

## ESTIMATION OF TRIP ATTRACTION RATE OF MEGA SHOPPING MALL AND SCHOOL IN DHAKA CITY

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### ABSTRACT

Dhaka is the capital of Bangladesh, suffering from various problems. Traffic congestion is one of the major problem which is increase by unplanned growth of different mega structures at different places. It has become a prime concerns for the Transport Planners and Engineers of Bangladesh. Travel demand forecasting of Dhaka city will be a good initiative to minimize it. Trip generation is the first step of the traditional four-step travel demand forecasting model. It consist trip production and trip attraction of a traffic analysis zone (TAZ). This paper focused on estimating trip attraction rate of a mega shopping mall and a school of Dhaka City using trip rate analysis method. As part of this study physical properties like floor space, no of shops and employees of Bashundhara city shopping complex were surveyed. Number of vehicles and people entering the market as well as school were counted with 15 minute interval during peak hours of data collection days. The major Trip rate analysis results found are average peak hour person trip attraction rate 3.91trips/1000ft<sup>2</sup>/hour and average peak hour car trip attraction rate is 1.76 trips/10000 ft<sup>2</sup>/hour for Bashundhara City. Whereas, average peak hour person trip attraction rate 15.9trips/1000ft<sup>2</sup>/hour and average peak hour car trip attraction rate 46.46 trips/10000 ft<sup>2</sup>/hour for Ideal School were found. These results indicates the importance of trip rate analysis before constructing any mega structures at Dhaka as new structures will affect the normal trip generation of surrounding area by attracting a large amount of traffic.

**Keywords:** Trip attraction, traffic analysis zone, trip generation

### 1. INTRODUCTION

These days, the transportation planning issues faced by most Asian cities include rapid urbanization and motorization which is leading to sharp increase in travel demand whereas, the supply has largely remained unmatched with demand. Trip generation and trip attraction is important to the traffic engineer and planner in considering the impact of new development such as office complex, shopping centre and residential development. New development leads a various impact to the people's daily activities. The impacts of surrounding roadway network tend to make people moving far from one place to another place. Road length is increasing and road network patterns change according to the accessibility needs of people and desire to reach their destinations. Hence, new development will increase the travel demand and also increase the vehicles. Trip attraction is obviously most pertinent relative to traffic at specific land use activity. (Box, Paul 1994 & Fan, Henry, Parking 1997). It plays an important role in many phases of transportation planning and traffic engineering related activities. It is the part of trip generation in the travel-forecasting process. From trip generation, other relevant analysis which includes trip distributions, modal split and trip assignment can be carried out. (Rosnita, 2009)

It involves the estimation of the total number of trips entering a parcel of land as a function of the socioeconomic, location, and land use characteristics of the parcel. In the reliable sector, urban transportation covers the movement of both people and goods within an urban area. At the individual level, urban transportation can be characterized by a trip. However, at the metropolitan area level, millions of these individual trips define urban transportation. A trip is a journey made by an individual between two different points. Each trip is performed one or multiple transportation modes for a defined purpose at a given time. Although a trip may involve more than one purpose, it is usually identified by its principal purpose. Trip generation analysis seeks to estimate the volume of trips that will be made by individuals to work, shopping, school, and so forth, but not the flows between points within the whole system. The functioning of metropolitan

cities is highly dependent on the movement of people, goods and information and trip attraction studies are a vital part of transportation planning, due to the recursive nature of urban transportation modeling procedure. Personal trips are commonly classified based on their main purpose such as work trips, shopping trips, social trips, recreational trips, school trips, home trips and business trips. Among all trip purposes, work trips are the most numerous; followed by shopping trips. (Majbah, Riad, Istiak, Priyanka, Ahasan & Tanweer, 2012). A very few studies have been done about shopping and school trip attraction in Dhaka city. Trip attraction rate of shopping mall and school are different. This study focuses on shopping trip attraction as well as school trip attraction in Dhaka city area. Mega Shopping mall Bashundhara City and Motijheel Ideal School is selected for this study.

