper realigning or widening. Because, major portion of the roads now pass through densely populated area and numerous permanent residential and commercial multi storied buildings are constructed on both sides of the roads. As well, following recommendation may adopt for regulating and controlling the decant growth and to reach a glowing future:

- To ensure sustainable and efficient development details land use and transportation plan should be developed on the basis of details observation, analysis and future requirements with a coordinated and integrated approach different organization
- As neither DCC nor RAJUK are interested to build roadway facilities by using own capital, DTCB should not only be given sole responsibility of transportation planning but also to pursue necessary funding for implementation of new roadway projects
- To ensure development of well defined functional local roadway system, land division criteria should be such that each property would be accessible by emergency vehicles and at least a Fire brigade vehicle and an Ambulance can get in side by side. In case of R/A development preference should be given to organized land developer than the individual developer
- To devise a policy regarding road cutting-digging which is frequently required by different utility providing organizations; in order to minimize the necessity of frequent road cutting-digging.
• To plan primary and secondary road network along with to prepare side road entry plan to facilitate planned development of local road network and thereby to ensure accessibility of the localities particularly those situated behind the roadside frontage development
• Not to allow further deterioration of the level of service of the existing roadway capacity by allowing indiscriminate densification of road adjacent landuse pattern.
• To prepare roadway densification plan and accordingly restrict conflicting roadside development works

REFERENCES

RMMS (2004), “Road Maintenance and Management Survey (RMMS)”, Dhaka City Corporation (DCC), 2003