

A Comparative Study on Traffic Volume and Temporal Variation of Different Types of Vehicles in Mohakhali, Khilgaon and Jatrabari Flyover

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ABSTRACT

Bangladesh is a developing country with huge population. As the country has excessive population, we have shortage of land for accommodation and transportation. We don't have sufficient roadway for several vehicles and the existing roads are quite narrow to maintain a huge amount of vehicles. The government has planned to build new flyovers with an aim to increase mobility and facilitate the city habitants with a reliable transport network free from the perennial traffic congestion in Dhaka as well as others busiest cities of the country. The transportation specialist think that flyovers are able to save the cities from several transport problems. Seven flyovers have been constructed in the capital of Bangladesh. The three major flyovers in Dhaka city are- Mohakhali, Khilgaon and Jatrabari-Gulistan flyover. After constructing these three flyovers, the habitants of the city are facing less transportation problems as compared to past days. Several surveys and analysis were performed to achieve the temporal variation (weekday-day; weekday-night ; weekend-day and weekend-night) to access how far the objectives have been met through the construction of these flyovers. From the assessment of traffic flow Mohakhali Flyover is the most useful flyover as compared to Khilgaon and Jatrabari flyover. In this flyover almost 36.396 % of vehicles passing above grade among all vehicles at grade and above grade on weekdays and 62.67% of vehicles passing above grade among at grade and above grade on weekend. Jatrabari Flyover performed too much close which almost 28.269 % of vehicles passed above grade among all vehicles at grade and above grade at weekdays and 50.64% of vehicles passing above grade among at grade and above grade at weekend. However, Khilgaon flyover performed very poorly and it is used by small amount of vehicles. Overall analysis has revealed the traffic volume in the above of these Flyover and determined the temporal variation of different types of vehicles. In Mohakhali flyover the highest flow of Vehicles are for microbus/car/jeep which is around (62 to 50) % both weekdays and weekends. In khilgaon flyover highest flow of vehicles are for motorcycle which is around (48 to 30) % both weekdays and weekend. Jatrabari flyover shows in weekend highest flow of Vehicles are for Motorcycle which is around 32% but in weekdays car\jeep are dominating. According to study, firstly the amount of private transports (car, bicycle) are much higher than public transport. Secondly, it has been shown that there are some discrepancies in performances between the flyovers and the roads. The factors are low maintenance service, footpaths are controlled by hawker on road and illegal car parking, sound pollution etc. are most abusive problems in the access road of this flyover. We believe the result from this research will be helpful in understand the traffic volume in those flyover location and it can be helpful for further studies in relevant topic.

Keywords:-Flyover, traffic, transportation, congestion, roadway.

INTRODUCTION

Flyover is a roadway with several lanes in both directions and an overpass which is generally built by using several pillars and columns. These types of structures are constructed due to the shortage of land and to solve many transportation problems like traffic jam. Increase in human population has resulted in an extensive increase in vehicular population.

The number of public transports user are diminishing day by day and the amount of private cars and motorcycles are dramatically increasing. As a result, the total number of vehicles and traffic problems are rising. People suffer from the daily inconvenience caused due to delayed traffic. The main causes of traffic problems include lack of proper planning of roads in terms of considering future capacity. So, traffic analysis and others traffic related researches can play an important role for improving of existing facilities of traffic and future needs of traffic and road.

Many countries of the world are suffering with traffic congestion. Bangladesh is one of the worse sufferers. As the population of the country is increasing day by day. The number of vehicles are rising with the same flow. Many problems such as- traffic jams, road accidents are growing. So, the country's economy is falling down.

To solve these problems necessary studies and researches like traffic volume study, speed study and geometric features of the road and others should be conducted. The number of flyovers, subways, underpass and by-pass roads should be increased. This research is based on traffic volume which present issues that exist at the flyover intersection and recommend improvement to the problems.

Dhaka is the capital of Bangladesh. The total population of Dhaka is almost 2

crores, which is 12.5% of total population of the country. However, the rate is increasing day by day and transport congestions are also rising in the same way. There are not enough roadways for this population and the condition of existing roads are not fair enough. So, the citizens of the city suffer much with traffic jams, delay travel time, road accidents and others. Government is unable to build new roadways to enhance the transportation sectors. Because Dhaka is a small city which already have accommodation problem. We don't have enough land to build new roads or make the existing roads wider.

The Roads and Highway Department (RHD) first suggested to make of grade separated flyovers at four rail crossings intersections during 1987. At that time, the Mohakhali and Khilgaon area of Dhaka city had a lot of traffic congestion including traffic jam. The first flyover of Dhaka city is Mohakhali flyover, which was built in 2004. The construction work was initiated in 2001 and took almost 3 years to complete the whole work.

The length of total flyover is almost 1.12 km and the construction work was done by a Chinese firm called First Metallurgical Construction Limited. The World Bank gave fund to build this flyover and the total cost was BDT 116 crores. The flyover consists two ramps and four-lane. There are 19 piers and almost 552 pilers in Mohakhali flyover.

Khilgaon flyover is considered as the second flyover in Dhaka city which was constructed in the year of 2005. The construction work was started in 2001. The construction work was completed by a firm named Development Construction Limited with self-fund. The length of total flyover is almost 1.9 km and the total cost was about BDT 81.75 crores. The project implementation was done by Local

Government Engineering Department (LGED). The flyover has two lanes and almost 543 piles.

After using these two flyovers the traffic congestion problems weren't solved. People expectation with the flyovers couldn't totally fulfilled. There were many facts for this problems. Drivers didn't follow the traffic rules in roads even in flyovers, lacking of management and signal, parking in the road were the main reasons.

The Jatrabari flyover which is usually called Mayor Mohammad Hanif Flyover is the largest flyover and one of the major flyover in Dhaka city. The total length of the flyover is almost 11.7 km and the total construction cost of this flyover was BDT

23 billion. The construction work was initiated in 2010 and ended in 2013. The flyover is a four lanes flyover. It starts from KutubKhali near Jatrabari and end at Palashi near Gulistan.

It has total six entrance ramps and seven departure ramps. The construction work was finished by Orion Infrastructure Ltd but the design was done by a Canadian construction company. The full project was monitored by Dhaka South City Corporation (DSCC). After 24 years the Orion Infrastructure Ltd will hand over the flyover to Dhaka South City Corporation (DSCC). According to the agreement within this 24 years Orion Infrastructure Ltd will collect the construction cost by taking toll from several vehicles. Orion group collect toll based on vehicle size.

Table 1:-Toll rates for Several vehicles of Jatrabari flyover

Vehicles	Toll Amount (in BDT)
Trailer	200
Six-wheeler Truck	150
Four-wheeler Truck	100
Bus	150
Minibus	100
Pickup Van	75
Microbus	50
Jeep	40
Car	35
Auto-rickshaw	10
Motorcycle	5

METHODOLOGY

Selection of the Study Area

Authors studied with three flyovers in Dhaka.

- Mohakhali flyover
- Khilgaon flyover
- Jatrabari flyover.

Table 2:-Descriptive Characteristics of Studied Flyovers

Name	Grade separation type	No.of Lanes	Length (km)	No of Ramps	Construction Cost (crore Taka)	Date of Commencement of Traffic Operations	Implementing Authority
Mohakhali Flyover	Partial	4	1.12	2	116.00	04 November, 2004	RHD
Khilgaon Flyover	Partial	2	1.90	3	81.75	22 March, 2005	LGED
Jatrabari-Gulistan Flyover	Partial	4	11.8	13	2,30.00	11 October, 2013	Orion Group

Mohakhali Flyover

The latitude and longitude of the flyover are 23°46'46.8696" N and 90°23'54.4272" E. The location and layout of this flyover is shown in Figure 1.

In Figure 1 shows respectively the google earth view and the Google Map view. The red line represents the alignment of the flyover and the blue line represents the rail track passing through the flyover.

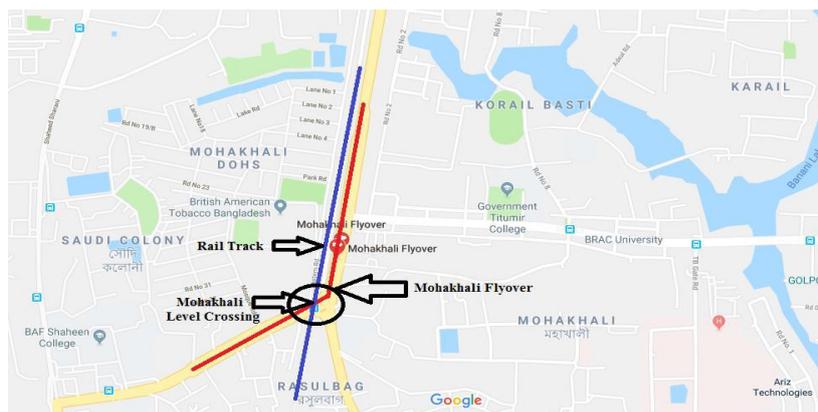
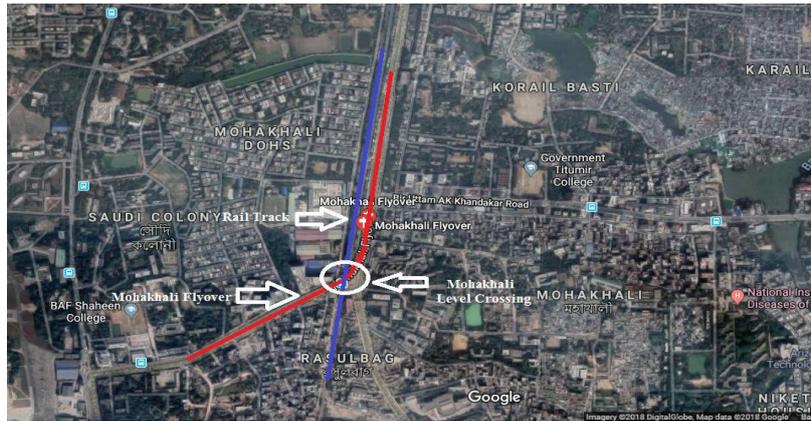


Fig.1:-Layout of the Mohakhali Flyover

Data Collection Time for Khilgaon Flyover

Weekend-Day data were collected at 5.15 pm - 5.30 pm on (Friday), Weekend-Night data were collected at 8.30 pm -8.45 pm on (Friday). Weekday-Day data were collected at 5.15 pm -5.30 pm on (Tuesday). Weekday-Night data were collected at 8.30 pm- 8.45 pm on (Tuesday). The time period for collecting data in weekday-day, weekday-night, weekend-day and weekend-night had been

identified from the field observations of hourly traffic volume during the studied time period.