The aim of this study is to determine the trip attractions of mega shopping malls in Dhaka city and to determine the trip attraction rate for school in Dhaka city. Through the trip attraction analysis, we can determine the attraction of the shopping trip and school trip in Dhaka city. Then, the travel demand can be estimated from the analysis. More specific purposes of the study are

- To determine Trip Attraction Rate of Bashundhara City shopping mall as a mega shopping mall in Dhaka city.
- To show the trip attraction variation of the shopping center during weekend and week day.
- To show the trip attraction variation during peak hour of the shopping center.
- To determine trip attraction rate of Motijheel Ideal School as well as regular trip attraction rate.
- To show the trip attraction pattern and variation during peak hour of the school

This research is intended to provide empirical trip attraction data for use in transportation planning and traffic engineering studies for urban areas throughout Dhaka city. Study also provides the foundation for subsequent research to be conducted by local agencies and private organizations to further build a comprehensive urban trip attraction database of shopping center and school.

### 1.1 Importance of Trip Attraction Rate

Travel demand forecasting is essential for the design of transportation facilities and services, and also for planning, investment, and policy development. Trip generation is the first step of the traditional four-step travel demand forecasting process. It is very important since this step produces accurate results of the analysis as it is the basis of subsequent steps and errors in this step can propagate in the entire estimation process of four steps model. One of the important factors for trip attraction (TA) is work trips. Motor Dhaka is a metropolis of 1528 km<sup>2</sup>. Population density in Dhaka is over 10,000 per km<sup>2</sup> in the city area. The population in Greater Dhaka has already crossed 10 million and average annual growth rate is 7%. Growth of Dhaka as a metropolis has brought with its demand for expanded infrastructure to service the needs of its urban residents and visitors. Vehicle (car and jeep) density for the Dhaka metropolitan is about 7 per 1,000 population and average annual growth rate is 8.1%. So, travel demand forecasting is essential for Dhaka city and trip attraction rate analysis should be a good initiative. Unfortunately in Dhaka trip generation has often been treated lightly with very little research works carried out. The study is an attempt to throw light on shopping centre trip attraction and school trip attractions.

## 2. METHODOLOGY AND DATA COLLECTION

Bashundhara city shopping mall is selected for analysis of trip attraction of Shopping Mall because it is one of the largest shopping mall in Dhaka city and now a days this kind of large shopping mall build in the city. But the road capacity in front or beside of this large shopping mall is not appropriate. So in this case traffic congestion occurs in this type of road and it is very uncomfortable and waste time both for customers of the shopping mall and other people who used this path for their daily purpose. Again, Motijheel Ideal School in Dhaka city is selected as a regular trip to find school trip attraction rate. Motijheel Ideal School is selected as it is large and renowned school in Dhaka city. Its hold 1.2 acres school area and large number of students. Trip rate analysis method will be applied for calculating trip attraction rate of the studied mall and school.

### 2.1 Primary Data Collection

At first primary survey was done for collecting data of physical features of shopping mall and school. After that person trip attraction and car trip attraction data were collected for both shopping mall and school.

#### 2.1.1 Physical Features of Bashundhara City

Bashundhara City shopping mall is visited first as a part of our survey for collecting some physical data of the shopping mall like the area, number of shop, number of employee, parking space, number of entry gate and exit gate etc. Bashundhara city shopping mall is one of the largest shopping mall in Bangladesh. It is situated at

Panthapath. It was opened to the public on 6 August, 2004. It has a large number of shops which makes it an important business center of Bangladesh. Floor wise shops distribution are represented in Tables 1.

Table 1: Number of shop in each floor in Bashundhara City Shopping mall

Floor No	Number of Shop
Basement	1 (mega shop)
Ground Floor	368
1st Floor	366
2 <sup>nd</sup> Floor	366
3 <sup>rd</sup> Floor	372
4 <sup>th</sup> Floor	374
5 <sup>th</sup> Floor	37
6 <sup>th</sup> Floor	9 (mega shop)
7 <sup>th</sup> Floor	102
Total	2336

The data shows that mall has space for about 2500 and total 8 floors and a basement. It consist retail stores, cafeterias and also possesses a large underground gymnasium, a multiplex movie theater, a top floor food court and an indoor theme park.

Others features of Bashundhara city like parking spaces, area, number of employee, parking space, number of entry gate and exit gate are collected from the mall authority. These data are represented in Table 2.

Table 2: Others physical features of Bashundhara City Shopping mall

Number of entry gate (person)	4
Number of entry gate (car)	150
Number of car spaces	834
Number of employees	7500
Total Parking Area	226966 sq. ft.
Total Floor space	1600000 sq. ft.

