

# Festival Time Transportation Demand Modeling in Bangladesh

Munim Islam<sup>1</sup>, Shanjeeda Akter<sup>2</sup>, Mohiuddin Imran<sup>3</sup>, Md. Imran Hossain<sup>4</sup>, Nazmul Hassan<sup>5</sup>

<sup>1,2,3,4,5</sup>Department of Civil Engineering, Bangladesh University of Engineering and Technology

(<sup>1</sup>munimriman28@gmail.com, <sup>2</sup>civil\_rima@yahoo.com, <sup>3</sup>mohiuddin.imran82@gmail.com, <sup>4</sup>mimranhossain09@gmail.com, <sup>5</sup>nazmulhassance09@gmail.com)

**Abstract-** Every year about 9.5 million people leave Dhaka to their village home for celebrating Eid festivals with their family which is about 63% of the total population of Dhaka. But due to the insufficient transport facilities, these homebound people suffer a lot. This fact has prompted this research where the demand of homebound people has been calculated through sequential demand forecasting modeling (after conducting a survey among 2000 people) and been compared with the present capacity and hence some solution approaches have been suggested for meeting the demand. From our research it has been found that about 7 hundred thousand people go to Rangpur division, 14 hundred thousand to Rajshahi, 9.6 to Khulna, 7 to Sylhet, 26 to Chittagong, 6 to Barishal and 23 hundred thousand people go to other parts of Dhaka division from Dhaka city. From mode choice modelling it has been found that mode choices of homebound people are dominated by Bus, Launch and Trains (32%, 34% and 23% respectively). This mode choice varies according to people's income, travel time and mostly to the destination. After finding the demand, it has been compared with present capacity. It has been found that the total demand of Rangpur division is 5 times more than the present capacity. Similarly, Demand to capacity ration for Rajshahi is 4, for Khulna is 3, for Sylhet 5, for other parts of Dhaka division 2.5, for Chittagong 5 and for Barishal, it is 2. A suggestion has been given at the end to manage this short time high demand situation by increasing capacity and availability of railways at the end.

**Keywords-** transportation demand modelling, tidal demand, transportation demand management, tdm in developing country

## I. INTRODUCTION

Bangladesh is one of the most densely populated countries of the world. According to Bangladesh Bureau of Statistics, the population of Bangladesh is 160 million where the population of its capital, Dhaka city, is 15 million [1]. Among this huge population 40% people come to Dhaka city from coastal and rural areas for better earning or for educational purposes [2]. Besides, Bangladesh is a Muslim Dominated country and Eid-ul-Fitr and Eid-ul-Adha are two biggest festivals of this country. Those migrated portion of people of Dhaka city usually celebrate these festivals with their family at their village home. For this reason the transportation demand increases rapidly during these festivals. Like most other

developing countries, the authority of transportation of Bangladesh faces huge problems for managing this tidal demand. The objectives of this study is:

- To conduct a survey among different sectors of people to identify the travel characteristics during Eid festival time.
- To analyze the survey data and conduct Demand Modelling.
- To compare the Demand with present capacity and hence suggest some solution to solve the problem.

## II. BACKGROUND OF THE PROBLEM

A rapid urbanization has been taken place around the Dhaka city in the last few decades. This fact has bring a large amount of migrated people to the central of the country from rural areas. It becomes impossible to the authority to manage the huge rush of home-bound people during Eid festivals. Besides, the traffic system is heterogeneous. Motorized, non-motorized (NMV) share the same road space. As a result traffics cannot get their desired operating speed. Heterogeneous composition of vehicle also causes discomfort, delay, accident etc. problem. And during festival time, when the transportation demand exceeds the supply, home-bound people suffer from these problem vigorously.

