



# A Brief Study on Capacity Loss at Major Dhaka City Roads

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**Abstract:** At present, one of the most important phenomena in Dhaka city is traffic congestion which is the result of high amount of existing vehicles in contrast to inadequate roadway facilities. Though there are a set of factors associated to this, one of the major reasons is the inability to use the city roads to their highest capacities. This study is based on finding the major players behind the growing phenomenon of capacity loss in major city roads. For this, seven major roads have been taken into consideration. A survey has been conducted on different roads of Dhaka City different factors playing key role to reduce the overall capacity have been identified. A group of data has been obtained from all of them to find the capacity reduced from all these roads and the usable capacity available. Different behaviors like parking on street, near intersections, existence of shops near roads, periodic maintenance, lack of facilities for waste disposal and several other factors have been identified for the overall situation. From this study, it has been found that the percentage of avg. capacity loss of roads in Dhaka is 12.91%, whereas capacity loss due to On/Off street construction have found to be 13%. On street parking causes more than 10% of loss of capacity. Water logging causes nearly 8% and poor maintenance contributes to about 7% of total capacity loss. Overall, the study has shown some interesting findings regarding major city road conditions and provided adequate recommendations for improvement.

**Keywords:** Congestion, Capacity Loss, Reduction in Road Width, Transport Condition in Dhaka

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## 1. Introduction

In Dhaka City one of the major problems in Transportation System is the loss of capacity of roads which is caused due to a set of reasons. Due to various factors the roads within this city cannot function with its fullest capacity. The loss of capacity of roads is a key contributor of traffic congestion. As this is known that traffic congestion in Dhaka City is one of the most important factors behind major economic and environmental loss, this paper is thus motivated to identify the reasons of capacity loss of road and the effects on roads of Dhaka City.

There are different forms of dispersed development which do not follow any forms of monitoring. This creates urban transport problems. The unplanned transportation system has affected the performance of the Dhaka city in the past years. This has been found that, only 9% of roadways and 6% of pavement area are available in this city, among which, 62 km is functional primary, 108 km secondary and 221 km connector roads [1]. Meanwhile, the road network is 16% of total city area in Tokyo and 25% of total area in majority of other developed cities [2]. For this reason in Dhaka, poor infrastructure is worsening the roadway condition. This

lessens mobility and depreciate the performance of overall traffic system. The key factors which are responsible for reducing the capacity of the roads of Dhaka City are on street parking, on street market, and on/off street construction, dustbins on roads, poor maintenance of roads, and water logging etc. [3]. In addition, the main factors affecting on street parking are parking at road intersection, non-motorized vehicle parking on road, motorized private vehicle parking on road, and bus stoppage on road [4]. In order to find out the major causes regarding the capacity loss of existing road networks, these factors have been considered to find out the amount of losses faced currently in major city roads. The focus is to find out the major reasons behind the loss and the contribution of each factors responsible. For this, seven major Dhaka city roads has been considered and a wide range of parameters have been assessed in order to find out the major players behind the severe congestion and capacity loss of Dhaka city streets.

## 2. Literature Review

Traffic is a frequent phenomenon in Dhaka city. The experts have found that High-amount vehicles and lack of

streets are the major causes for this capacity loss [1]. This is natural and a common sight of this densely populated city like Dhaka. Nonetheless, the capacity loss due to countless factors is also a dynamic player of traffic congestion and other transportation problems.

No relevant study or survey methods have been found that can enumerate the capacity loss of roads in Dhaka city. Then again, there are many attempts to sort out the each factors and their impacts on roads. The factors behind capacity loss is described here.



Figure 1. Motorized Vehicles Parked on the road.

### 2.1. On Street Parking

On Street Parking is one of the most common phenomena in the roads of Dhaka city. Due to unplanned parking facilities it is found quite often that various types of vehicles are parked illegally on the roads of Dhaka City. This causes reduction of road width and thus creates hindrance of free-flow of traffic undertaking. It is the most vital factor of reduction of road width of Dhaka city [5]. There are various types of on street parking which are:

- Parking at road intersection
- Non-motorized vehicle parking on road.
- Motorized private vehicle parking on road.
- Bus stoppage on road.

a) *Parking at Road Intersection*: The road intersections are the most fragile parts for vehicular movement which is also affected by parking. This does not allow the vehicles a smooth run which causes congestion at intersections. Different NMVs (Non- Motorized vehicles) are found parked at most of the major city road intersections currently.