The above data illustrate that mall has a huge floor space which makes it a mega shopping mall. Again it has a large amount of parking area. Different types of shop and excellent parking facilities will attract more person trip and car trip.

### 2.1.2 Physical Features of Motijheel Ideal School

Motijheel Ideal School was visited first as a part of Primary survey. We mainly focus on collecting physical features of Scholl in this primary survey as like as Bashundhara City Shopping mall. Here authority of school gives some physical data of the respective school like the area, number of student, number of teacher, number of stuff, parking space, number of entry gate and exit gate. Obtained data from are shown is table 3.

Table 3: Physical features of Motijhell Ideal School

Campus size	1.2 acres
Campus Type	Urban
Number of entry gate	02
Number of stuff	40
Number of student	2500
Number of teaching stuff	150

### 2.2 Trip Attraction Data collection

Trip attraction data of Bashundhara City Shopping mall and Motijheel Ideal School are collected after completing primary survey. Data collection is an important and complex step of any type of study. In this case actual field data was collected by visual counting.

### 2.2.1 Trip Attraction Data collection of Bashundhara City

Data was collected for every 15 minutes time interval. This interval is chosen because Highway Capacity Manual uses this interval as the base unit for capacity calculation, and also it is rather practical from the standpoint of the person collecting the data. The typical duration of a survey was three hours. Here data was collected for 4.00PM to 7.00 PM. This time is very convenient for shopping trip attraction. Three different days Saturday, Sunday and Monday of a week were selected for data collection. In between three days there is one weekend (Saturday) and other two are working day. Every day trip attraction in shopping mall is not same. Naturally weekend trip attraction rate found maximum. Data was collected in different days for find out maximum trip attraction as well as difference between these days trip attraction of shopping mall. Scheduled three collected data represented in the following table 4.

Table 4: Three days person and car trip attraction data of Bashundhara City

Time Interval	Saturday		Sunday		Monday	
	Incoming people	Incoming vehicles (car)	Incoming people	Incoming vehicles (car)	Incoming people	Incoming vehicles (car)
4:00pm-4:15pm	1479	75	1308	105	1021	59
4:15pm-4:30pm	1509	67	1186	51	1076	49
4:30pm-4:45pm	1612	73	1209	73	1153	58
4:45pm-5:00pm	1496	70	1635	42	1278	50
5:00pm-5:15pm	1747	55	1340	56	1298	70
5:15pm-5:30pm	1593	80	1295	72	1334	73
5:30pm-5:45pm	1649	80	1387	70	1451	76
5:45pm-6:00pm	1831	67	1179	73	1309	68
6:00pm-6:15pm	1865	56	1226	52	1338	36
6:15pm-6:30pm	1905	66	1296	39	1433	59
6:30pm-6:45pm	1924	69	1321	35	1367	43
6:45pm-7:00pm	1887	52	1279	38	1389	39
Total	20497	806	15660	703	15447	677

### 2.2.2 Trip Attraction Data of Motijheel Ideal School

For school trip attraction rate collected data for two days. The time of data collection was 7.10am to 8.00 am as it is before starting time of school. Data collection days are same days of the different week. Collection time also kept same for both weeks. Data was collect for 50 minutes continuously and the time was before start the school. Any time interval is not chosen because of there is a huge pressure all in a sudden.

As school trip is a regular trip, two days value should be same theoretically. In spite of observe regular trip we done this to find out maximum trip attraction rate and find out difference between two days trip attraction rate. Collected data are represented in following table 5 and table 6.

Table 5: School Car trip attraction data

Type of Vehicles	Day 1		Day 2	
	Number of vehicle	Car (Equivalent PCU)	Number of vehicle	Car (Equivalent PCU)
Rickshaw and School Van	105	158	89	134
Car and School Bus	91	91	82	82
C.N.G	04	05	01	02
Motor Bike	08	04	17	19
Total	208	258	189	227

Table 6: Total Person trip attraction and Car trip attraction data

Day	Total incoming Students	Total other Pupils Travel	Total Vehicles
Day 1	573	338	258
Day 2	464	296	227

From two days data, it can be observed that in first day incoming vehicle, incoming student and incoming pupil is more than second day. As it is a big school of Dhaka it attracted a large amount of person and car trip.