Usually transportation system of Bangladesh is predominated by roadways, but the southern part of this country is dominated by water way. During the Eid festivals buses, trains, launches take three to five times more passengers than usual time. Thus the increasing demand has been met up for years. According to the Daily Star, National Committee to protect River, Road and Railway has said that 658 launch accidents have been occurred in the two decades, where more than thirteen thousand people have been found dead [3]. Situation in the roadways are not different. Bangladesh Times stated that in the last five years three hundred people got killed and thousands of people injured in road accidents [4].

A study has been conducted by Accident Research Institute (ARI) in 2007 which shows that daily accidents during Eid-ul-Fitr and Eid-ul-Adha increases up to 16.5 percent and 25 percent respectively [5]. This is not a random event, lack of transportation system management is the main reason of this problem during Eid festivals. Only proper measures to improve the transportation supply and demand management can reduce

these problems. In transport, as in any network, managing demand can be a cost-effective alternative to increasing capacity. A demand management approach to transport also has the potential to deliver better environmental outcomes, improved public health, stronger communities, and more prosperous cities [6].

### III. METHODOLOGY

To find the demand four step modelling system has been applied. A survey has been conducted among two thousand people of Dhaka city. Then this survey data has been used to calculate the transportation demand of home-bound people.

#### A. Survey Design

Occupation has been set as a primary parameter for the selection of target people. A target number of people from different profession has been set in accordance with the demographical composition of Dhaka city.

Data have been collected through field survey, questionnaires, interview and online survey. Before conducting main survey, a pilot survey of two hundred people has been made to set the required information and survey levels.

#### B. Identifying Traffic Analysis Zone (TAZ)

Before the modelling process the whole Bangladesh except Dhaka city has been divided into 15 zones. Bangladesh has 7 divisions with 64 districts. The 15 zones have been chosen because of their same political boundary, uniformity in socio-economic activities and population distribution, same transportation facility or mode availability [7].

#### C. Four Step Modelling using the survey data

- Trip Generation:

From the survey the frequency of trips of people from different occupations has been calculated. From the help of trip generation frequency and demographic composition of Dhaka city, the total number of people generating trips during Eid festival has been estimated [8].

- Trip Distribution:

After calculating the number of generated trips, those have been distributed to Traffic Analysis Zones divided earlier. Gravity Modelling has been used for this purpose.

If the origin of the trip is *i* and destination is *j*, then the formula of gravity modelling is [9]

$$Trips\ between\ i\ and\ j = \frac{\text{trips produced in } i \times \text{attractiveness and accessibility characteristics of } i}{\text{attractiveness and accessibility characteristics of all zones in the area}} \quad (1)$$

An assumption has been made before conducting the gravity modelling – “People go to a zone from Dhaka is related to the total population of that zone”. This assumption has been made because it was found that the number of migrated people to Dhaka from a rural area is influenced by the population density of that area. So population density has been selected as a factor of gravity modelling.

After distributing the trips an Origin-Destination (O-D) Matrix has been generated.

- Modal Split Model:

The origin destination matrix obtained from the trip distribution phase has been used as the input of Modal Split Model. Probability of using a mode can be expressed as followed [10].

$$P_i = \frac{e^{v(i)}}{\sum_{r=1}^n e^{v(r)}} \quad (2)$$

Where,

$P_i$  = probability of using mode *i*

$V(i)$  = utility of mode *i*

$v(r)$  = utility of mode *r*

*n* = number of modes in consideration

The modal split model has been done by using “Biogeme” software.

- Trip Assignment:

After finding the mode choice of home-bound people, trips have been assigned to different paths of Dhaka to different traffic analysis zones.

### IV. DATA ANALYSIS AND DEMAND CALCULATION

#### A. Total number people generating trips from Dhaka:

It has been found that almost 9.5 million people leave Dhaka during Eid festival every year which is about 63% of total population of Dhaka city.

