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ASSESSING THE PERFORMANCE OF FLYOVERS IN CHITTAGONG CITY

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ABSTRACT

Efficiency of the city transportation network has greatly influenced by traffic volume, roadway capacity, traffic composition, geometric design, road side land use etc. At present, Bangladesh Road Transport Authority (BRTA) source shows that the total number of registered vehicle in Chittagong city is 84391. This huge amount of vehicles along with the non motorized vehicles create congestion in different roads of Chittagong city. Due to mitigate the effect of congestion Govt. has built four flyovers to enhance the mobility and ensure trustable transportation solution according to them. In this research, surveys and analysis have been conducted to find out how far the objectives have been met to construct the flyovers in Chittagong city. The aim of this study is to find out the traffic volume, average vehicle speed, queue length of Akhteruzzaman- Chowdhury flyover and Kadamtali flyover located in Chittagong metropolitan area.To assess the temporal variation, traffic flow is determined under and over the flyovers for different time frames (weekdays & weekends; for day & night). Kadamtali flyover has represented maximum mobility of vehicle flow (about 64%) at only night time but fewer flow (about 29%) at day time. In addition, a small percentage of the flow (about 37%) are observed in Akhteruzzaman Chowdhury flyover at different time frames. It is also found that less percentage of public buses (< 20 %) are using flyovers as they need to drop off the passengers at different locations under the flyover. In contrast, higher percentages of cars, CNG, bikes are using flyovers as it will take less time to travel. It is found that time mean speed along the flyover corridor is significantly low (<20 km/hr at-grade and <60 km/hr above-grade). Non-motorized vehicles (about 98 %) are forced to use at-grade road which will create long queue under the Kadamtali flyover and delay along Akhteruzzaman Chowdhury flyover corridor. Flyover are giving benefits to a small number of people rather it will creating narrow road at- grade, make public transportation unpopular, transfer traffic congestion form one spot to another, abate the future prospect of coordinated public trasportation system. Both the flyovers of Chittagong city would not serve the purpose of abating traffic jam at rail crossing under it. It is also recommended to build full grade separated flyovers along with other traffic engineering measures to reduce the conflict of rail road traffic.

Keywords: *Flyover, rail road, performance evaluation, congestion, queue length, level crossing.*

1. INTRODUCTION

Population is increasing rapidly in Bangladesh with the increasing number of motorized and non-motorized vehicles. But due to insufficient road-network it is not possible to abate the intensity of traffic jam in city area with the limited number of roads (Rahman, Mamun, Kabir & Mannan, 2015). Due to unplanned existing road network this traffic decreases free flow speed of vehicles and make the road network congested. New infrastructures i.e. flyover, mass rapid transit (MRT), bus rapid transit (BRT) have been built to abate the traffic impact of city area. But due to insufficient funding it is not possible to fulfill the required demand. In addition, developing infrastructure also a time-consuming issue and sometimes building flyovers will make road under it narrower for vehicle movement and flyover itself might not fulfill its' desired purpose of construction. Chittagong is the second largest cities of Bangladesh, is listed as the second worst livable city in Bangladesh after Dhaka. Unfortunately, Chittagong Development Authority (CDA) and other traffic decision makers have overlooked the traffic management tools i.e. eliminating illegal parking, removing non-motorized vehicle from major roads, denoting zebra crossing and constructing foot over bridge or tunnel for pedestrian movement at intersections etc. Rather, four flyovers have been built to mitigate congestion in Chittagong city. The main aim of this research is to assess the functional effectiveness of the existing flyovers constructed over level crossing and assess how far they are successful in extenuating congestion and enhancing mobility in Chittagong city.
The specific objectives of this study are:

1. To assess the comparative level of operation of road space under and over the flyovers.
2. To find the utilization of flyover spaces by non-motorized vehicles and public transportation.
3. To assess the effectiveness of flyovers in terms of abating the intensity of traffic congestion levels.