### 3. TRIP ATTRACTION ANALYSIS AND RESULTS

This section focuses on the calculation of trip attraction rates of the studied shopping center and school. The rates are estimated with the collected survey data. Trip rate analysis method will be applied for calculating trip attraction rate of the studied shopping center. At first peak hour incoming trip will be calculated from the collected data for both person trip and car trip for shopping center. After the estimation of peak hour trip rate, the trip rate will be used to calculate trip attraction rate with respect to the physical features of shopping center. For school trip attraction rate first find average from the two days data of incoming vehicle, incoming student and incoming people. Then trip rate analysis for school with respect to physical features of the school is done.

#### 3.1 Variation of Person trip and Car trip attraction

There is a large variation in the number of people coming to the shopping center depending on time of the day, day of the week and the season. Trip attraction rate varies widely in our studied shopping center. From collected trip attraction data it is observed that trip attraction for Bashundhara city in Saturday is higher than other two days (Sunday and Monday). Following two consecutive figures (Figure1 & Figure 2) will show the variation of three days trip attraction rate of Bashundhara City Shopping mall.

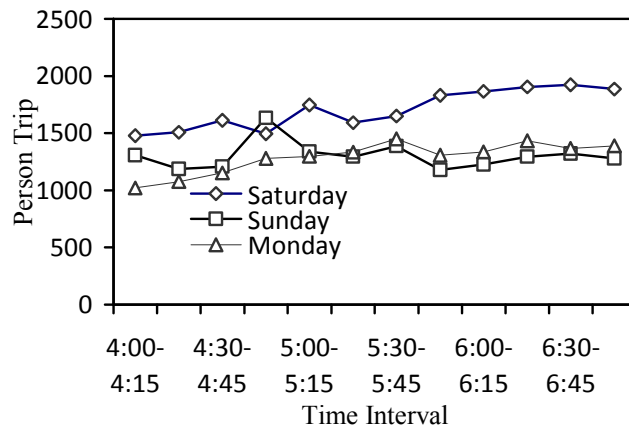


Figure 1: Variation of three days person trip attraction

Figure 1 demonstrates three days variation of person trip attraction of mall at 15 min time interval. It shows all three day fluctuation in person trip attraction. Saturday trip attraction rate is higher than others two days as Saturday is weekend. Generally in weekend the percent of incoming people in shopping mall is higher than any other day. So, Saturday person trip attraction rate is maximum.

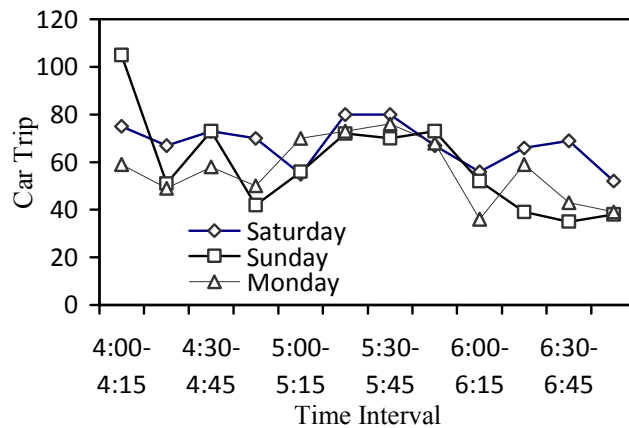


Figure 2: Variation of three days car trip attraction

Above Figure 2 illustrates three days variation of car trip attraction of mall at 15 min time interval. It shows the fluctuation in car trip attraction for all three days. This graph characteristics is similar to the previous person trip attraction graph, here Saturday trip attraction rate is higher than others two days as before. Generally in weekend the maximum number of people and car coming to shopping mall. Again as person trip and car trip are interrelated with each other so, Saturday car trip attraction is also higher than others days.

### 3.2 Peak Hour Trip rate Calculation of Bashundhara City

In this survey the number of incoming people and number of car was counted for every 15 minutes interval. The sum of every 4 consecutive interval of incoming trip is then counted for calculating peak hour incoming trip rate. Summation of every 4 interval data will be calculated for hourly trip rate. The highest hourly data will be considered as peak hour trip rate for Shopping Centre. This procedure will be done for all three days data and for both person trip attraction and car trip attraction.

Hourly trip rate data of Shopping mall for different days is shown in following three consecutive tables. Table 7 represent the data of hourly trip attraction of Saturday for both person trip and car trip.