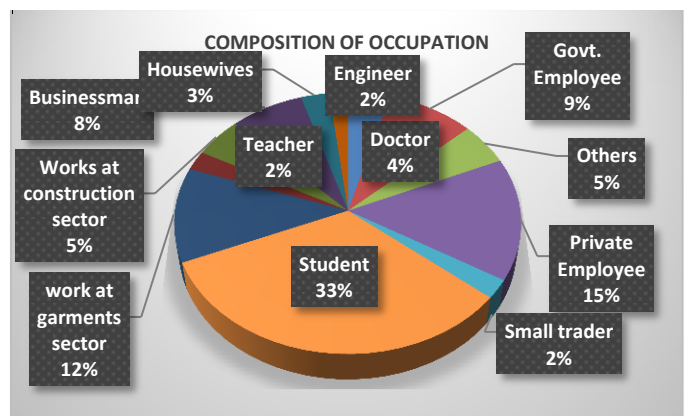


Figure 1. Demographic composition (based on occupation) of Dhaka city

TABLE I. NUMBER OF PEOPLE LEAVING DHAKA DURING EID FESTIVAL

Occupation	Number of people of that occupation in Dhaka city	Percentage of people go to their village home each Eid	Total number of people goes to their village home each Eid.
Student	1680000	56.4	947520
garments worker	1,800,000	76.5	1377000
Construction worker	675,000	60.9	411075
Private + govt. employees	3165534	55.5	1756871
Manufacturing	155682	77	119875.1
Business	2006568	68	1364466
Doctor	21000	60	12600
Others	825,216	73	602407.7
Household	3600000	80	2880000
		<b>Total:</b>	<b>9471815 people</b>

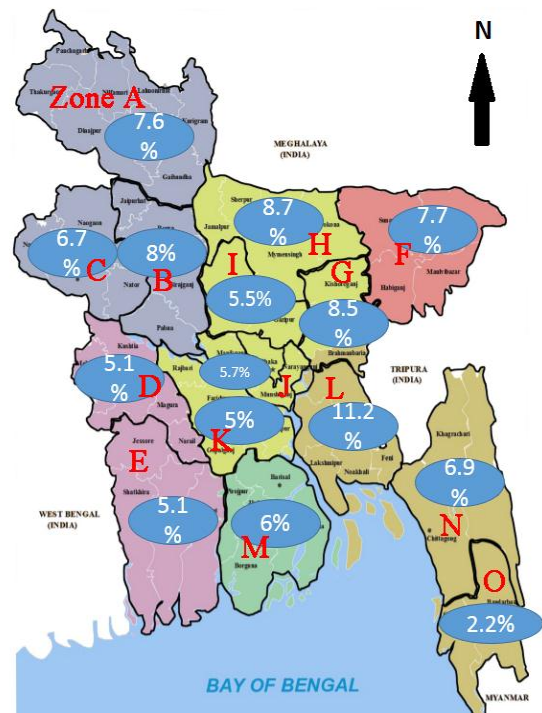


Figure 2. percentage of people going to different region (Traffic analysis zones are shown by Red Letters)

B. Number of people going to different region from Dhaka)

TABLE II. NUMBER OF PEOPLE GOING TO DIFFERENT REGION

Origin	Dhaka
Destination	
A (Rangpur Region)	722792 people
B (Bogra Shirajganj Region)	755156
C (Rajshahi, Nawabganj Region)	636489
D (Jhenaidah, Kushtia region)	485457
E (Jessore, Khulna Region)	485457
F (Sylhet Region)	733580
G (B.Barria Region)	809096
H (Mymensingh Region)	819884
I (Tangail, Gazipur)	517821
J (Narayanganj, Munshiganj, Manikganj)	539397
K (Faridpur Region)	474670
L (Noakhali Region)	1057219
M (Barishal Region)	571761
N (Chittagong, Khagrachari)	658065
O (Cox's Bazaar region)	204971