Jatrabari-Gulistan Flyover

This flyover is called Mayor Mohammad Hanif Flyover. The latitude and longitude of the flyover are respectively 23°42'37.728" N and 90°25'59.5524" E. The layout of this flyover is shown in Figure 3.

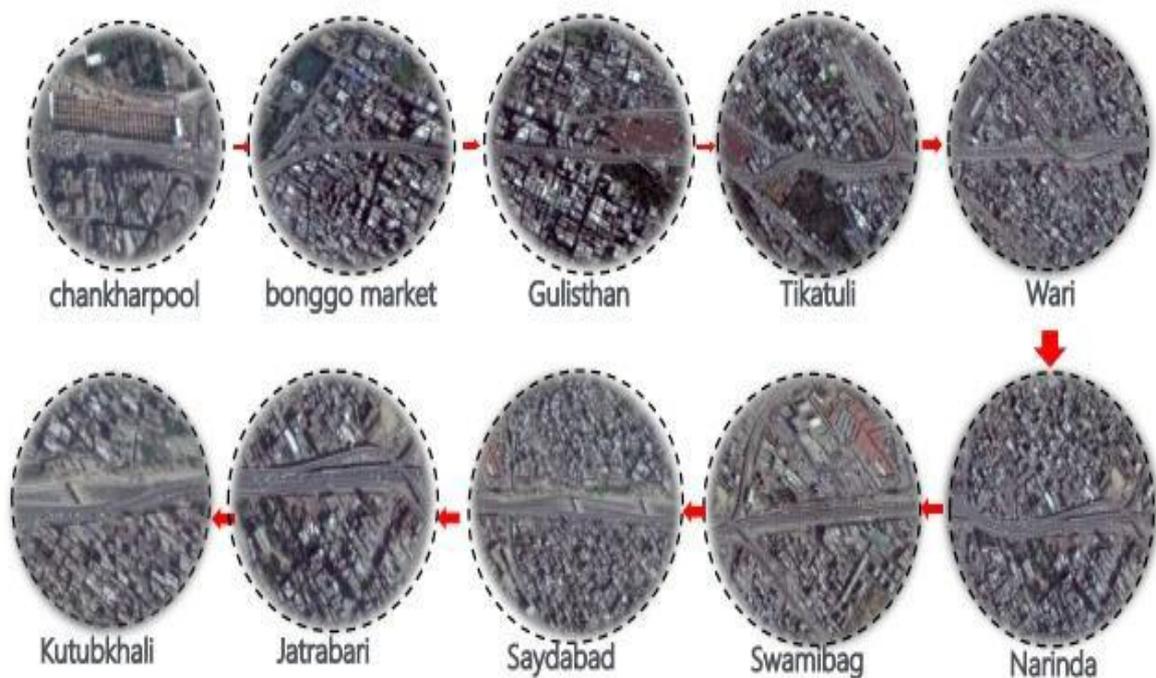


Fig.3:-Layout of Jatrabari-Gulistan Flyover

Data collection Time for Jatrabari Flyover

In Jatrabari-Gulistan Flyover Weekend-Day data were collected at 2.15 pm - 2.30 pm on (Friday), Weekend-Night data were collected at 7.30 pm -7.45 pm on (Friday). Weekday-Day data were collected at 5.15 pm -5.30 pm on (Sunday). Weekday-Night data were collected at 8.30 pm- 8.45 pm on (Sunday).

The time period for collecting data in weekday-day, weekday-night, weekend-day and weekend-night had been identified

from the field observations of hourly traffic volume during the studied time period.

Reconnaissance Survey

Reconnaissance survey was conducted by walking along the each flyover corridor, the adjacent areas of each flyovers and also above-grade and at-grade visiting were conducted.

The survey was initiated on 13 june, 2021 and ended on 6 July, 2021.

Classified Traffic Count at the Studied Flyovers

In this research, short counts (15 minutes classified traffic count) were done by Video recording method during weekday-day, weekday-night, weekend-day and weekend-night to assess the relative level of usage of road space and to extract the percentage of different types of vehicles travelling through at-grade and above-grade during these time periods.

These data were analysed to get the percentage of several vehicles (Bus, Car, Microbus, Motorcycle etc) travelling through above-grade and at-grade road. The data collection was conducted in the

peak hours during weekday-day; weekday-night; weekend-day and weekend-night. Data were used to obtain the traffic flow and rate of different types of vehicles. A number of surveyors collected the data in both weekday and weekend.

As there were several vehicles of different shapes and weight which created a problem. As a solution of this problem vehicle counts were converted into passenger car units (PCU). The passenger car units (PCU) values are provided by the Geometric Design Standards for Roads & Highways Department of Bangladesh.

Table 3:-PCU values of various vehicles

Vehicle Type	Passenger Car unit (PCU) value
Passenger Car	1
Bus	3
Utility Vehicle	1.0
Microbus/Jeep	1.5
Paratransit	2
CNG	0.75
Motorbike	0.75
Truck	3.0
Bicycle	0.50
Rickshaw/Van	2.0

Secondary Data

Secondary data on flyover construction, traffic flow, pedestrian accident data, flyover accident data, rail accident data, number of level crossings, number of

trains passing through the study corridor and speed limits on route were collected from the LGED, RHD, ARI, Ministry of Railways and Kamalapur Administration Building.

DATA ANALYSIS AND RESULTS

Mohakhali Flyover

Table 4 shows the classified traffic count data collected from Mohakhali Flyover.

Table 4:-Classified Traffic count at Mohakhali Flyover (PCUs)

Mohakhali Flyover	Over/Under	Rickshaw /Van	Motor Cycle	Bicycle	Car/Jeep/Microbus	CNG	BUS	Utility	Truck	Total equivalent hourly flow (PCU)	Percentage of Total (%)	Ratio of Vehicles passing over and under
Weekend, Day	over	0	50	0	314	106	23	13	0	2030	58.96	1.43:1
	under	4	92	32	143	79	15	4	0	1413	41.04	
Weekend, Night	over	0	152	2	318	88	15	14	1	2134	66.67	2:01
	under	3	113	24	85	67	19	4	1	1067	33.33	
Weekday, Day	over	0	151	0	282	83	21	25	1	2118	48.87	0.40:1
	under	0	157	21	211	105	50	11	9	2216	51.13	
Weekday, Night	over	0	93	1	274	93	16	23	3	1961	28.53	0.40:1
	under	0	311	60	470	253	80	70	14	4912	71.47	

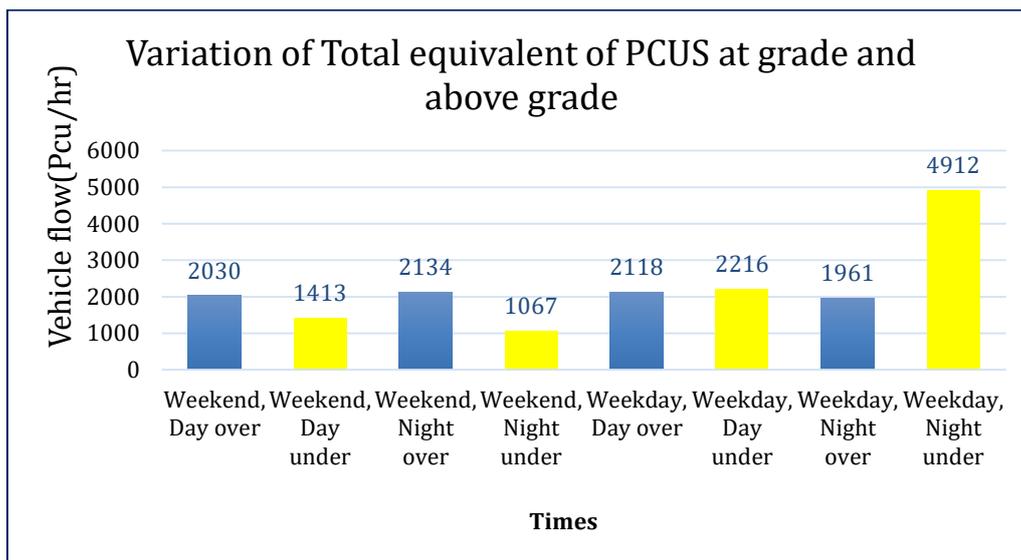


Fig.4:-Grade wise and Temporal comparison of Vehicle Flow at Mohakhali Flyover

Table 4 and Figure 4 illustrate that maximum amount of vehicles were moved through using the flyover. During weekend-day, 58.97% vehicles moved by using flyover and almost 41.04% vehicles used the road below flyover.

In weekday-day the values were opposite, which showed that 48.87% vehicles used flyover and 51.13% passed by the road under flyover. Overall, the ratio of above-grade to at-grade flow were 1.43:1 and 0.40:1.

From Figure 4 it is observed that the highest flow at above-grade was 2134 (PCU/hr) which occurred at weekend-night and the highest flow at at-grade was 4912 (PCU/hr) which occurred at weekday-night. During weekend-night, 66.67% vehicles moved through above grade and 33.33% travelled at grade. However, in weekday-night rate of vehicles were same as weekday-day rates. In weekday-night 28.53% vehicles passed by above-grade and the percentage of

vehicles moved at grade were 71.47%. The variation may be occurred due to traffic jam and volume of vehicles.

Comparison with Previous studies (Mohakhali)

A comparison has been drawn between the weekday- day data collected by author’s in 2021 with the present data set of this study to visualise the yearly variation of flow and also to observe whether the flyover is performing better than previous or not.