It is a matter of surprise that there is no study related to flyovers in Chittagong to understand the impact of flyovers over the city transportation system. In the study, researchers concluded that flyovers will not bring any solution in Dhaka in the aspect of social, financial and economical point of view (Islam, Anwari & Hoque, 2018). So, it is obvious that flyovers will not bring a sustainable solution to Chittagong city if succient precations are not taken. Flyovers constructed in Chittagong city without any feasibility study is nothing but useless for reducing congestion and transport crisis. Simulation software like VISSIM can be used to evaluate the alternative measures before building flyovers to assess the existing and future performance (Mamun, Mohammad, Haque & Riyad, 2016).

2. METHODOLOGY

This study had considered two flyovers (Akhtaruzzaman Chowdhury and Kadamtali flyover) with rail crossing displayed in figure 1. In figure 1, blue color marking presented the rail crossing and red color marking presented the flyover location. These rail crossings are incompatible with at-grade road. Because of the partially grade separated flyover it is tough to terminate conflicts between railroad traffic on at grade traffic movement. At first, reconnaissance survey was performed before real data collection to know the geometric features and rush hour information (Shah, Rahman, & Mamun, 2015). Traffic survey was conducted by using video camera and manual observation at peak period to measure traffic data (i.e. variation traffic volume, queue length and average speed) at under and above flyover (Shah, Rahman, & Mamun, 2015).