C. Revealed Preference of choosing mode:

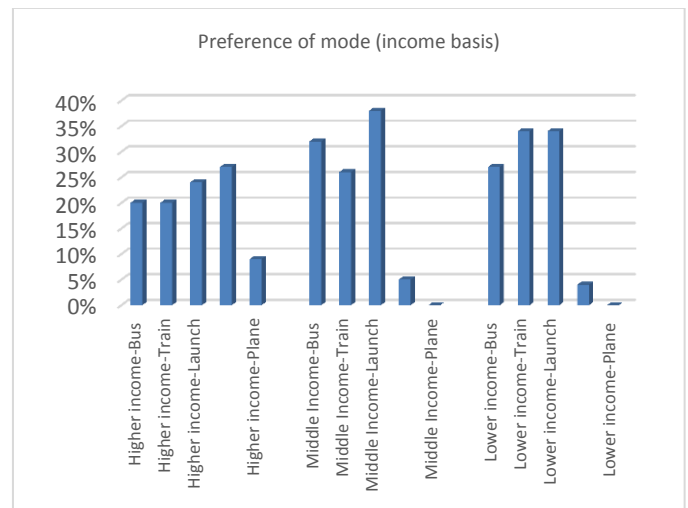


Figure 3. Preference of mode (income basis)

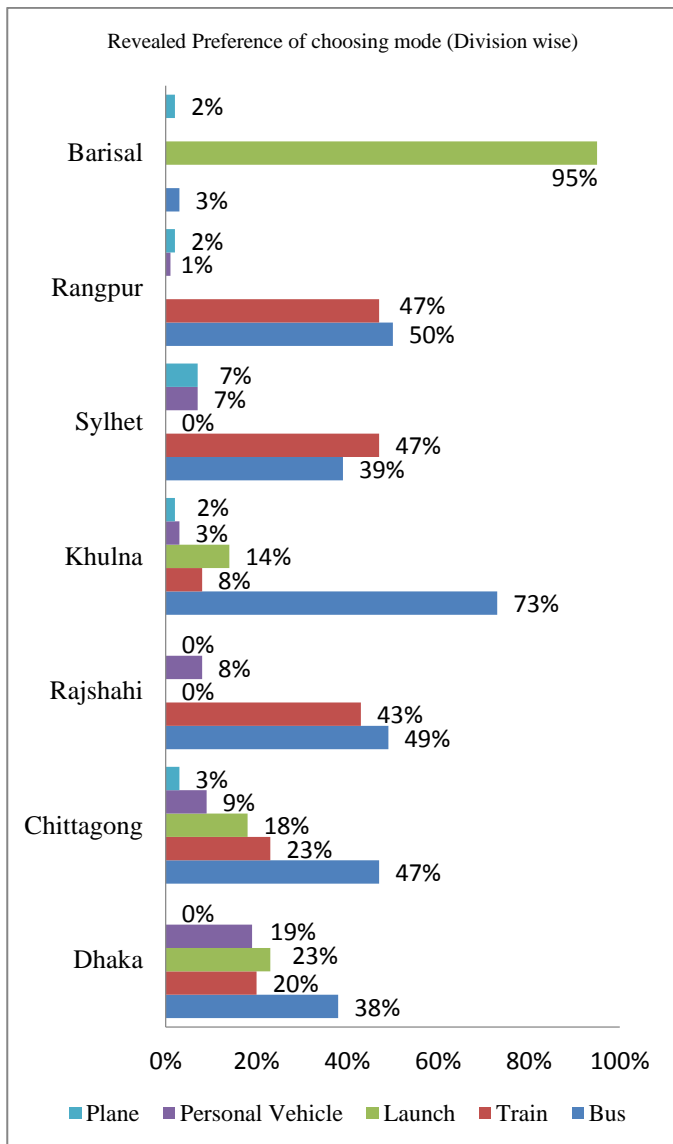


Figure 4. Revealed preference of choosing mode.

#### V. COMPARISON BETWEEN FESTIVAL TIME DEMAND AND SUPPLY

It has been found that this festival time rush exists for three days before Eid. Total capacity of a region has been calculated by adding the three day's capacity of available modes of that region.