Table 5:-Comparison with past studies on Yearly Basis of Mohakhali Flyover

Above-Grade	Above-Grade	At-Grade	At-Grade
Weekday-Day, 2017	Weekday-Day, 2021	Weekday-Day, 2017	Weekday-Day, 2021
4767	2118	2271	2216

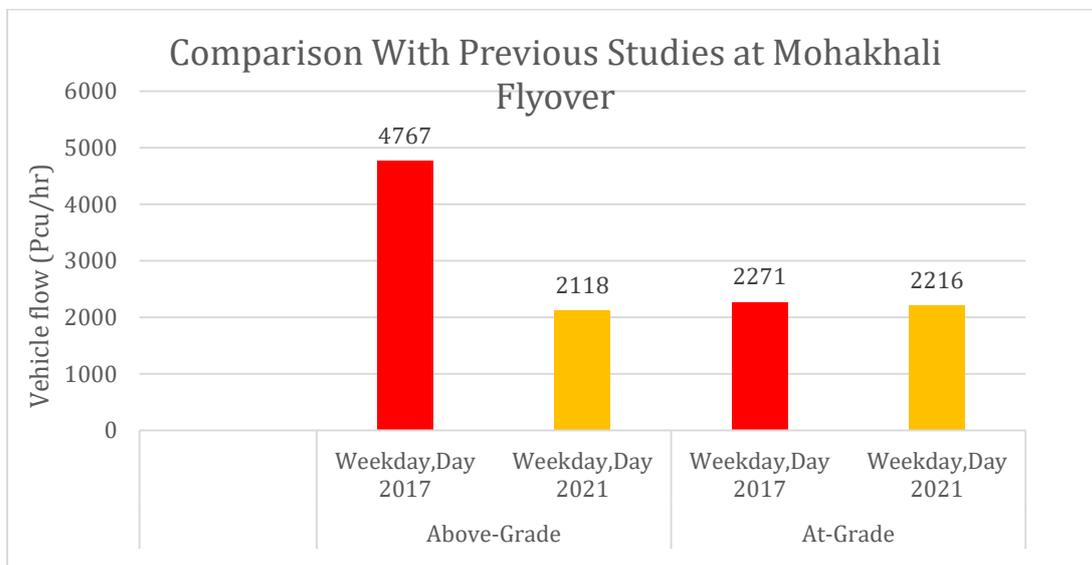


Fig.5:-Comparison of Vehicle Flow on Yearly Basis of Mohakhali Flyover.

Figure 5 shows that the graph has a decreasing pattern at both grades (from 4767 PCU/hr to 2218 PCU/hr) above-grade and (from 2271 PCU/hr to 2216 PCU/hr) at-grade. Compared to 2017 weekday-day period, flow had almost decreased 55.57% at above-grade and 2.42% at at-grade. In addition to that, the above-grade to at-grade flow ratio has decreased from 2.09:1 to 1.05:1, indicating a prodigious increasing trend for vehicles

to move from at-grade to above grade. So, it can be said that the number of vehicles using flyover were decreased from 2017 to 2021.

Khilgaon Flyover

Table 6 shows the classified traffic count data collected from Khilgaon Flyover. The total flow across different times of the day in Khilgaon Flyover are compared in Figure 6.

Table 6:-Classified Traffic Count at Khilgaon Flyover (PCUs)

Khilgaon Flyover	Over/Under	Rickshaw /Van	Motor Cycle	Bicycle	Car/Jeep/Microbus	CNG	BUS	Utility	Truck	Total equivalent hourly flow (PCU)	Percentage of Total (%)	Ratio of Vehicles passing over and under
Weekend, Day	over	0	40	0	17	17	4	6	0	290	9.17	0.10:1
	under	156	186	33	102	105	24	15	9	2872	90.83	
Weekend ,Night	over	0	45	0	21	24	1	9	0	333	10.76	0.12:1
	under	196	197	19	96	45	18	4	3	2761	89.24	
weekday, Day	over	0	120	0	35	21	5	8	0	561	21.4	0.27:1
	under	67	49	42	132	66	42	27	0	2060	78.6	
Weekday Night	over	0	42	0	23	22	2	5	0	306	10.93	0.12:1
	under	120	197	21	159	48	18	9	6	2493	89.07	

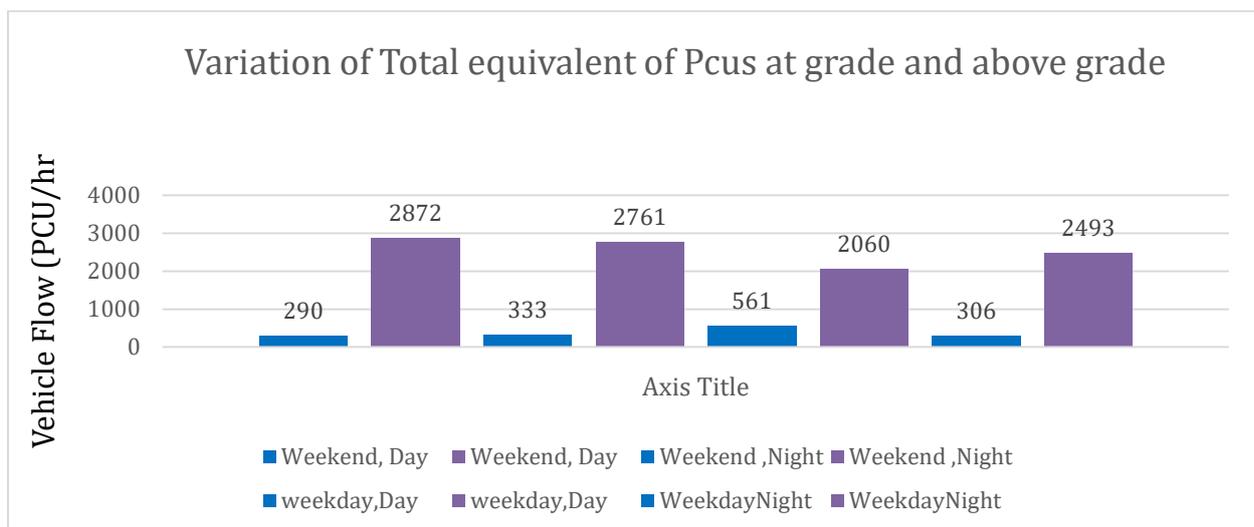


Fig.6:-Grade wise and Temporal comparison of Vehicle Flow at Khilgaon Flyover

Table 6 and Figure 6 show that maximum amount of vehicles were moved at-grade or used the road under the flyover. During weekend-day, 9.17% vehicles moved by using flyover and almost 90.83% vehicles used the road below flyover. In weekday-

day the values were almost same, which showed that 21.4% vehicles moved by above-grade and 78.6% passed by the road under flyover. Overall, the ratio of above-grade to at-grade flow were 0.10:1 and 0.27:1. From Figure 6 it is observed that

the highest flow at above-grade was 561 (PCU/hr) which occurred at weekday-day and the highest flow at at-grade was 2872 (PCU/hr) which occurred at weekend-day. During weekend-night, 10.76% vehicles moved through above grade and 89.24% travelled at grade. However, in weekday-night showed the almost similar rate of percentages same as weekend-night rates. In weekday-night 10.93% vehicles passed by above-grade and the percentage of vehicles moved at grade were 89.07%. From the above table and graph it is clear that less amount of vehicles use the

Khilgoan Flyover to travel. Maximum vehicle travel by at-grade to move in several destinations.

Comparison with Previous Studies (Khilgaon)

A comparison has been drawn between the weekday, day data collected by authors in 2021 with the present data set of this study to visualize the yearly variation of flow and also to observe whether the flyover is performing well than previous or not.

Table 7:-Comparison with past studies on Yearly Basis of Khilgaon Flyover

Above-Grade	Above-Grade	At-Grade	At-Grade
Weekday-Day, 2017	Weekday-Day, 2021	Weekday-Day, 2017	Weekday-Day, 2021
12163	561	2060	4560

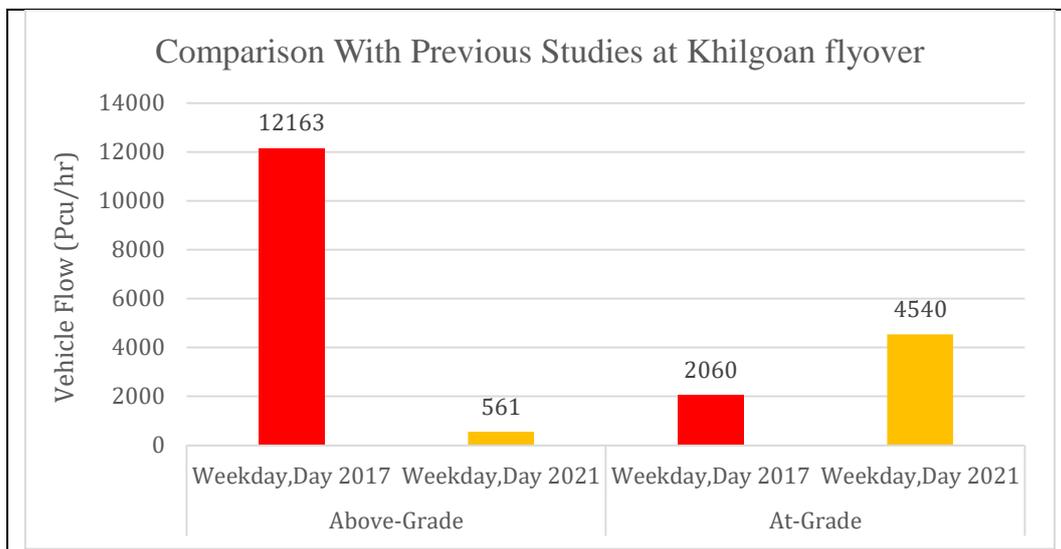


Fig.7:-Comparison of Vehicle Flow on Yearly Basis of Khilgaon Flyover

Figure 7 illustrates that the graph has a decreasing pattern at above-grade (from 12163 PCU/hr to 561 PCU/hr) and increasing pattern at at-grade (from 2060 PCU/hr to 4540 PCU/hr). Compared to 2017 weekday-day period, flow had decreased almost 95.4% at above-grade and increased almost 54.63% at at-grade.

So, it can be said that the number of vehicles using flyover were decreased with a huge rate from 2017 to 2021. However, the using of at-grade showed a rising pattern from 2017 to 2021 of Khilgaon Flyover.