Table 7: Hourly person trip attraction and Car trip attraction of Saturday

15 minutes Time Interval	Person Trip (PT)	Car Trip (CT)	Hourly Person Trip and Car Trip Attraction ( 4pm-7pm)								
			4:00-5:00	4:15-5:15	4:30-5:30	4:45-5:45	5:00-6:00	5:15-6:15	5:30-6:30	5:45-6:45	6:00-7:00
4:00-4:15	1479	75									
4:15-4:30	1509	67	6096 PT								
4:30-4:45	1612	73	285 CT	6364 PT							
4:45-5:00	1496	70		265 CT	6448 PT						
5:00-5:15	1747	55			278 CT	6485 PT					
5:15-5:30	1593	80				285 CT	6820 PT				
5:30-5:45	1649	80					282 CT	6938 PT			
5:45-6:00	1831	67						283 CT	7250 PT		
6:00-6:15	1865	56							269 CT	7525 PT	
6:15-6:30	1905	66								258 CT	7581 PT
6:30-6:45	1924	69									243 CT
6:45-7:00	1887	52									

In the above table 7 hourly person trip and car trip attraction is calculated from 4:00pm – 7:00pm. Nine different hours are formed for this time range of 4:00pm-7pm to calculate the hourly trip rate as well as peak hour trip rate. For Saturday peak hour of person trip attraction is 6pm-7pm, as maximum number of person trip (7581trip) made in this hour. Whereas peak hour of car trip attraction is two different hour's i.e. 4:00pm -5:00pm and 4:45pm-5:45pm.because maximum car trip (285trip) attracted to the mall in these hours.

Table 8: Hourly person trip attraction and Car trip attraction of Sunday

15 minutes Time Interval	Person Trip (PT)	Car Trip (CT)	Hourly Person Trip and Car Trip Attraction ( 4pm-7pm)								
			4:00-5:00	4:15-5:15	4:30-5:30	4:45-5:45	5:00-6:00	5:15-6:15	5:30-6:30	5:45-6:45	6:00-7:00
4:00-4:15	1308	105	5338								
4:15-4:30	1186	51	PT								
4:30-4:45	1209	73	271	5370 PT							
4:45-5:00	1635	42	CT	232 CT	5479 PT						
5:00-5:15	1340	56			243 CT	5657PT					
5:15-5:30	1295	72				240 CT	5201 PT				
5:30-5:45	1387	70					271 CT	5087 PT			
5:45-6:00	1179	73						267 CT	5088 PT		
6:00-6:15	1226	52							234 CT	5022 PT	
6:15-6:30	1296	39								199 CT	5122 PT
6:30-6:45	1321	35									164 CT
6:45-7:00	1279	38									

The above table 8 represent hourly person trip and car trip attraction of Sunday, calculated from initial trip data. In this day peak hour of person trip attraction is 4:45pm-5:45pm, as maximum number of person trip (5657trip) occur in this hour. This value is considered as peak hour person trip attraction rate. Again, peak hour of car trip attraction is 5:00pm -6:00pm. In this time interval maximum car trip (271 trips) attracted to the mall. This trip value is considered as peak hour car trip attraction rate.

Table 9: Hourly person trip attraction and Car trip attraction of Monday

15 minutes Time Interval	Person Trip (PT)	Car Trip (CT)	Hourly Person Trip and Car Trip Attraction ( 4pm-7pm)									
			4:00-5:00	4:15-5:15	4:30-5:30	4:45-5:45	5:00-6:00	5:15-6:15	5:30-6:30	5:45-6:45	6:00-7:00	
4:00-4:15	1021	59										
4:15-4:30	1076	49	4528 PT									
4:30-4:45	1153	58	216 CT	4805 PT								
4:45-5:00	1278	50		227 CT	5063 PT							
5:00-5:15	1298	70			251 CT	5361 PT						
5:15-5:30	1334	73				269 CT	5392 PT					
5:30-5:45	1451	76					287 CT	5432 PT				
5:45-6:00	1309	68						253 CT	5531PT			
6:00-6:15	1338	36							239 CT	5447 PT		
6:15-6:30	1433	59								206 CT	5527 PT	
6:30-6:45	1367	43									177 CT	
6:45-7:00	1389	39										

The above table 9 illustrates hourly person trip and car trip attraction of Monday, calculated from initial trip data. Peak hour of person trip attraction of this day is 5:30pm-6:30pm, as maximum number of person trip (5531trip) occur in this hour. This value is considered as peak hour person trip attraction rate. Whereas peak hour of car trip attraction is 5:00pm -6:00pm. In this time interval maximum car trip (271 trips) attracted to the mall. This trip value is considered as peak hour car trip attraction rate