TABLE III. COMPARISON BETWEEN DEMAND AND SUPPLY OF VARIOUS MODES IN DIFFERENT REGION

Districts	Modes of transportation	Three day's capacity during Eid season rush	Demand of different modes	Demand to capacity ratio
Mymensingh Region (H)	Bus	226800	573918	2.5
	Train	46800	163976	3
Tangail, Gazipur (I)	Bus	230400	466038	3
	Train	7800	25891	3
Narayanganj, Munshiganj (J)	Bus	216000	485457	2
	Train	11700	26969	3
Faridpur Region (K)	Bus	180000	379736	2
	Launch	40800	94934	2
Rangpur Region (A)	Bus	97920	361396	3.5
	Train	331200	216837	7
	Plane	1500	3613	2
Bogra, Sirajganj Region (B)	Bus	161210	604124	3.5
	Train	7800	75515	9
	Launch	4500	22654	5
Rajshahi Region (C)	Bus	126720	445542	3.5
	Train	19500	127297	6
	Plane	2000	6365	3
Jhenaidah, Kustia Region (D)	Bus	129600	461130	3
Jessore, Khulna, Bagherhat (E)	Bus	126000	354825	3
	Train	15600	38841	2.5
	Launch	22800	67971	4.5
	Plane	2000	9710	4.5
Sylhet Region (F)	Bus	120960	440148	5
	Train	19500	110037	5
	Plane	3600	22007	11
Bahmanbaria, Narshingdi (G)	Bus	172800	566367	3
	Train	23400	80909	3
	Launch	12000	40454	3
Noakhali Region (L)	Bus	273600	687192	2.5
	Train	15600	31000	2
	Launch	150000	317165	2
Barishal Region (M)	Bus	74880	114352	1.5
	Launch	318300	548890	1.7
	Plane	1000	1700	1.7
Districts	Modes of transportation	Three day's capacity during Eid season rush	Demand of different modes	Demand to capacity ratio
Chittagong, Khagrachori (N)	Bus	40320	296129	7
	Train	35100	197419	5
	Launch	30000	118451	4
	Plane	2300	14161	5
Cox's Bazar, Bandarbands (O)	Bus	34200	185473	5
	Plane	2000	6149	3

## VI. CONCLUSION & RECOMMENDATION

From the above table it can be stated that, the total number of people leaving Dhaka during Eid festival is 94,71,815 while the present capacity of transportation system of Bangladesh can only afford 30,37,580 people. The average demand is 3 times more than the capacity.

To overcome this situation, proper Transportation Demand Management (TDM) and Transportation System Management (TSM) is necessary. To increase the capacity we have to increase the supply of internal railways, waterways and airways. Because of the limitations of existing road infrastructure, increasing the number of buses will not that much effective. Rather it will increase congestion. Railways authority have to increase the number of trains where the railway is available. 18 to 22 bogies or wagons can be carried by a train which can easily carry about fifteen hundred of passengers. This is a good way to meet high transport demand. For example, in Dhaka-Sylhet railway, demand is 5 times more than the capacity. If 20 trains can be added in this route, then thirty thousand more passenger can be carried comfortably each day. With this additional capacity the demand of Sylhet-going people can be met.

Initiative should be taken to strengthen internal airways too. Like Bangladesh, China also faces high transport demand during Spring Festival. They need to provide transportation facilities to an average of four hundred and sixty million homebound people during Spring Festival. Along with the roadways, their developed airways and railways greatly support them to meet the demand. So to mitigate this short time high demand situation, Bangladesh needs to improve the capacity and availability of railways and airways throughout the country. Only then safe and sound transportation facilities can be expected for the homebound people.

## ACKNOWLEDGMENT

I want to pay my gratitude to my research supervisor, Dr. Moazzem Hossain, Professor, Department of Civil Engineering, Bangladesh University of Engineering and Technology for providing us continuous support and guideline to perform this research work.

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