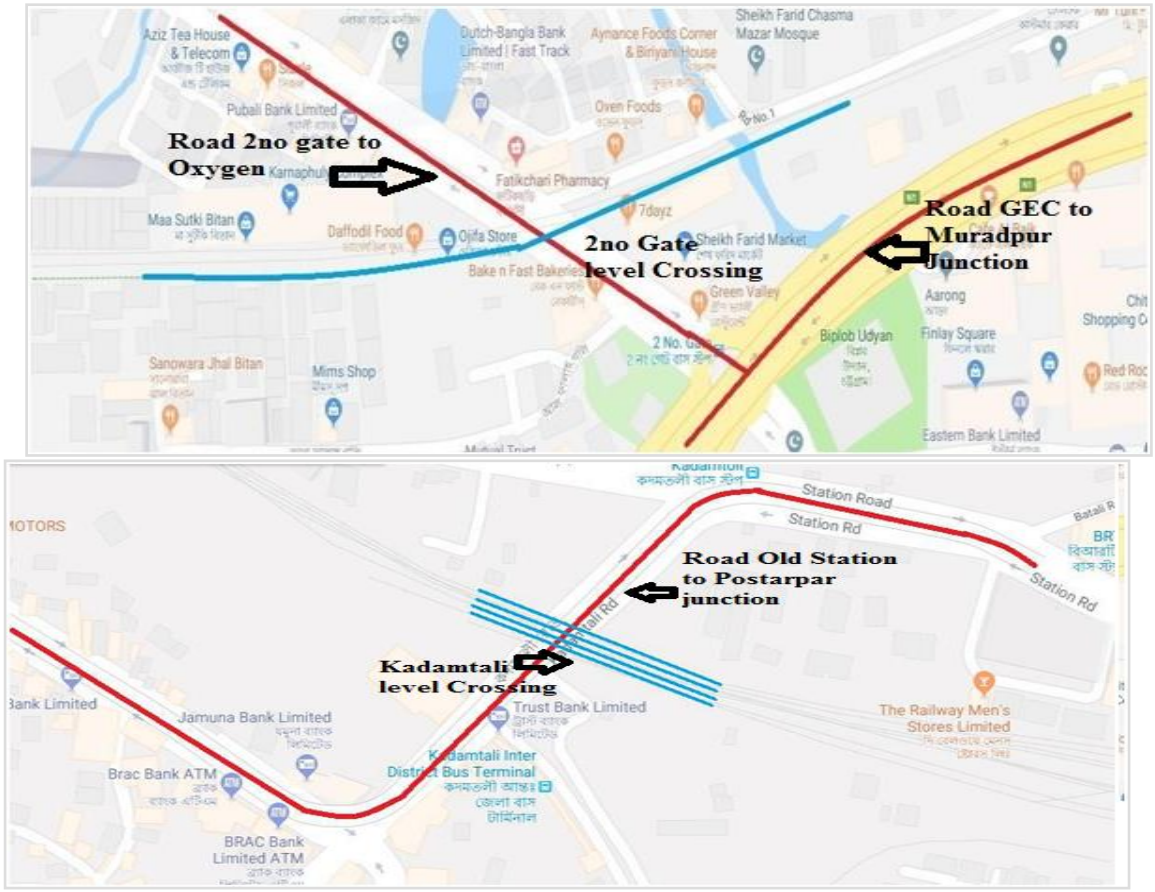

Figure 1: Layout of the Akhtaruzzaman Chowdhury and Kadamtali Flyover with level Crossing

Details of these flyovers are given in table 1.

Table 1: Features 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
Akhtaruzzaman Flyover	Partial	4	5.2	5	697.00	01, June 2018	CDA
Kadamtali Flyover	Partial	2	1.57	2	58.20	30, January 2016	CDA

Source: (Mahmud, 2015 and Staff Correspondent, 2017)

The peak time period (15 min. interval) for collecting data in weekday, day; weekday, night; weekend, day and weekend, night identified from the traffic survey then converted to equivalent hourly rate (PCU/hr) for both of these flyover travel corridors. Survey time is presented in the table 2.

Table 2: Selected Peak Time Interval of Akhtaruzzaman Chowdhury and Kadamtali Flyover

Name of the Flyover	Survey Time	Survey Month and Year	Selected Peak Time (15 min. interval)			
			Weekend, day	Weekend, night	Weekday, day	Weekday, Night
Aktaruzzaman Flyover	Friday, Saturday and Wednesday	October, 2018	5.15 pm - 5.30 pm	8.30 pm - 8.45 pm	5.15 pm - 5.30 pm	6.30 pm - 6.45 pm
Kadamtali Flyover	Friday, Saturday and Wednesday	October, 2018	5.15 pm - 5.30 pm	8.30 pm - 8.45 pm	5.15 pm - 5.30 pm	6.30 pm - 6.45 pm

3. RESULTS AND DISCUSSION

3.1 Variation of traffic flow