**3.3 Trip Rate Analysis for Shopping mall with respect to physical feature**

In this section peak hour trip attraction rate with respect to different physical features of mall are determined. It is one of the major purpose of the study to observe how much trip attracted respect to various features or how trip are related with these features. For this calculation only peak hour trip attraction value is considered as it is our prime concern. In the following table 10 and table 11 both peak hour person trip attraction and peak hour car trip attraction rate are relates with floor area, parking area, number of shop, and number of employees respectively. At first three days peak hour trip attraction rate with respect to mall features calculated individually. After that average of three days finding are calculated for more precise results.

Table 10: Relation of Peak hour person trip and physical features of Bashundhara City

Day	Peak hour person trip	Gross floor area (ft <sup>2</sup> )	Peak hour person trip attraction rate (trip/1000ft <sup>2</sup> /hr)	Total number of Shop	Peak hour person trip attraction rate (trip/shop/hr)	Total number of employee	Peak hour person trip attraction rate (trip/100 employee/hr)
Day 1	7581	1600000	4.74	2336	3.25	7500	101.08
Day 2	5657		3.54		2.42		75.43
Day 3	5531		3.46		2.37		73.74
Avg.	6257		3.91		2.68		83.43

The major findings from table 11 are, the average peak hour person trip attraction rate for gross floor area is 3.91 trip/1000ft<sup>2</sup>/hr which means for every 1000ft<sup>2</sup> floor area on an average 3.91~4 trip attracted per hour. Again with respect to total number of shop peak hour average trip attraction rate is 2.68~3 trip per hour for a shop. Furthermore, for every 100 employees of shopping mall peak hour average person trip attraction rate is 83.43~84 trip per hour. These results represent that a large number of person trip attracted by the shopping mall during peak hour.

Table 11: Relation of Peak hour car trip and physical features of Bashundhara City

Day	Peak hour Car trip	Gross floor area (ft <sup>2</sup> )	Peak hour Car trip attraction rate (trip/10000ft <sup>2</sup> /hr)	Gross parking area (ft <sup>2</sup> )	Peak hour Car trip attraction rate (trip/1000ft <sup>2</sup> /hr)	Total parking spaces	Peak hour person trip attraction rate (trip/10parking spaces/hr)
Day 1	285	160000	1.78	226966	1.25	834	3.42
Day 2	271		1.69		1.20		3.25
Day 3	287		1.79		1.26		3.44
Avg.	281		1.76		1.24		3.37

Again, as like as person peak hour trip attraction rate peak hour car trip attraction rate results are shown in table 12. Prime findings from table 12 are, average peak hour car trip attraction rate for gross floor area is 1.76~2 trip/10000ft<sup>2</sup>/hr which means for every 10000ft<sup>2</sup> floor area on an average 2 trip attracted per hour. Whereas with respect to gross parking area peak hour average car trip attraction rate is 1.24~1 trip per hour for 1000ft<sup>2</sup> parking area. Furthermore, for every 10 parking spaces of shopping mall peak hour average car trip attraction rate is 3.37~4 trip per hour. These results represent that a large number of car trip attracted by the shopping mall during peak hour.

### 3.4 Peak Hour Trip rate Calculation of School

Determination of school peak hour trip attraction rate is different than shopping mall. Because in this case data is collected for two days and the collection time is only 50 min. Here data collection time 7am-8am is considered as peak hour. Because the school start time is 8am and maximum trip attracted one hour before school starting time. From collected data combined person trip and stuff trip attraction of day1 and day2 are 911 and 760 respectively. So the average of two days or average peak hour person trip attraction rate is 836. Again peak hour car trip attraction of day 1 and day 2 were 258 and 227 respectively. So two days average or peak hour car trip attraction is 247. These peak hour values will relates with school physical features to find different peak hour trip attraction rate respect to physical features of school.

### 3.5 Trip Rate Analysis for School with respect to physical feature

In this section like shopping mall peak hour trip attraction rate with respect to different physical features of school are determined. It is one of the major purpose of the study to observe how much trip attracted by the school respect to various features or how trips are related with these features. In the following table 12 and table 14 both peak hour person trip attraction and peak hour car trip attraction rate are relates with gross area, number of employees and number of entry gate respectively. At first two days peak hour trip attraction rate with respect school features calculated individually. After that average of two days finding are calculated for more precise results.