b) *Non-motorized vehicles parking on Road*: In Dhaka City, NMVs like Rickshaw, vans are one of the most plentiful types. Rickshaws have been known as one of the most chaotic and unrestrained cluster of vehicles functioning on the city roads. The DCC, which is the licensing authority for the rickshaws, has issued

licenses to about 78,000 rickshaws [6]. But the actual number operating within Dhaka is estimated to be anywhere up to 600,000 vehicles [7].

c) *Motorized Vehicles Parking on Roads*: In Dhaka, up to the year of 2003, number of registered private cars were more than eighty thousands while after June, 2011, it climbed up to a grand total 1,74,122 which indicates almost doubling the figure in eight years only [8]. The total number of motor vehicles is 6, 43,003 after June, 2011 showing 27.1% of private cars which supplies only 5% of total trips [8]. This phenomenon causes severe congestion which is very common at the festival seasons when more than 9 million people leave Dhaka [9]. As a result, high concentration of parking demand in front of every large development is found even in the form of multiple row parking. (see Fig.1)

### 2.2. Parking at Intersection

Parking at intersection reduces the road width considerably and it is a common feature of Dhaka road [10]. Chao ET. Al. showed various forms of difficulties caused by on street parking near intersections and found that this is one of the major players behind the capacity loss of city roads [11].

### 2.3. On/Off Street Construction

On or, Off Street construction are another forms of problems that lessens the capacity of the road provisionally (see Fig.2). This time-based capacity loss is inspected on Temporary Losses of Highway Capacity and Impacts on Performance by Chin ET. Al. which has shown impermanent losses of highway capacity due to On/Off Street Constructions [12].



Figure 2. Construction work in Dhakeshwari Road.

### 2.4. Maintenance and Management of Roads

Maintenance and Management of roads are very important to control the factors which are guilty of reducing the capacity of the roads. Being a mega city many types of Construction works are happening in the City. Currently a 8.25 kilometer long flyover construction is taking place at Mogbajar-Mouchak [13]. This construction project has started more than two years ago. This massive constructional

work reduces the whole Moghbajar-Mouchak-Shantinogor route capacity. Also many types of maintenance work are done on the streets of Dhaka. For this reason the usable capacity of many roads in Dhaka City decreases (see Fig. 3).



Figure 3a. On street construction in Moghbazar, Dhaka (May, 2015).



Figure 3b. On street construction in Moghbazar, Dhaka (May, 2015).

## 2.5. Waste Management and Drainage System

Hundreds of tons of solid wastes lie scattered and uncollected on the roads and lanes of the capital every day, hindering pedestrians' movement and causing health hazards and environment pollution. Every day nearly 1500 tons of solid wastes are left unattended by the Dhaka South City Corporation and the Dhaka North City Corporation [14]. For these reasons we can find many dustbins on streets of Dhaka City. These dustbins are placed lacking proper planning consequently creating problem for ongoing traffic [4].

## 3. Methodologies

To assess the percentage of usable capacity of a road, a set of measures have been taken. For the analysis of loss of capacity of roads, a set of parameters have been taken into account.

### 3.1. Calculation of % of Reduction of Road Width

After classifying the types of obstruction the calculation of percentage Reduction of Road width has been calculated using various factors. To do so, a set of data have been collected at "Peak Time" from different locations when the vehicle flow was highest. The method used for calculation is dependent on following parameters.

- Width of Road
- Width of Obstruction

The equation needed for the calculation of reduction of road width is [15]:

$$\% \text{ Reduction of Road Width} = \frac{\text{Width of obstruction (ft)}}{\text{Width of road (ft)}} \times 100\% \quad (1)$$

### 3.2. Calculation of % of Capacity Loss

The next step is to find the percentage of capacity loss of the total road. To find the percentage of capacity loss of the existing road by a specific factor, the equation used is given below [16].

$$\text{Capacity Loss} = \frac{\text{Length of obstruction (ft)} \times \% \text{ Reduction}}{\text{Length of Road (ft)}} \times 100\% \quad (2)$$

### 3.3. Calculation of % Usable Capacity

After calculating the total percentage of capacity loss the percentage of usable capacity of the road can be determined by simply subtracting the value obtained in capacity loss from 100.

$$\text{Usable Capacity (\%)} = 100 - \text{Capacity Loss} \quad (3)$$

## 4. Result Analysis

In order to analyze the roadway capacity of different major roads in Dhaka city, a set of seven major roads have been taken into account. All the roads play a major role in hauling the city traffic. Upon analyzing the parameters related to

capacity of roadways, this has been found that all the roads considered face capacity loss to some extent which hinders the flow capacity of citywide traffic.