Table 4.1 shows the relative usage by vehicles of road space above and under the Akhtaruzzaman flyover. The greatest disparity in traffic flows between different grades is at weekday, day, with 65.46% vehicles traveling at-grade and only 35.35 % vehicles traveling above-grade. Overall percentage shows that most of the vehicles (more that 60%) are moving under the flyover. Moreover, the ratio of above-grade to at-grade flow is less than 0.60 in all cases. This will imply that Akhtaruzzaman flyover did not efficiently fulfill its purpose of reducing traffic conflict with rail road traffic.

Table 3: Traffic Volume Condition of Akhtaruzzaman Flyover at different time segments

Aktaruzzaman Flyover	Above/Under	Total Equivalent Flow (PCU/hr)	Percentage (%)	Ratio Between Above and Under
Weekend, Day	Above	1798	38.77	1:0.63
	Under	2839	61.22	
Weekend, Night	Above	1913	39.41	1:0.65
	Under	2941	60.32	
Weekday, Day	Above	1934	34.53	1:0.53
	Under	3666	65.46	
Weekday, Night	Above	1833	35.92	1:56
	Under	3270	64.07	

Figure 2 shows that a profuse number of vehicles are traveling through under the flyover compared to the above grade condition. It is also observed that the highest traffic flow at above-grade (1934 PCU/hr) occurs at weekday (day) and at at-grade (3666 PCU/hr) occurs at weekday, day. This implies that maximum flow both at-grade and above grade-occur at weekday period.

Flyover is necessary to construct if more than 8,500 vehicles/ hr cross the the intersection. But from our survey data, it is found that total equivalent hourly rates (PCU/hr) are much lower than standard value which eliminates the need for both flyover in Chittagong.