Table 12: Relation of Peak hour person trip and physical features of Motijheel Ideal School

Day	Peak hour person trip	Gross area (ft <sup>2</sup> )	Peak hour person trip attraction rate (trip/1000ft <sup>2</sup> /hr)	Total number of employee	Peak hour person trip attraction rate (trip/100 employee/hr)	Total entry gate	Peak hour person trip attraction rate (trip/entry gate/hr)
Day 1	911	52363	17.40	190	480	2	456
Day 2	760		14.51		400		380
Avg.	836		15.97		440		418

Some important findings from table 12 are, the average peak hour person trip attraction rate for gross area of school is 15.97~16 trip/1000ft<sup>2</sup>/hr which means for every 1000ft<sup>2</sup> school area on an average 16 trips attracted per hour. Besides, for every 100 employees of school peak hour average person trip attraction rate is 440 trips per hour. Moreover, with respect to entry gate peak hour average person trip attraction rate is 418 trips per hour for a gate. These results represent that a large number of person trip attracted by the school during peak hour.



Table 13: Relation of Peak hour car trip and physical features of Motijheel Ideal School

Day	Peak hour car trip	Gross area (ft <sup>2</sup> )	Peak hour car trip attraction rate (trip/10000ft <sup>2</sup> /hr)	Total number of employee	Peak hour person trip attraction rate (trip/100 employee/hr)	Total entry gate	Peak hour person trip attraction rate (trip/entry gate/hr)
Day 1	258	52363	49.27	190	135.78	2	129
Day 2	227		43.35		119.47		113.5
<b>Avg.</b>	<b>243</b>		<b>46.41</b>		<b>127.62</b>		<b>121</b>

From table 13, the average peak hour car trip attraction rate for gross area of school is 46.41~47 trip/1000ft<sup>2</sup>/hr which means for every 1000ft<sup>2</sup> school area on an average 47 trips attracted per hour. Besides, for every 100 employees of school peak hour average car trip attraction rate is 127.62~128 trips per hour. Again, with respect to entry gate peak hour average car trip attraction rate is 121 trips per hour for a gate. These results represent that a large number of car trip attracted by the school during peak hour.

#### 4. CONCLUSIONS

The study has focused on estimating trip rate analysis of a Mega shopping mall and a school in Dhaka using trip rate analysis method. Considering the present case of growth and public interest, the study has been conducted firstly in Bashundhara City. For Bashundhara City Shopping mall data were collected at the peak period (4.00 PM to 7.00 PM) both on the weekdays and holidays. After that three days peak hour trip attraction rate is calculated from the counted data. Those peak hours trip attraction rate ultimately provides the trip attraction rate of the Bashundhara City on the basis of various physical properties. The major finding of the the analysis are divided in two ways one is person trip attraction rate other is car trip attraction rate. Average peak hour person trip attraction rate for gross floor area is 3.91~4 trip/1000ft<sup>2</sup>/hr which means for every 1000ft<sup>2</sup> floor area on an average trip attracted per hour whereas average peak hour car trip attraction for gross floor area is 1.76~2 trip/10000ft<sup>2</sup>/hr which means for every 10000ft<sup>2</sup> floor area on an average two car trip attracted per hour. These results indicate that a huge person and car trip is attracted by Bashundhara City Shopping mall.

For trip attraction rate study Motijheel Ideal School was considered as test case. There is some difference between school and shopping mall data collection. During school data collection peak period was considered to be before school opening hour i.e. 7am - 8am and data was collected for only 50 minutes. The major findings of analysis are, average peak hour person trip attraction rate for gross area of school is 15.97 ~16 trip/1000ft<sup>2</sup>/hr and average peak hour car trip attraction rate for gross area of school is 46.41~ 47 trip/1000ft<sup>2</sup>/hr. These results introduced that a large amount of person and car trip attracted by Motijheel Idea School.

The study can be expanded covering more area under consideration. Moreover, if the data were collected for more time interval and more days the data would be more accurate. Continuous data collection with the goal of developing a larger database that includes at least five data points for up to ten land use categories. Use of the optional demographic data to cross-reference trip attraction to income, auto ownership, and other socio-economic factors could be an effective parameter.

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