Jatrabari – Gulistan Flyover

Table 8:-Classified Traffic Count at Jatrabari – Gulistan Flyover (PCUs)

Jatrabari	Over/Under	Rickshaw /Van	Motor Cycle	Bicycle	Car/Jeep/Microbus	CNG	BUS	Utility	Truck	Total equivalent hourly flow(PCU)	Percentage of Total (%)	Ratio of Vehicles passing over and under
Weekend, Day	over	0	156	0	116	136	54	16	1	1891	44.55	0.80:1
	under	204	54	18	30	9	24	6	9	2354	55.45	
Weekend, Night	over	0	136	0	126	98	51	22	39	2243	58.31	1.34:1
	Under	15	28	0	42	21	33	39	51	1675	41.69	
Weekday, Day	Over	0	101	0	112	64	62	25	1	1687	27.1	0.37:1
	Under	356	130	60	30	40	70	20	21	4540	72.91	
Weekday, Night	Over	0	93	0	131	53	60	23	42	2168	29.26	0.41:1
	Under	120	28	7	35	35	105	67	210	5242	70.74	

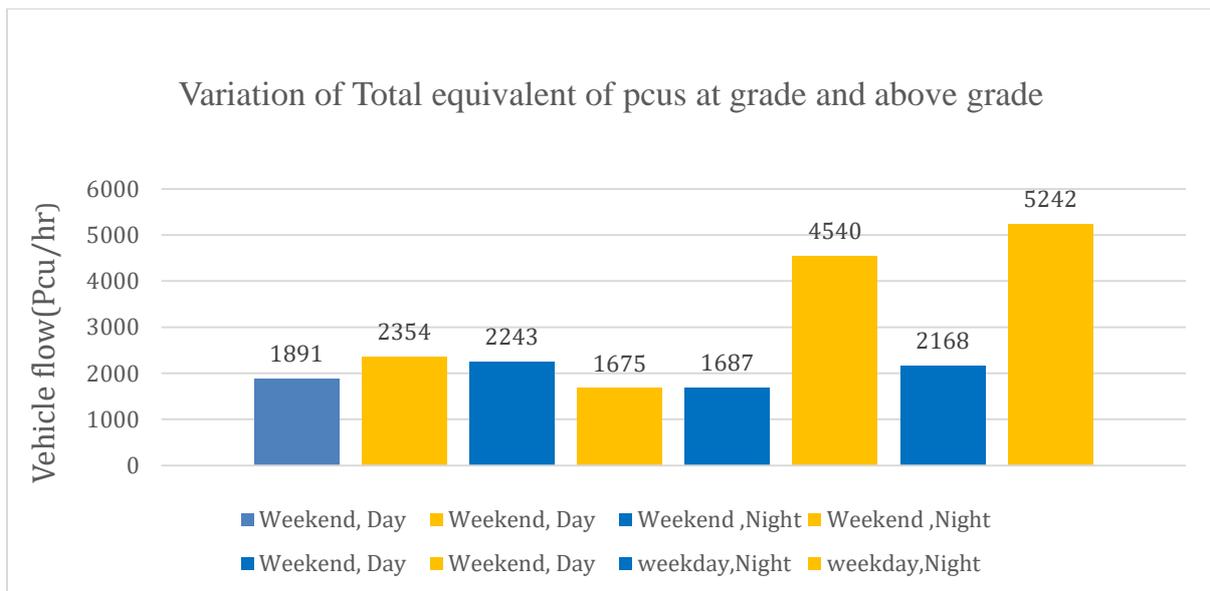


Fig.8:-Grade wise Temporal comparison of vehicle Flow at Jatrabari – Gulistan Flyover

Table 8 and Figure 8 illustrate that maximum amount of vehicles were moved at-grade or used the road under the flyover except the weekend-night period data. During weekend-day, 44.55% vehicles

moved by using flyover and almost 55.45% vehicles used the road below flyover. In weekday-day the values were almost same, which showed that 27.1% vehicles moved by above-grade and

72.91% passed by the road under flyover. So, it obtained that both weekday-day and weekend-day maximum vehicles of several sizes were travelled through at-grade. Overall, the ratio of above-grade to at-grade flow were 0.80:1 and 0.37:1.

From Figure 8 it is observed that the highest flow at above-grade was 2243 (PCU/hr) which occurred at weekend-night and the highest flow at at-grade was 5242 (PCU/hr) which occurred at weekend-night. During weekend-night, 58.31% vehicles moved through above grade and 41.69% travelled at grade which was inversed as compared to other period. However, in weekday-night showed the almost similar rate of percentages same as

weekend-night rates. In weekday-night 29.26% vehicles passed by above-grade and the percentage of vehicles moved at grade were 70.74%. From the above table and graph it is clear that less amount of vehicles use the Jatrabari Flyover to travel. One of the reasons for this type of result may be the excess toll of vehicles.

Comparison with Previous Studies (Jatrabari)

A comparison has been drawn between the weekday (day) data collected by authors in 2021 with the present data set of this study to visualise the yearly variation of flow and also to observe whether the flyover is performing better than previous or not.

Table 9:-Comparison with past studies on Yearly Basis of Jatrabari – Gulistan Flyover

Above-Grade	Above-Grade	At-Grade	At-Grade
Weekday-Day, 2017	Weekday-Day, 2021	Weekday-Day, 2017	Weekday-Day, 2021
8074	1686	2400	4540

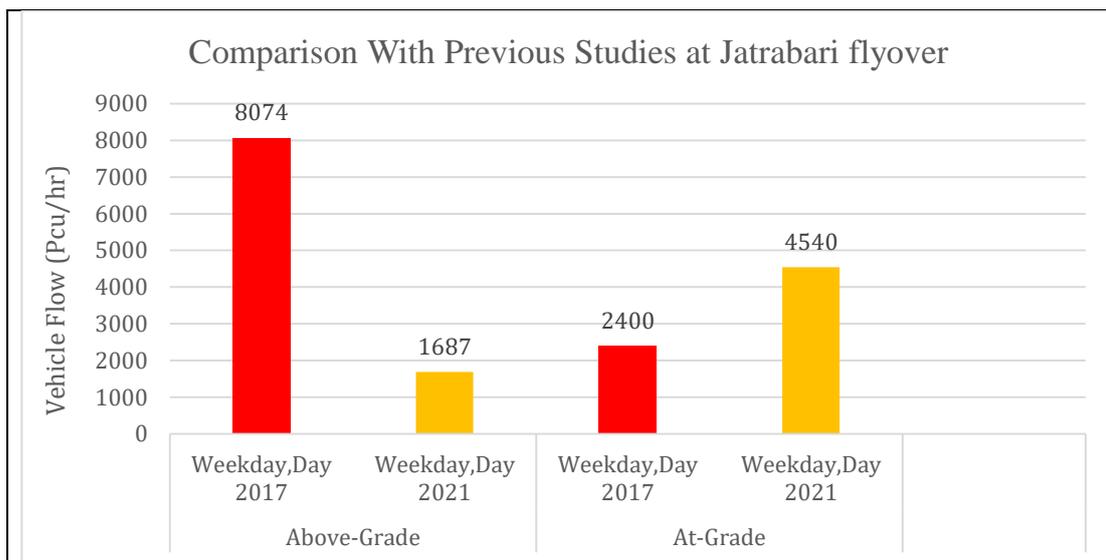


Fig.9:-Comparison of Vehicle Flow on Yearly Basis of Jatrabari-Gulistan Flyover

Figure 9 shows that the vehicle flow had fallen down (from 8074 PCU/hr to 1687 PCU/hr) above grade, and risen (from 2400 PCU/hr to 4500 PCU/hr) at grade.

The percentage decreased in above-grade and increased at-grade are respectively 79.11% and 89.17%.

Table 10:-Percentage of Different Types of Vehicles at Mohakhali Flyover

Mohakhali Flyover	Rickshaw	Motorcycle	Bicycle	Car/Jeep/ Microbus	CNG	Bus	Utility	Truck
Weekend, Day,Over	0	9.88	0	62.06	20.95	4.55	2.57	0
Weekend, Day,Under	1.08	24.93	8.67	38.75	21.41	4.07	1.08	0
Weekend, Night,over	0	25.76	0.34	53.9	14.92	2.54	37	0.17
Weekend, Night,Under	0.95	35.76	7.59	26.9	21.2	6.01	1.27	0.32
Weekday, Day, Over	0	26.82	0	50.9	14.74	3.73	4.44	0.18
Weekday, Day, Under	0	27.84	3.72	37.41	18.62	8.87	1.95	1.6
Weekday, Night, over	0	18.49	0.2	54.47	18.49	48	4.57	0.6
Weekday, Night,under	0	24.72	4.77	37.36	20.11	6.36	5.56	1.11