The bar chart shown in Fig.4 shows the percentage of capacity loss in major city roads. Most of the capacity loss is faced by Motijheel Road, an amount above 25% which where the least loss is faced by the Shahbagh roads which is just below 4%. Outer circular road also has about 24% capacity loss in traffic. The flow capacity loss is half of Motijheel in Panthapath and Greenroad which is about 12%. From this chart, this is evident that Motijheel road has the least amount of usable capacity for traffic flow where Shahbagh road can accumulate comparatively better flow situation.

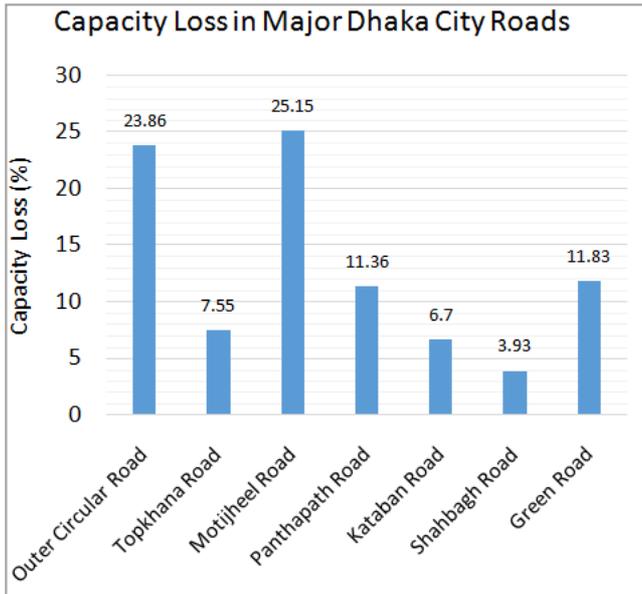


Figure 4. Capacity loss in Major Dhaka city roads.

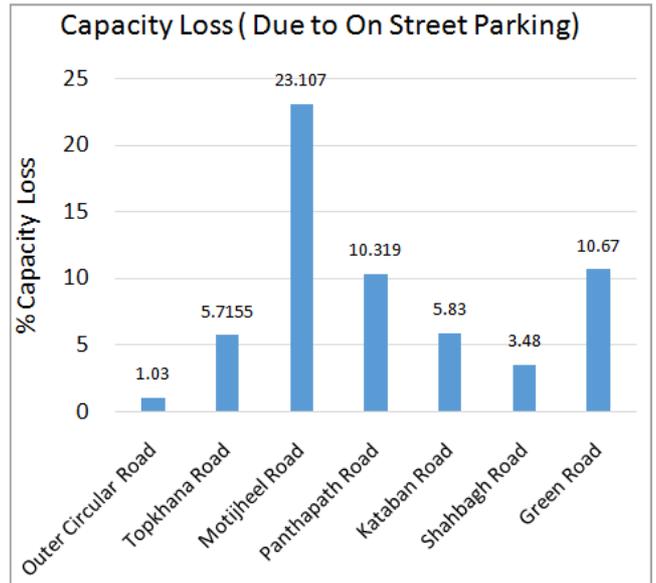


Figure 5. % Capacity Loss due to on street parking.

As this is already known that parking near intersections can cause major traffic hindrance, this can also reduce the effective road width. Most of the in city intersection parking is observed at Greenroad which reduces the effective road width about 35.5% which is stated on Table 1. This leaves only about 64.5% road width open to traffic which creates major congestion. In spite of lack of flow capacity, Motijheel road shows least amount of reduction in road width compared to all seven roads considered. From the chart, the trend line shows that, the average amount of reduction of road width in most of the major city roads is about 27%.

Table 1. % Reduction of road width due to intersection parking (Appendix-A).

Road Name	% Reduction of Road Width (Due to Parking at Intersection)
Outer Circular Road	25.81
Topkhana Road	22.12
Motijheel Road	17.57
Panthapath Road	27.51
Kataban Road	33.51
Shahbagh Road	26.76
Green Road	36.56

On Street parking is the most common issue in every road in Dhaka city. This is the major problem which causes the capacity of the roads in Dhaka. Fig.5 shows the capacity loss of roadway width due to street parking which has found that there's a substantial amount of on street parking in most of the city roads among which, on street parking in Motijheel is the highest which is about 23%.