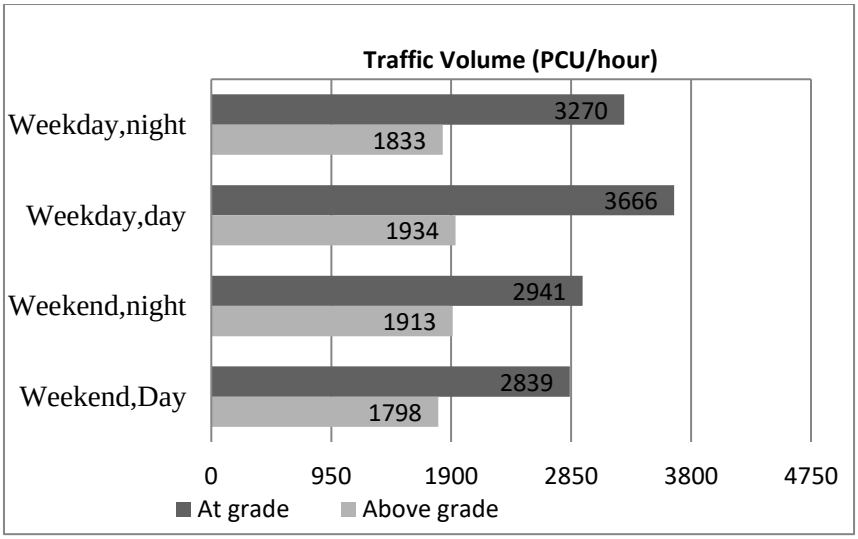

Figure 2: Comparison of vehicle flow at Akhtaruzzman Flyover at different grade condition

Table 4 shows relative usage by vehicles of road space over and under the flyover clarifies that at day time most of vehicles are using at grade road but at night large proportion of vehicles are using flyovers for both week day and weekend. The ratio of above-grade to at-grade flow also reflects that. The greatest disparity in flows between different grades is at weekday, night, with 77.66% vehicles travelling at-grade and 22.33 % vehicles travelling above-grade.

Table 4: Traffic Volume Condition of Kadamtali Flyover at different time segments

Kadamtali Flyover	Above/Under	Total Equivalent Flow (PCU/hr)	Percentage Total	Ratio Between Above and Under
Weekend,Day	Above	629	25.46	1:0.34
	Under	1841	74.53	
Weekend, Night	Above	1288	66.46	1:1.98
	Under	650	33.53	
Weekday, Day	Above	575	22.33	1:0.28
	Under	1999	77.66	
Weekday, Night	Above	3270	64.07	1:3.79
	Under	863	29.62	

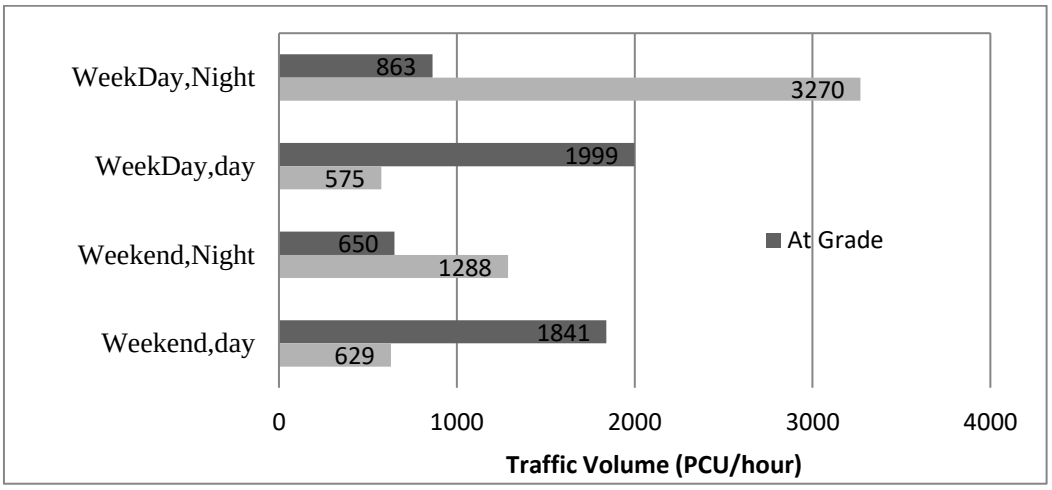

Figure 3: Comparison of vehicle flow at Kadamtali Flyover at different grade condition Flyover