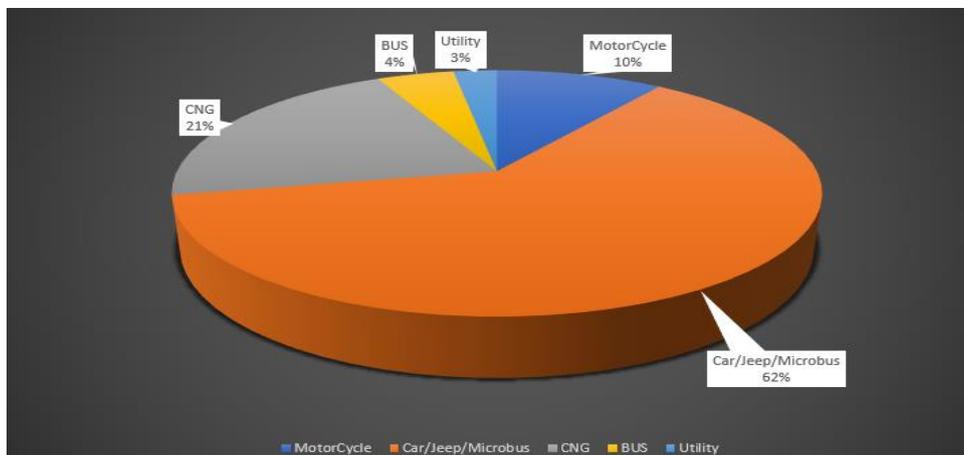


Fig.10:-Percentage of vehicle at weekend-day, over

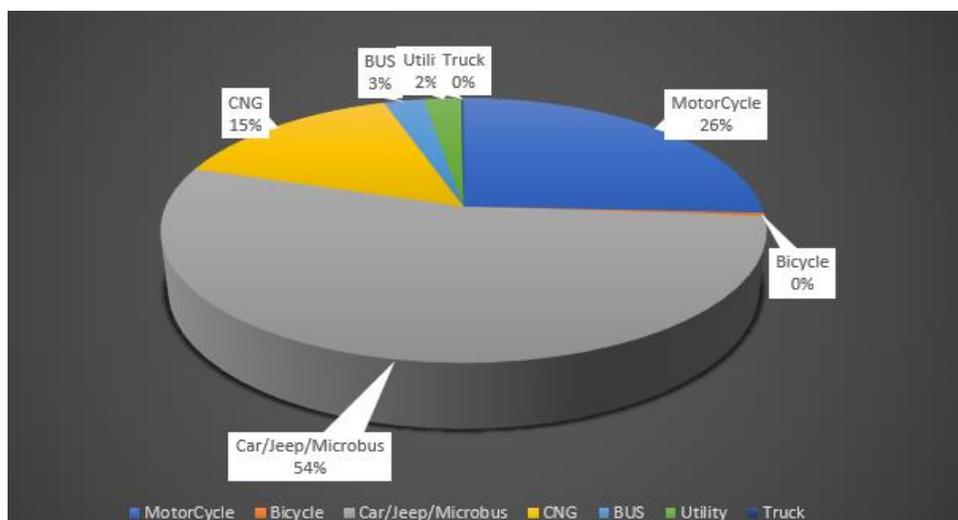


Fig.11:-Percentage of vehicle at weekend-Night, over

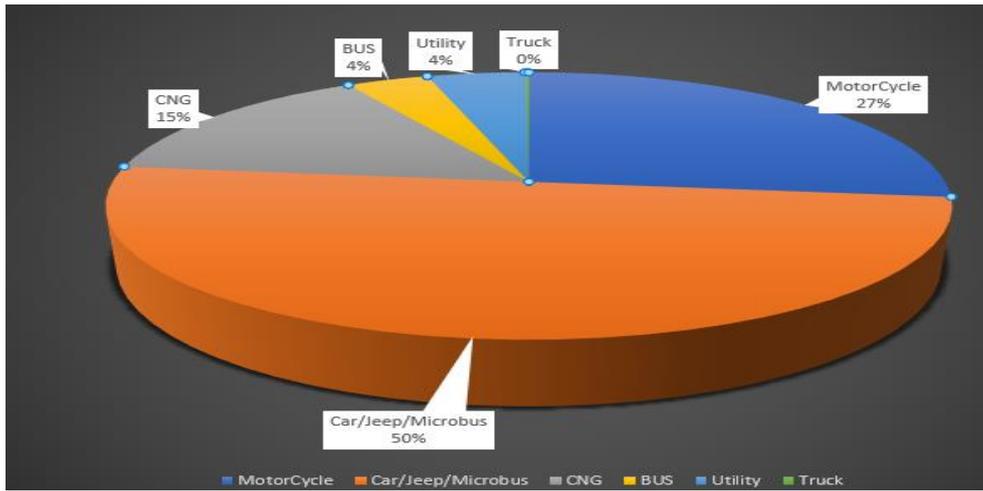


Fig.12:-Percentage at Vehicle at weekday-Day, over

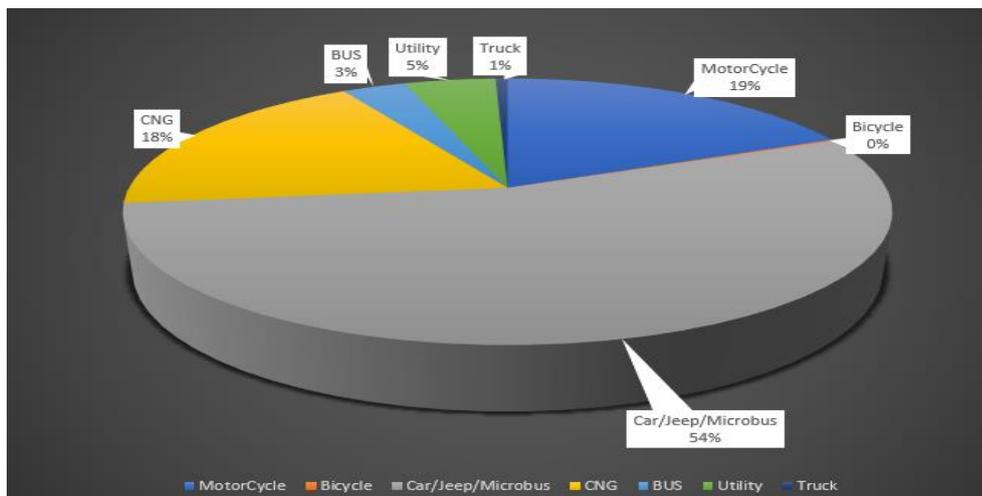


Fig.13:-Percentage of vehicle at weekday-Night, over.

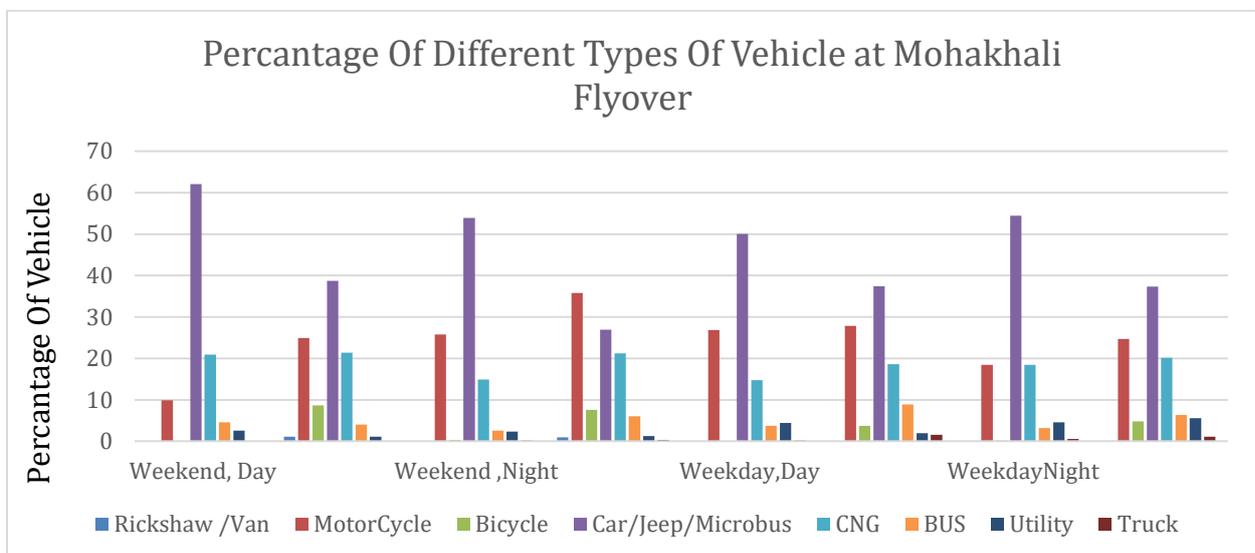


Fig.14:-Temporal Variation of Different Types of Vehicles in Mohakhali Flyover

Proportion of Different Types of Vehicles

From Figure 10, it is observed that during weekend-day time 62% cars used the flyover and which was maximum as compared to other vehicles. The second maximum rate was gained by CNG and almost 21% CNG moved through the flyover. During that time no truck and bicycle was noticed. In Figure 11, during weekend-night period almost 54% car travelled by flyover which was maximum and 26% motorcycle were counted during that time. The buses rate was small which was almost 3%. In the next graph or Figure 12, we get the percentage of different

vehicles during weekday-day period. During that time 4% bus, 27% motorcycle, 0.18% truck used the flyover to travel to their destination. Almost 51% car/jeep/microbus passed through the flyover. In Figure 13, 54% car, 48% bus moved by the flyover which were maximum. Apart from these two vehicles, 19% motorcycle and CNG, 5% utility used the flyover during weekday-night. Finally, from Figure 14 we obtained temporal variation of several types of vehicles. The highest rate was obtained by car/jeep/microbus during all period. At the other hand, lowest amount of rickshaw were noticed in Figure 14.

Table 11:-Percentage of Different Types of Vehicles at Khilgaon Flyover

Khilgaon Flyover	Rickshaw	Motorcycle	Bicycle	Car/Jeep/microbus	CNG	Bus	Utility	Truck
Weekend, Day, Over	0	47.62	0	20.24	20.24	4.76	7.14	0
Weekend, Day, Under	24.76	29.52	5.24	16.19	16.67	3.81	38	1.43
Weekend, Night, over	0	45	0	21	24	1	9	0
Weekend, Night, Under	33.91	34.08	58	16.61	7.79	41	0.69	0.51
Weekday, Day, Over	0	63.49	0	18.52	11.11	2.65	83	0
Weekday, Day, Under	15.65	11.45	9.81	30.84	15.42	9.81	6.31	0
Weekday, Night, over	0	44.68	0	24.47	23.4	13	5.13	0
Weekday, Night, under	20.97	34.44	3.67	27.8	8.39	45	1.57	1.05