From various types of parking conditions, this have been found that Non-motorized vehicle (Rickshaw & Vans) reduces nearly 26% of road width which causes a loss of capacity about 1% (Fig. 6).

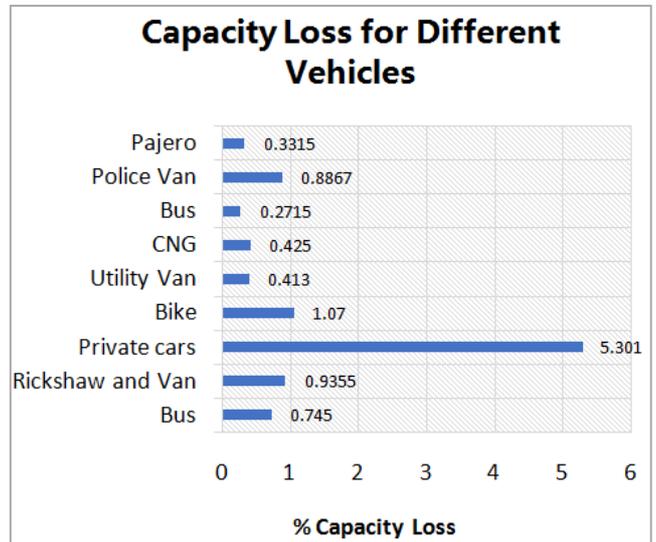


Figure 6. Capacity loss of due to vehicle parking.

Motorized vehicle like Private Car reduces more than 33% of road width causing about 5.5% capacity loss. Bus reduces more than 34% of road width. Also Utility van reduces more than 24% of road width where Motor Bike reduces more than 19% of road width causing around 1% capacity loss of Dhaka city roads.

Also, the study has found an average amount of 24.86% of loss in roadway width for all the major roads due to on street shops. These shops includes the hawkers, extended portions of roadside shops etc. On or off street construction is another major player for the citywide congestion. In addition, the haphazard maintenance jobs in on and off season also causes major loss in capacity. Detailed survey results are provided in Appendix-A.

From Fig. 7, we can see On/Off Street Construction causes nearly 13% of loss of capacity of Dhaka Roads. Where upon On Street Parking causes more than 10% of loss of capacity

of Dhaka Roads. Water logging causes nearly 8% of capacity loss. Poor maintenance causes nearly 7% of capacity loss of Dhaka roads. Dustbins cause 0.319% of capacity loss. On Street Shop causes nearly 0.6% of capacity loss and Parking at intersection causes nearly 0.4% of capacity loss of Dhaka Roads.

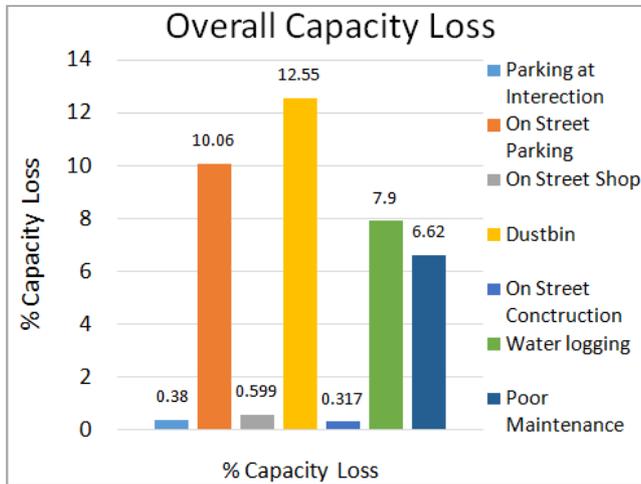


Figure 7. Overall capacity loss.

## 5. Conclusion

The analysis of loss of capacity of roads provides a quantitative realistic condition of roads of Dhaka. This study shows how to develop a simplified method to survey and quantify the capacity loss of roads of Dhaka city. It also shows how to analyze the factors which are playing vital role to reduce the capacity of the existing roads. The method of this study can be used to evaluate the capacity loss of Dhaka roads. It can be adopted to evaluate the loss of capacity of roads in Dhaka City. This research has shown the factors responsible for loss of roadway capacity and also the particular fields to improve. So, from this study, it can be said that only the total purge of these certain factors which are guilty of reducing the capacity of roads can improve the capacity of existing roads. The future studies might improve the reasons behind the presence of the factors in diverse amounts and with that, different roads can be quantified.