From figure 3 it is observed that the highest flow at at-grade (1841 PCU/hr) occurs at weekend, day which is lower compared to flow (3270 PCU/hr) at above-grade occurs at weekday, night. This implies that most of the traffic moves through flyover at night compared to day time at weekend but at weekday the condition is opposite. It may be due to the fact that at night time, the vehicular flow at this flyover corridor tends to be lower at-grade level and hence, road users feel comfortable to use at-grade road rather using flyover to save their fuel and time.

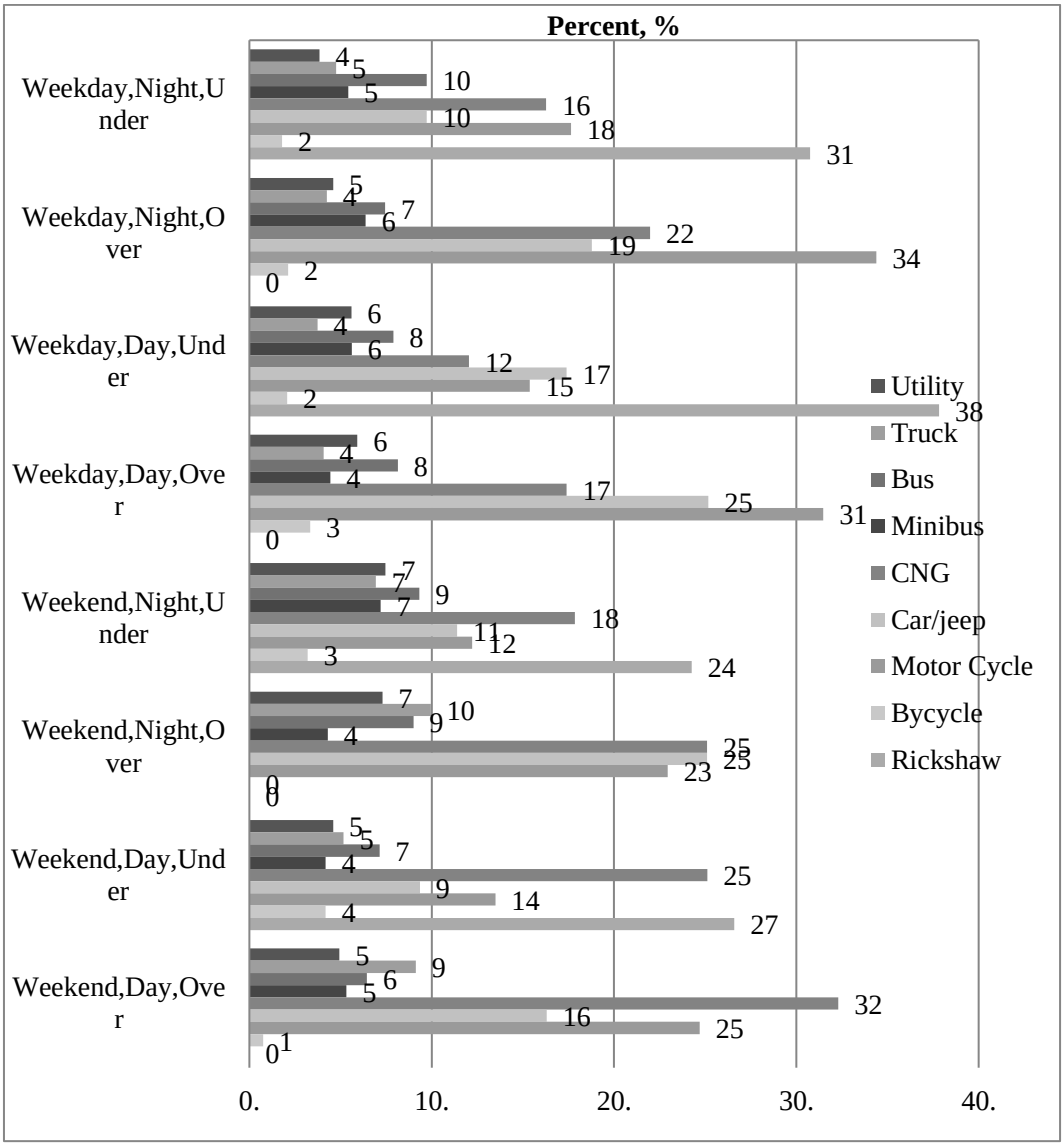

Figure 4 : Temporal Variation of Different Types of Vehicles in Aktaruzzaman Flyover

Figure 4 shows that NMVs are the most contributing vehicles among others and uses mostly (about 100 %) the road under the flyovers. It is also observed that Car and CNG prefers to use flyover about 44% to 120% compared to the at grade condition. In terms to the condition of public transportation about 15 to 25% is preferring to use at grade condition compared to flyover. This research implies that most beneficiary of constructing flyovers is private car, CNG and motorcycle. As percentage of public transport is trifling, it can be concluded that public transport are getting negligible benefits from this flyover. Rail crossing of Akhtaruzzaman flyover is near to the busy intersection 2 number Gate. So, public transport will continue to serve people at-grade.

Figure 5 represents that most beneficiary of constructing flyovers is CNG, private car and motorcycle. The percentage of public transport is insignificant. Hence, it can be concluded that public transport are getting negligible benefits from this flyover. Since there is significant land usage beneath flyover, including residential and commercial spaces, people will continue to use at-grade facilities. Hence, public transport will continue to serve people at-grade. In addition to that the percentage of NMVs in this flyover is negligible Further analyses have been performed to understand the NMVs fact more clearly.