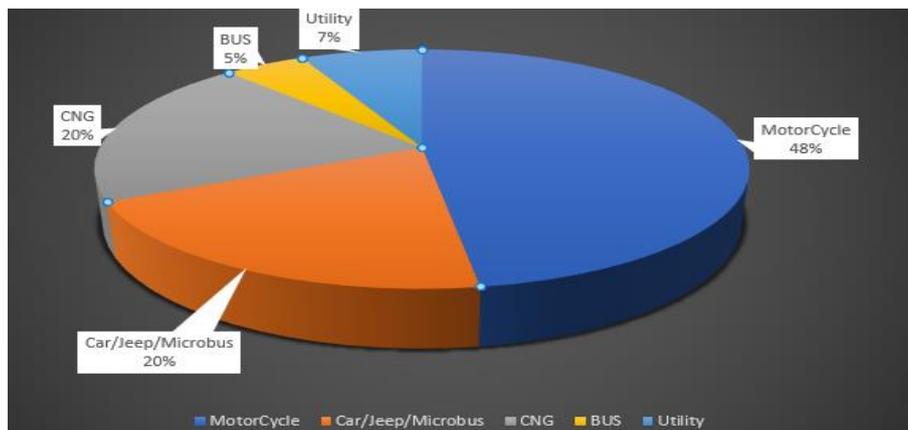


Fig.15:-Percentage of vehicle at weekend day, over

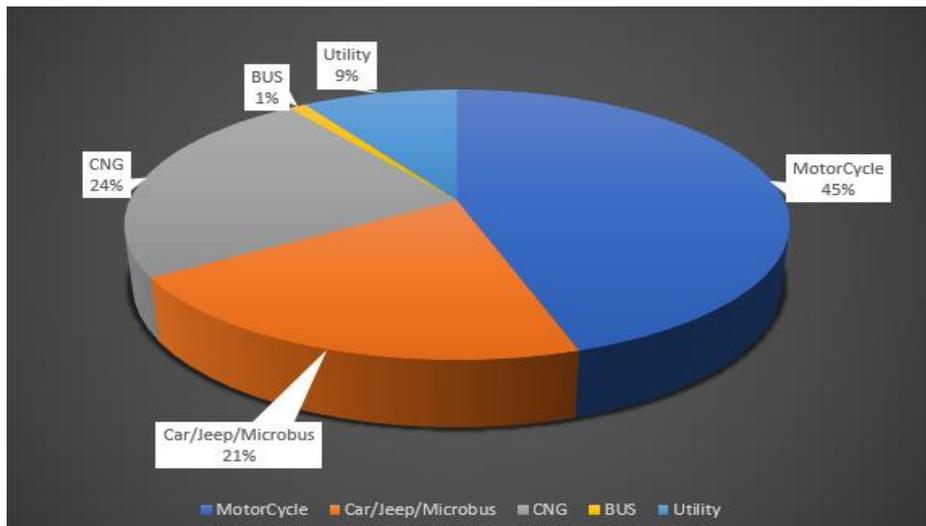


Fig.16:-Percentage of vehicle at weekend-Night, over

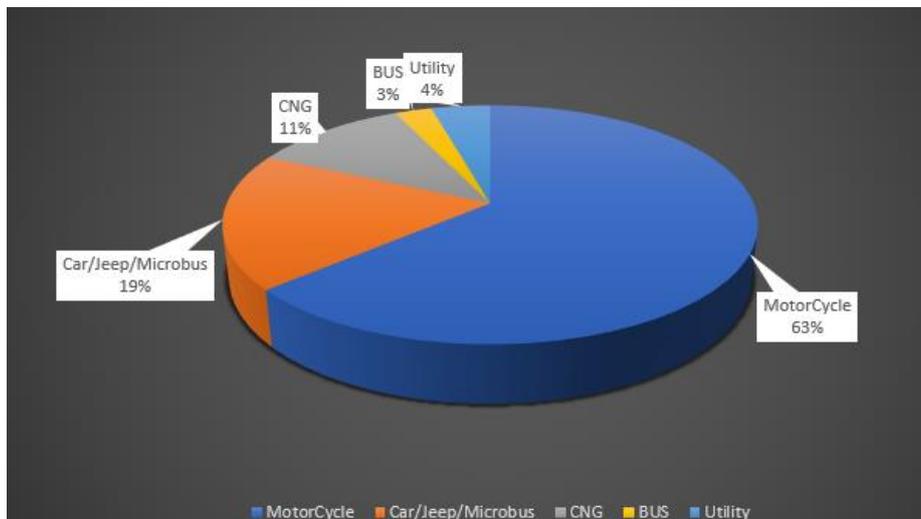


Fig.17:-Percentage of vehicle at weekday-day, over

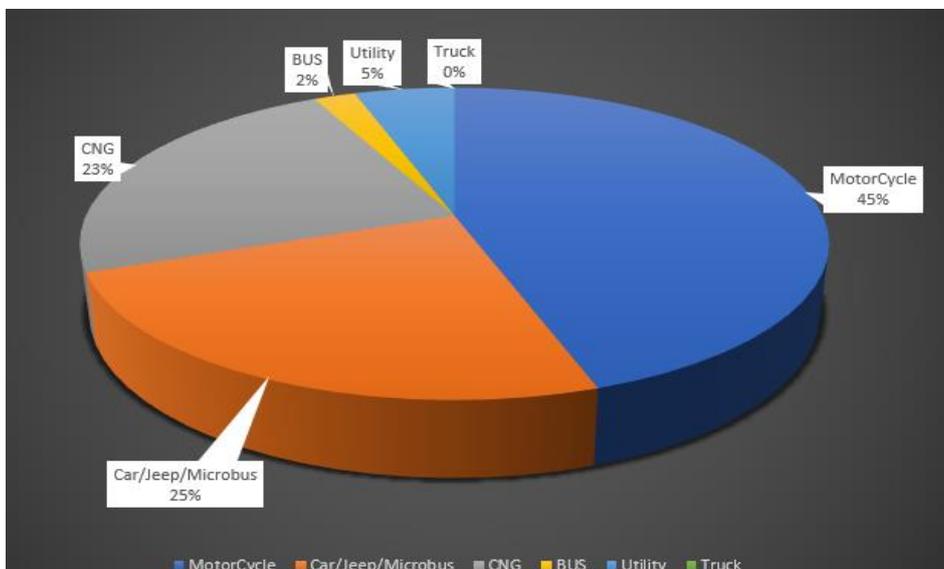


Fig.18:-Percentage of vehicle at weekday-Night, over

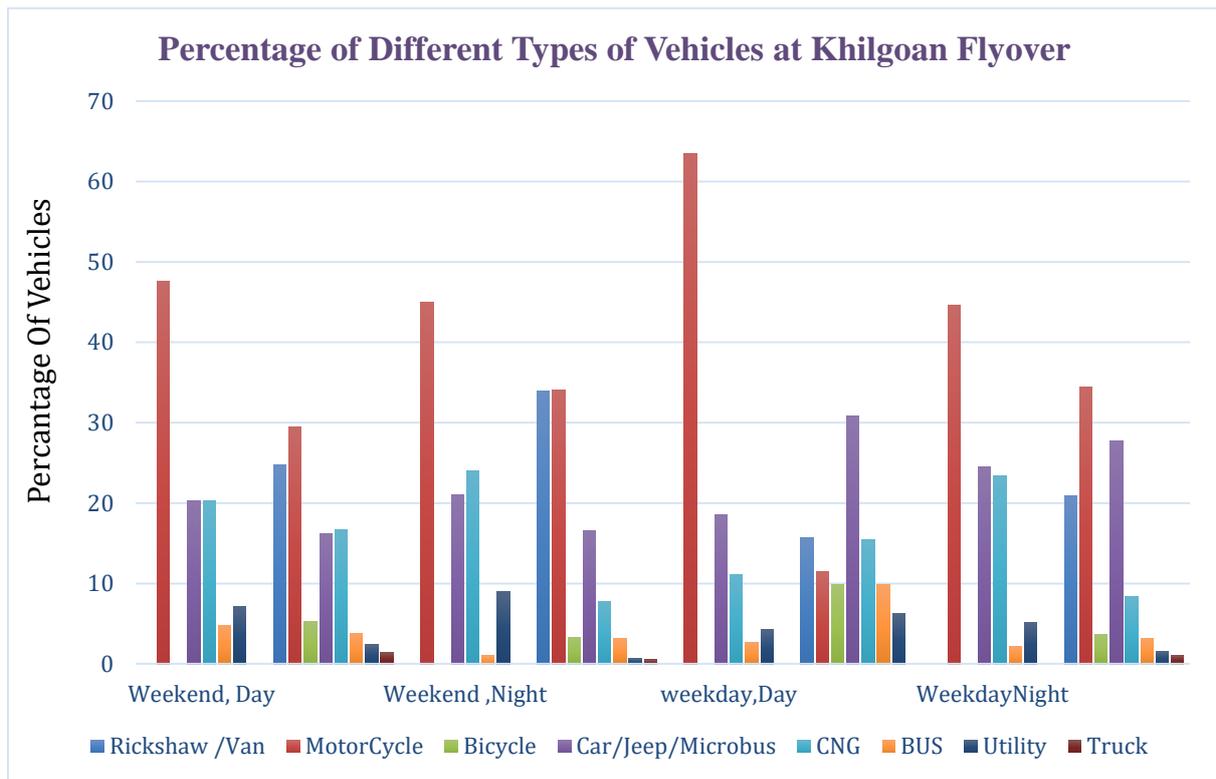


Fig.19:-Temporal Variation of Different Types of Vehicles in Khilgaon Flyover

Proportion of Different Types of Vehicles

From Figure 15, it is observed that during weekend-day time 48% motorcycle used the flyover and which was maximum as compared to other vehicles.

The second maximum rate was gained by car and CNG and almost 20% car and CNG moved through the flyover.

During that time no truck and bicycle was noticed. In figure 16, during weekend-night period almost 45% motorcycle travelled by flyover which was maximum and 24% CNG were counted during that time.

The buses rate was small which was almost 1% and 9% utility were counted at that time. In the next graph or figure 17,

we get the percentage of different vehicles during weekday-day period. During that time 3% bus, 63% motorcycle, 83% utility, and 11% CNG used the flyover to travel to their destination.

Almost 19% car/jeep/microbus passed through the flyover. In figure 18, 24% car, 13% bus moved by the flyover which were maximum. Apart from these two vehicles, 45% motorcycle, 23% CNG and 5% utility used the flyover during weekday-night. Finally, from figure 19 we obtained temporal variation of several types of vehicles.

The highest rate was obtained by motorcycle during all period except weekday-day time. At the other hand, lowest amount of truck were noticed in fig 19.

Table 12:-Percentage of Different Types of Vehicles at Jatrabari Flyover

Jatrabari Flyover	Rickshaw	Motorcycle	Bicycle	Car/Jeep/microbus	CNG	Bus	Utility	Truck
Weekend, Day, Over	0	32.57	0	28.2	28.39	11.27	3.34	0.21
Weekend, Day, Under	57.63	15.25	5.08	8.47	2.54	6.78	1.7	2.54
Weekend, Night, over	0	28.81	0	26.69	20.76	10.81	4.66	8.26
Weekend, Night, Under	6.55	12.3	0	18.34	9.17	14.41	17.03	227
Weekday, Day, Over	0	27.67	0	30.68	17.53	16.98	6.84	0.27
Weekday, Day, Under	48.96	17.88	8.25	4.12	5.5	9.63	2.75	2.89
Weekday, Night, over	0	2.43	0	32.58	1.48	14.93	5.72	10.45
Weekday, Night, under	19.77	4.61	1.15	5.77	5.77	17.30	11.04	34.6