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## Appendix-A

Table 2. Collection of field data for the analysis of capacity loss from seven major roads in Dhaka

Road Name	Length of Road	Width of Road	Obstruction types	% reduction of road width	Capacity Loss	Total Loss	Usable Capacity
Outer Circular Road	2355	31.76	Parking at Intersection	26%	0.08	23.86	76.14
			On Street Parking	18%	1.03		
			On Street Shop	10%	0.02		
			Dustbin	24%	0.37		
			On Street Construction	46%	14.05		
			Water logging	28%	7.9		
			Poor Maintenance	13%	0.41		
Topkhana Road	1081	26	Parking at Intersection	22%	0.915	7.5495	92.4505
			On Street Parking	20%	5.7155		
			On Street Shop	13%	0.919		
			Dustbin				
			On Street Construction				
			Water logging				
			Poor Maintenance				
Motijheel Road	2445	30.51	Parking at Intersection	18%	0.06	25.147	74.853
			On Street Parking	40%	23.107		
			On Street Shop	66%	1.98		
			Dustbin				
			Parking at Intersection	28%	0.44		
			On Street Parking	26%	10.319		
			On Street Shop	17%	0.312		
Panthapath Road	3085	23.835	Dustbin	48%	0.29	11.361	88.639
			On Street Construction				
			Water logging				
			Poor Maintenance				
			Parking at Intersection	34%	0.417		
			On Street Parking	24%	5.83		
			On Street Shop	23%	0.39		
Katabon Road	2484	22.57	Parking at Intersection	34%	0.417	6.697	93.303
			On Street Parking	24%	5.83		
			On Street Shop	23%	0.39		

Road Name	Length of Road	Width of Road	Obstruction types	% reduction of road width	Capacity Loss	Total Loss	Usable Capacity	
Shahbagh Road	1419	23.21	Dustbin					
			On Street Construction	15%	0.06			
			Water logging					
			Poor Maintenance					
			Parking at Interection	27%	0.202			
			On Street Parking	29%	3.486			
			On Street Shop	21%	0.24			
			Dustbin				3.928	96.072
			On Street Construction					
			Water logging					
Green Road	4110.38	17.04	Poor Maintenance					
			Parking at Interection	37%	0.546			
			On Street Parking	32%	10.67			
			On Street Shop	24%	0.3596			
			Dustbin	57%	0.256		11.8316	88.1684
			On Street Construction					
			Water logging					

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## Biography



**Mohiuddin Imran** comes from one of the best engineering universities from Bangladesh named 'Bangladesh University of Engineering and Technology'. He has sheer interest in different fields of research including Transportation and Environmental Engineering. His undergraduate thesis was 'Assessment of Dhaka City Roads Before and After Resurfacing' under the direct supervision of Prof. Dr. Md. Zakaria, Department of Transportation Engineering, Faculty of Civil Engineering, BUET, Dhaka. In his further studies, he had been greatly impassioned with working in several research fields including development in transportation modes and transportation materials. He has participated in different conferences and training sessions throughout the years.



**Md. Imran Hossain** has recently graduated in Civil Engineering (Geotechnical major, Transportation minor) from Bangladesh University of Engineering and Technology (BUET). Now he is pursuing the MSc in Geotechnical Engineering. Moreover, he is a

Lecturer at Department of Civil & Environmental Engineering at Uttara University. His interest for Geotechnical Engineering subsequently turned into passion during his thesis on 'Compressed earth block stabilization using natural fibre'. He has worked with 'Building Pioneers gUG' on a Case Study for finding suitable compressed earth block material. After graduation, Hossain wishes to move somewhere where he can get opportunity to research on Geotechnical issues.



**Reasat E Noor** has completed his undergraduate courses from Bangladesh University in Engineering and Technology in Civil Engineering with a major in Transportation and minor in Environmental Engineering. Currently, he is working with Shimizu Bangladesh with several projects ongoing near Dhaka focused on the

construction of new major bridges in Bangladesh. He thrives for practical knowledge in Civil Engineering fields. He tries to work for the betterment of the community through his in depth knowledge in this field and conduct researches for the development of the poor.