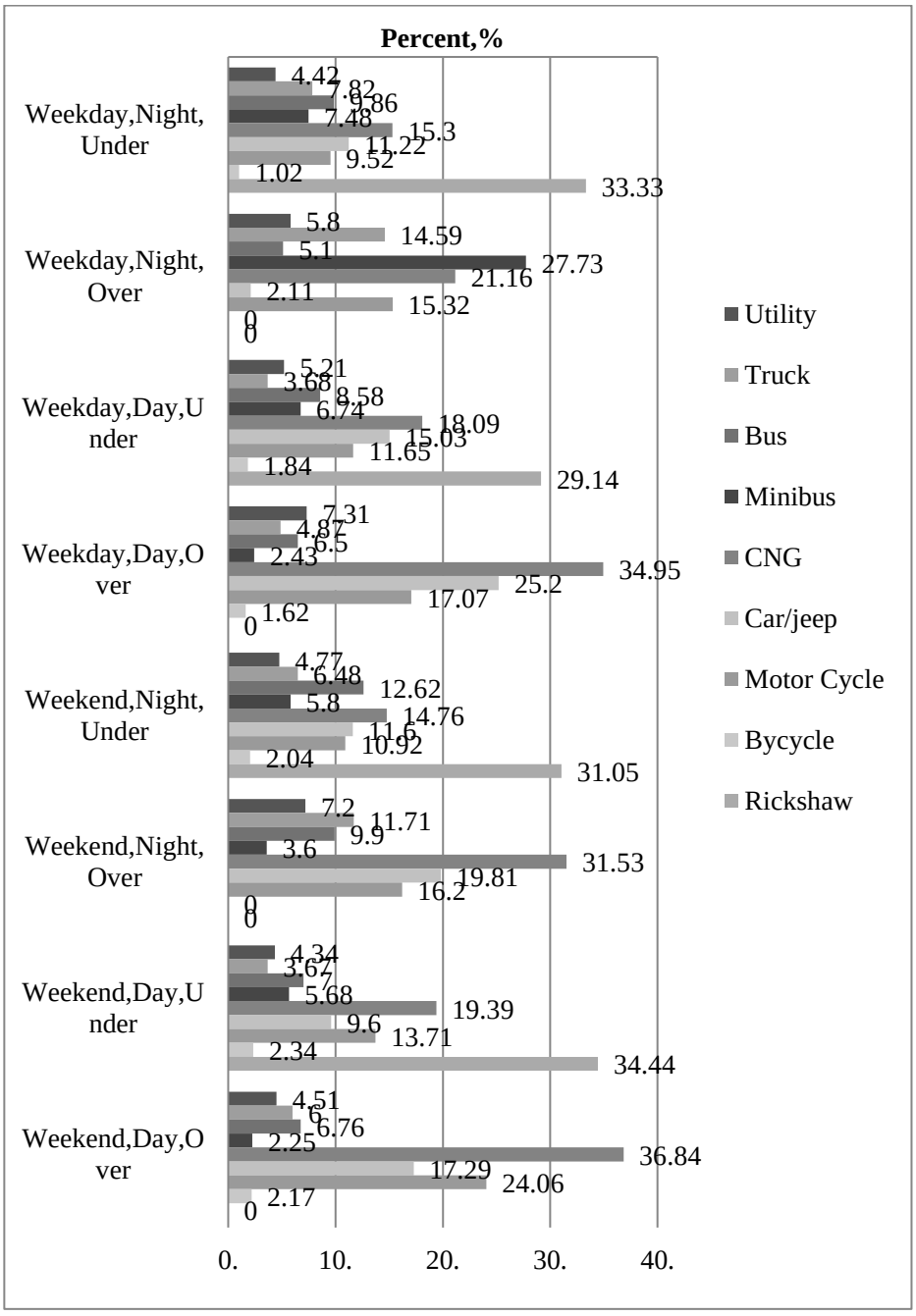

Figure 5: Temporal Variation of Different Types of Vehicles in Kadamtali Flyover

3.2 Mobility Condition

To determine the mobility of vehicle speed is measured for the flyover corridor at different grade condition. Time Mean Speed of each type of vehicle was measured at Aktaruzzaman and Kadamtali Flyover to assess the mobility conditions of vehicles both at-grade and above grade. Time Mean Speed

has been calculated by dividing the segment length of the studied road segment by the sum of total time in motion, and then divided by the number of total vehicles.

Table 5: Time Mean Speed Above Grade and At-Grade at Aktaruzzaman and Kadamtali Flyover

Vehicle Name	**Aktaruzzaman Flyover**		**Kadamtali Flyover**		**Aktaruzzaman Flyover**		**Kadamtali Flyover**	
	Time Mean Speed (km/hr)		Time Mean Speed (km/hr)		Free FlowSpeed (km/hr)		Free FlowSpeed (km/hr)	
	Above Grade	At Grade	Above Grade	At Grade	Above Grade	At Grade	Above Grade	At Grade
Bike, Bus, Bus, Truck, CNG, Car	57.49	19.87	40.06	17.78	85	65	65	45

3.3 Congestion level (Queue Length)

In this study, congestion level has been assessed in terms of queue length, where queue length is defined as the length of the line of motor vehicles that have been stopped at a level crossing in order for the trains to pass. It was measured taking photograph through mobile camera then taking the length manually.