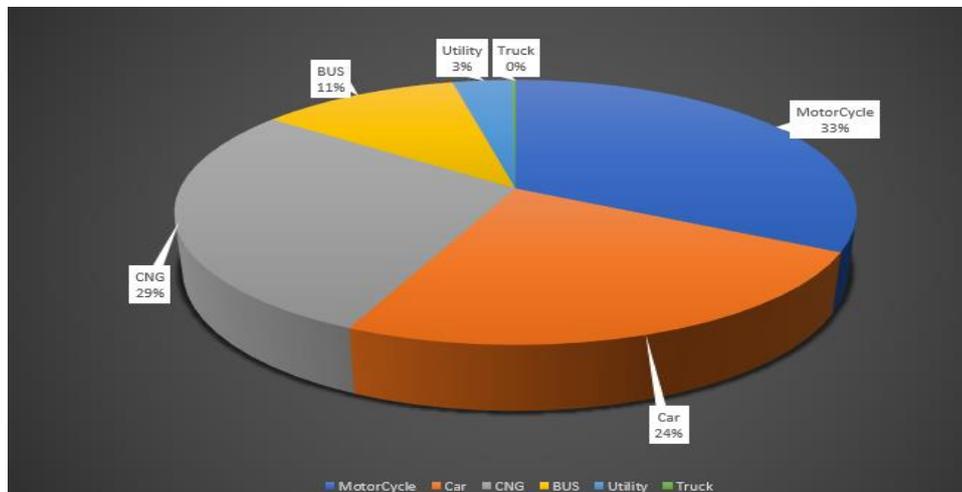


Fig.20:-Percentage of vehicle at weekend-day, over

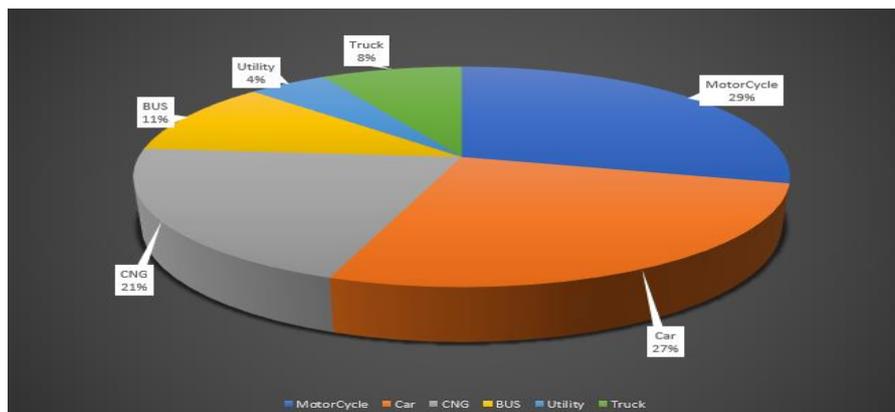


Fig.21:-Percentage of vehicle at weekend-Night, over

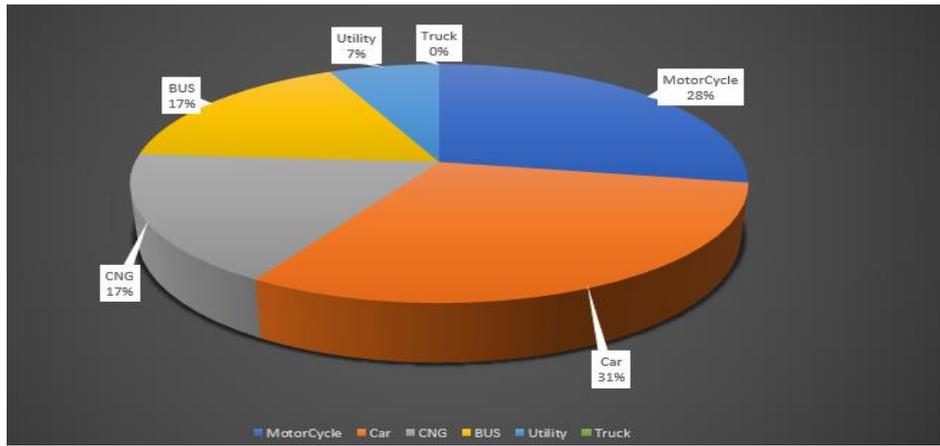


Fig.22:- Percentage of vehicle at weekday-Day, over

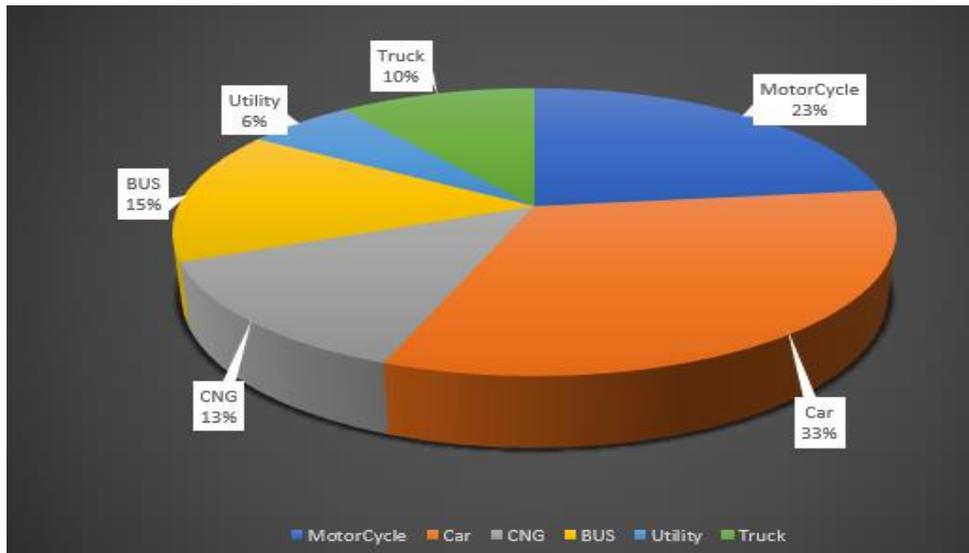


Fig.23:-Percentage of vehicle at weekday-Night, over

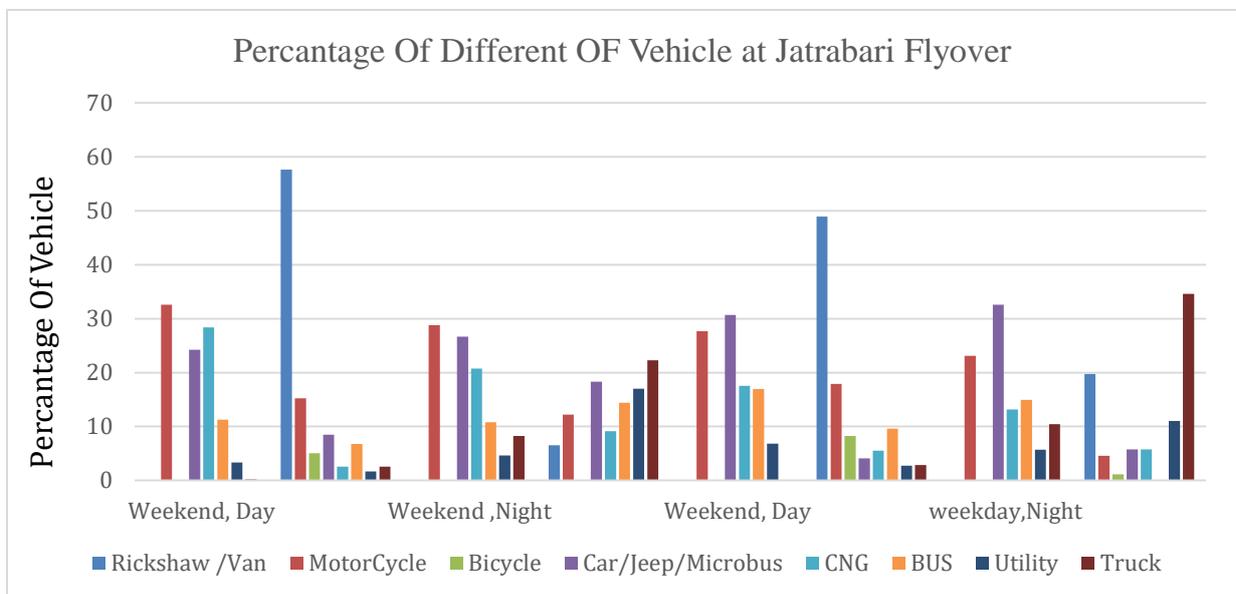


Fig.24:-Temporal Variation of Different Types of Vehicles in Jatrabari Flyover

Proportion of Different Types of Vehicles

From Figure 20, it is observed that during weekend-day time 33% motorcycle used the flyover and which was maximum as compared to other vehicles. The second maximum rate was gained by CNG and almost 28% CNG moved through the flyover. During that time no bicycle was noticed. In figure 21, during weekend-night period almost 29% motorcycle travelled by flyover which was maximum and 21% CNG, 27% car were counted during that time. The bus rate was almost 11% and 5% utility were counted at that time. In the next graph or Figure 22, we get the percentage of different vehicles

during weekday-day period. During that time 17% bus, 28% motorcycle, 7% utility, and 18% CNG used the flyover to travel to their destination. Almost 31% car/jeep/microbus passed through the flyover. In figure 23, 33% car, 15% bus moved by the flyover which were maximum. Apart from these two vehicles, 10% truck, 2% motorcycle, 1.5% CNG and 6% utility used the flyover during weekday-night. Finally, from Figure 24 we obtained temporal variation of several types of vehicles. The highest rate was obtained by motorcycle during all period. At the other hand, lowest amount of bicycle were noticed in Figure 24.

Comparison of Flyovers at Above Grade

Table 13:-Percentage of PCUs above grade at weekdays

Name of The Flyover	Time	PCUS Above grade at day & Night	PCUS at grade at day & Night	Total PCUs above grade at Day & Night	Total PCUs above grade & At grade	Percentage of PCUs above grade
Mohakhali Flyover	Day	2118	2216	4079	11207	36.40
	Night	1961	4912			
Jatrabari Flyover	Day	1687	4540	3855	13637	28.27
	Night	2168	5242			
Khilgoan Flyover	Day	561	2060	867	5420	15.99
	Night	306	2493			

Total PCU above grade Vs Name of the flyover graph at Weekdays

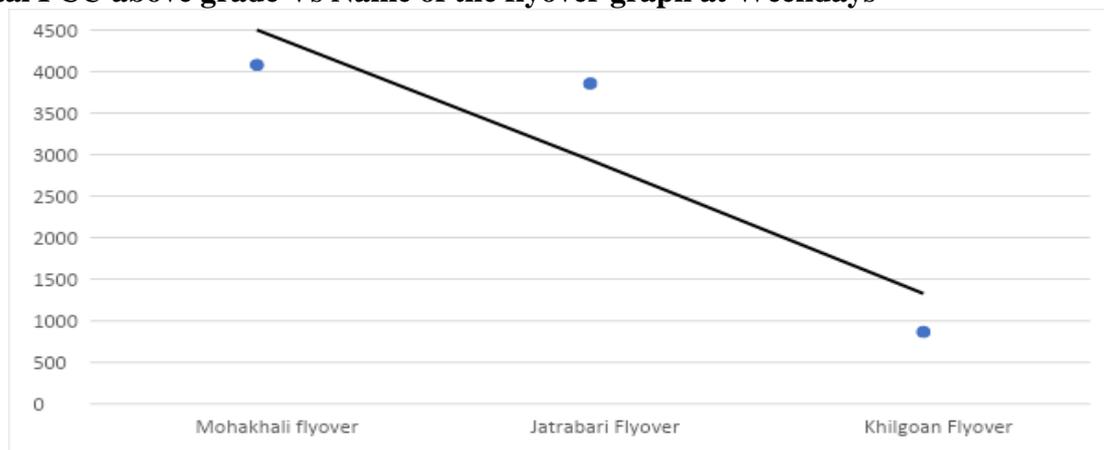


Fig.25:-Total PCU above grade Vs Name of the flyover graph at Weekdays

Table 14:-Percentage of PCUs above grade at weekend

Name of The Flyover	Time	PCUs Above grade at day & Night	PCUs at grade at day & Night	Total PCUs above grade at Day & Night	Total PCUs above grade & At grade	percentage of PCUs above grade
Mohakhali Flyover	Day	2030	1413	4164	6644	62.67
	Night	2134	1067			
Jatrabari Flyover	Day	1891	2354	4134	8163	50.64
	Night	2243	1675			
Khilgoan Flyover	Day	290	2872	623	6256	9.96
	Night	333	2761			

Total PCU above grade Vs Name of the flyover graph at Weekends

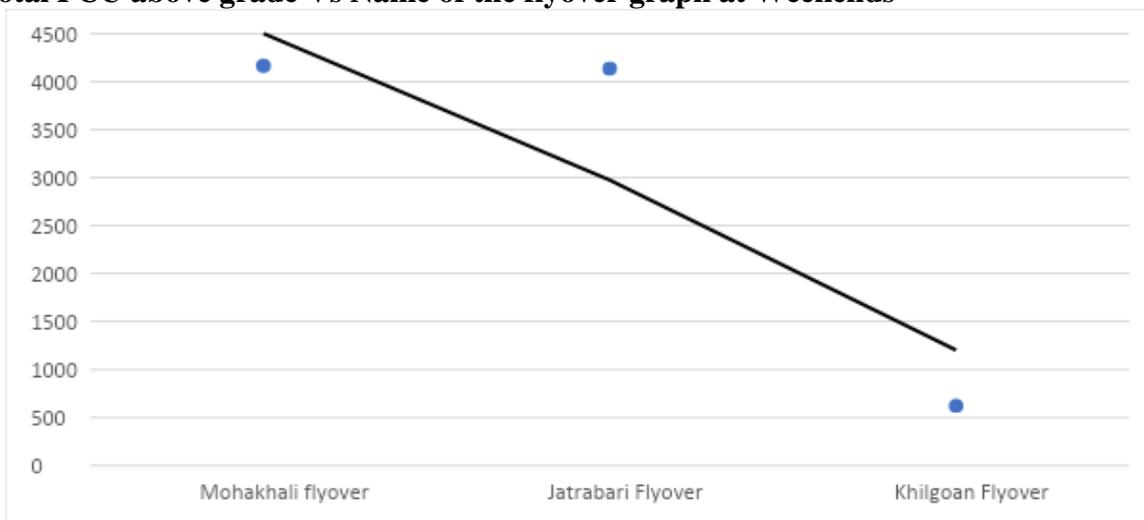


Fig.26:-Total PCU above grade Vs Name of the flyover graph at Weekend

From Table 14 in Mohakhali Flyover 4164 PCU/hr vehicle moved above the flyover in day and night at weekdays which was the highest PCU/hr vehicle than Khilgaon (623 PCU/hr) and Jatrabari – Gulistan flyover (4134 PCU/hr). 36.40 % of vehicle moved through above grade among all vehicle at grade and above grade in Mohakhali flyover which mean 62.67% passed at grade in weekend. In Table 13, Khilgaon and Jatrabari flyover carried 15.99% and 28.26% respectively. During weekdays Mohakhali flyover obtained

maximum rate which was 4079 PCU/hr .Jatrabari Flyover had also carries almost similar PCU/hr as Mohakhali flyover which was 3855 PCU/hr. However, khilgaon flyover amount was 867 PCU/hr which was lower than other two flyovers. As Mohakhali Flyover is near to Mohakhali bus stop and it is also an important part of Dhaka-Mymensingh highway that's maybe the reason of getting the highest percentage of PCUs. As khilgaon flyover is located in the centre point of Dhaka city and in weekend a large

number of people didn't use this flyover that's maybe the reason of its lower percentage.

CONCLUSION

► In Mohakhali Flyover during weekend highest flow of vehicles are found for microbus/car/jeep which is around 62% and the flow for truck is below 1%, So it can be considered as non-significant flow. Flow for other vehicles varies up to 20%.

In Mohakhali Flyover in weekday highest flow of Vehicles are obtained for microbus/car/jeep which is around 50% and the flow for truck is below 1%. So it can be considered as non-significant flow. Flow for other vehicles varies up to 25%.

► In Khilgaon Flyover in Weekend highest flow of Vehicles are obtained for Motorcycle which is around 48% and the flow for truck is below 0%. So it can be considered as non-significant flow. Flow for other vehicles varies up to 20%

In Khilgaon Flyover in Weekday highest flow of Vehicles are counted for Motorcycle which is around 30% and the flow for truck is below 0%. So it can be considered as non-significant flow. Flow for other vehicle varies up to 15%

► In Jatrabari Flyover in Weekend highest flow of Vehicles are obtained for Motorcycle which is around 32% and the flow for truck is below 1%. So it can be considered as non-significant flow. Flow for other vehicle varies up to 30%

In jatrabari Flyover in Weekday maximum flow of Vehicles are counted for Car/Jeep microbus which is around 30% and the flow for truck is below 1%. So it can be considered as non-significant flow. Flow for other vehicle varies up to 25%

► In Jatrabari Flyover non-motorized vehicle like rickshaw are dominating at grade both weekend and weekdays, day time period its upto (48.96 % - 57.63%). But at night time it decreases almost 6.55%.

► In Mohakhali Flyover on the weekend, day time period 41.04 % vehicles travelling at-grade and 58.96 % vehicles travelling above-grade. This variance decreases to a minimum of 48.87 % above- grade and 51.13 % at-grade respectively at weekday,

On the weekend night period 66.67 % vehicles traveling above grade and 33.33% vehicle traveling at grade on the contrary at weekdays 28.53% vehicle traveling above grade and 71.47% vehicles traveling at grade respectively.

So, large number of road user like to use Mohakhali Flyover at weekend night period.

► In Mohakhali Flyover at weekend time period, night flow is 24.64% less than that of day flow at-grade level and 4.87% higher above grade. Whereas, in weekday time period, night flow is 54.89 % higher than that of day flow at-grade level and 7.41% less above-grade. It indicates that flow decreases above grade and increases at-grade during night time on weekdays.

► In Khilgaon Flyover at weekend, day time period 90.83 % vehicles travelling at-grade and 9.17 % vehicles travelling above-grade. This variance increases to a minimum of 21.4 % above- grade and decreases 78.6 % at-grade on weekdays.

At weekend night time period 10.76 % vehicles travelling above grade and 89.24% vehicles travelling at grade on the contrary 10.93% and 89.07% vehicles travelling above grade and at grade respectively at weekday night.

So it implies that road user likely use khilgaon flyover at weekday Day time.

► In khilgaon Flyover on weekends, day flow is 3.86% higher than that of night flow at-grade level and 12.91% less above grade. Whereas, in weekday time period, night flow is 17.37 % higher than that of day flow at-grade level and 45.45% less above-grade. It indicates that flow decreases above grade and increases at-grade during night time and hence, it

implies that road users are less interested to use flyover at night time.

► In Jatrabari Flyover on the weekend, day time period almost 44.45 % vehicles traveling at-grade and 44.55 % vehicles traveling above-grade. This variance decreases to a minimum of 27.1% above-grade and 72.91 % at-grade respectively at weekday,

At weekend night time period 58.31 % vehicle traveling above grade and 41.69% vehicle traveling at grade on the contrary 29.26% and 70.74% vehicles travelling above grade and at grade respectively at weekday night.

Which Implies that road users mostly use Jatrabari Flyover at weekend night time periods.

► In Jatrabari Flyover at weekend time period, Day flow is 28.84% higher than that of day flow at-grade level and 15.69% less above grade. Whereas, in the weekday time period, night flow is 13.39% higher than that of day flow at-grade level and 219% higher above-grade. It implies that road users prefer to use the flyover at night time.

► Both Mohakhali and Jatrabari Flyovers are mostly used on weekends because both are the main points of Dhaka-Mymensingh highway and Dhaka-Chattogram Highway. As khilgaon Flyover is located near Motijheel that's why it is mostly used on weekdays.

FUTURE SCOPE

► Scattered movement of non-motorized vehicles almost blocking all the roads. This should be decreased to reduce traffic jams. These should be moved on a specific lane so that other vehicles can easily overtake them.

► More public transport facilities should be provided to support the needs of habitants living in the residential area near the road.

► The volume count must contain more than one cycle to get more authentic value.

► Bangladesh should have its own PCU factors suited to our different roadway conditions.

► To get significant variation from flow fluctuation curve 24hours traffic flow should be taken.

► The buses we saw on the road were too old to navigate easily, even the manoeuvrability of the buses was initially poor. It is also strongly recommended to replace these old buses with new ones.

► Bicycles should have their own separate lanes, which are normally located beside the footpath or shoulder. But the road we examined did not have any particular lane.

REFERENCES

1. <https://civilmint.com/flyover>
2. A case study of Mohakhali flyover. Department of URP, Bangladesh University of Engineering and Technology (BUET), Dhaka, Bangladesh
3. Moslem Uddin, M. (2006). "Assessment of Khilgaon flyover under seismic load", Department of Civil Engineering, Bangladesh University of Engineering and Technology (BUET), Dhaka, Bangladesh
4. <https://dailyasianage.com/news/23063/khilgaon-flyover-extension-opens-today>
5. <https://www.thedailystar.net/news/jatrabari-flyover-opens-today>
6. Chandra, S., Kumar, V., & Sikdar, P. K. (1995). Dynamic PCU and estimation of capacity of urban roads. *Indian Highways*, 23(4).
7. Sikdar, S. C. P. (2000). Factors affecting PCU in mixed traffic Situations. *Road & Transport Research*, 9(3), 40.
8. Central Road Research Institute, (1988), "Capacity of Roads in Urban Areas", Project sponsored by Ministry Surface Transport, September, 1988.

9. Chandra, S., & Prasad, N. V. (2004). Capacity of multilane urban roads under mixed traffic conditions. In *Highway Research Bulletin, Indian Roads Congress* (Vol. 75, pp. 97-103).
10. Arkatkar, S. S. (2011). Effect of intercity road geometry on capacity under heterogeneous traffic conditions using microscopic simulation technique. *International Journal of Earth Sciences and Engineering*, 4(6), 375-380.
11. http://teacher.buet.ac.bd/cfc/CE452/12_Volume%20study_print6.pdf
12. Taleb, M. A., & Majumder, S. (2012). Impact of flyovers in Dhaka City of Bangladesh on the affected people in the adjacent area. *International Journal of Engineering and Technology*, 4(1), 103.
13. Prothom Alo English Desk, "Moghbar-Mouchak Flyover Opened to Public," Prothom Alo, Dhaka, Bangladesh, 26-Oct-2017,
14. Miyauchi, Y. (2017). Capturing urban mobility with cell phone data with an application of flyover opening in Dhaka. *IGC Bangladesh, Nakajima Foundation and Massachusetts Institute of Technology, Dhaka, Bangladesh.*
15. Dhaka City Corporation (DCC) Jatrabari-Gulistan Flyover Project: Rational Solution Approaches, Bureau of Research Testing & Consultation (BRTC), Department of Civil Engineering, Bangladesh University Of Engineering and Technology (2008).