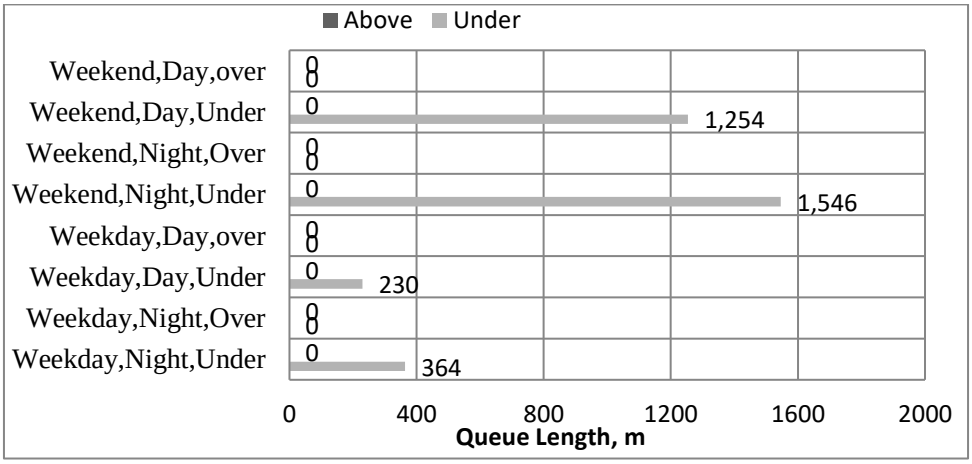

Figure 6: Temporal Comparison of Queue Length at Aktaruzzaman Flyover

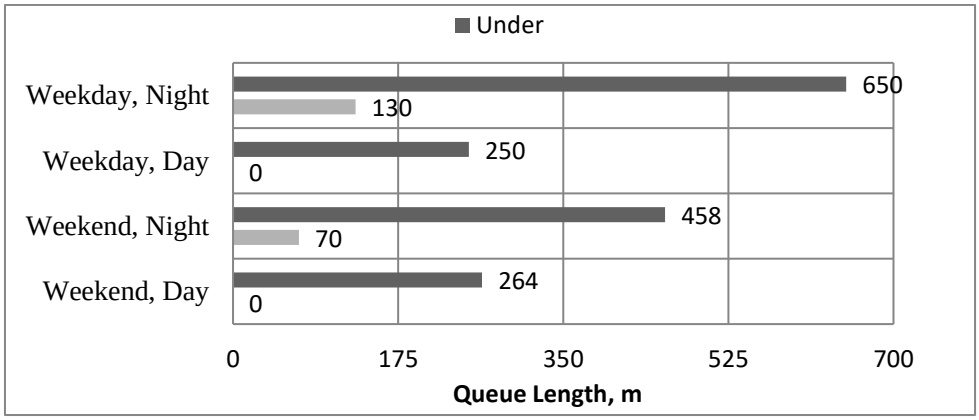

Figure 7: Temporal Comparison of Queue Length at Kadamtali Flyover

Figur 6 represents that the flyover has failed to reduce congestion, as most of the vehicles are using at grade road and creating a lengthy queue i.e. 1546 m at weekend night. From figure 7 the longest queue length at above-grade was recorded at weekday night (650 m) compared to other conditions which opposite to Akhtaruzzaman flyover. This is surely the worst case and it implies that both these flyovers have completely failed to fulfill its demand of traffic.

4. CONCLUSIONS

It is concluded that partially graded flyovers cannot reduce the upcoming traffic impact on rail crossings of Chittagong city area. Assessing the usage of at-grade and above grade road of the partially graded flyovers (Akhtaruzzaman and Kadamtali Flyover) of Chittagong city shows that flyovers are not efficiently accomplish the purpose of reducing congestion in Chittagong city area. Rather it creates huge traffic jam in rail crossing area by creating longer queue length of vehicles and huge number of heterogeneous traffic volume. Moreover, it will create advantages only for cars and CNGs to avoid the rail crossings under the flyovers. But most of the NMV and public transportation are using at-grade road which will create huge congestion, reduce the average speed and make the implementation purpose of flyovers failed. It is suggested that Bus Rapid Transit (BRT) and Mass Rapid Transit (MRT) can bring sustainable solution to reduce the volume of cars and smaller sized vehicles on road (Islam, Anwari, Hoque & Amin, 2018).Due to insufficient source of fund it is recommended to build low cost traffic engineering measures to control conflicts between vehicle-vehicle, vehicle-pedestrian. Otherwise, only full grade separation can resolve the conflict of rail-road traffic which is time consuming and very expensive.

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