

## The Impact of MRT Line-6 Construction Work on The Environment, Road Users, and Traffic During the Construction Period

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### ABSTRACT

The study examines the impact of metro rail construction on traffic volume, speed, environmental impact assessment, road blockage, and effects on pedestrians and locals. The MRT line-6 project in Bangladesh has initiated the metro rail era, but it has led to adverse impacts on road users, including health issues, lost working hours, economic losses, and environmental pollution. The construction of MRT line-6 has blocked footpaths and entrances of local shops and institutions, causing daily movement problems, economic losses, and adverse health impacts. The pace of construction activity during the COVID-19 pandemic has resulted in delayed completion and prolonged suffering for road users. For traffic volume study the direct manual counting method is used for data collection at the selected location and the stopwatch method is used to collect spot speed data at selected locations. The results show a 23.68% decrease in traffic flow during the morning and a 21.39% decrease during evening peak hours compared to before the construction. The average spot speed in under-construction areas is significantly lower than in construction-free areas. Monthly EIA reports reveal higher levels of Suspended Particulate Matter (SPM), PM10, and PM2.5 than Bangladesh Standards, and gaseous substances like CO, NO<sub>x</sub>, and SO<sub>2</sub> are below standards in both monitoring locations. The study aims to analyze traffic volume and speed during metro rail construction in Dhaka city, determining traffic flow rate and spot speed. It also examines the environmental and health impacts of construction using monthly EIA reports. The study also aims to visualize the effects on pedestrian movement and local people's suffering. It analyzes road blockages due to construction, road users' effects, and the impact of COVID-19 on the metro rail project. The findings will help visualize the adverse effects on traffic flow rate, vehicle speed, and local people's suffering.

**Keywords:** *Traffic Volume Study, Traffic Speed Study, Environmental Impact Assessment, Pedestrian*

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Dhaka, the capital and busiest city of Bangladesh, is facing significant traffic congestion and environmental damage due to its dense population. The construction of the Dhaka Metro Rail, also known as the Dhaka Metro, was initiated in 2016 to reduce these issues. The Metro Rail consists of 20.1 kilometers of electricity-powered light rail tracks and 16 elevated stations, each measuring 180 meters. By 2022, the Dhaka Metro is expected to handle over 60,000 passengers per hour, with wait times of about 4 minutes. With a maximum speed of 100 km/h (62 mph), the full journey may be completed in less than 40 minutes [1]. Smart cards, also known as magnetic contactless integrated circuit tickets, will be used by the system, and platform screen door (PSD) barriers will improve efficiency and safety. At each of the 16 stations, trains with six air-conditioned, spacious carriages will arrive every four minutes [2]. The Dhaka Transport Coordination Authority of the Communications Ministry oversees the project, with the general consultant being a group of international and Bangladeshi businesses, including Nippon Koei Japan and Development Design Consultants [3].

Md. Tanvir Ahmed et. al (2019), conducted a study on “Metro Rail Constructions and its Effects on Road Users”. This study aims to identify the difficulties encountered by drivers in a construction zone. According to this study, the amount of traffic on this road has significantly fallen by roughly 52% compared to earlier, and as a result, the average speed has decreased to 1.1 km/h, compared to the city of Dhaka's average speed of 7 km/h [4]. However, some owners of private vehicles have shifted their routes in favor of using this road, which causes congestion across Dhaka. It has become much more challenging for pedestrians to cross the roads, especially now. Before metro rail construction, MRT (Mass Rapid Transit) authority prepared traffic data that was utilized to compare the results [2]. The findings show that the effects of metro rail construction on traffic and road users in the construction regions are significant.

Ravi Bhutani et. al (2014), conducted a study on “Impact of Metro Rail Construction Work Zone on Traffic Environment.” This study implies that construction operations and long-term construction work zones are a necessary part of the implementation of metro rail projects [5]. Long-term construction zones on urban roadways cause a variety of issues, including reduced capacity, longer travel times, longer lines, increased fuel consumption, and an increase in the number of forced merges and traffic accidents, which result in unreported economic losses. This research aims to investigate the effects of building work zones for metro rail on the surrounding traffic environment and, as a result, quantify these effects for the current situation. In order to estimate the economic loss caused by the metro rail construction work zone, it is therefore required to analyze and quantify the impact of mass rapid transit system building work zones on the traffic [6].

Preyansh Gupta and M. R. Apte (2017), conducted a study on “Importance of Traffic Management during Execution of Metro Rail Project in India”. This study implies that in India, managerial issues more frequently cause infrastructure projects to fail than technical issues do. Negligence in the overall management techniques affects the community and the environment in addition to the project's time and cost [7]. Large infrastructure projects like the Metro Rail Project take a long time to complete, like 10 to 15 years in a developing metro city. It is understood that the purpose of these projects is to improve social welfare through the provision of public transportation, yet for such a lengthy period of actual road construction, it is completely disregarding systematic management measures designed to minimize disruption to nearby commuters [6]. The freeway and arterial road congestion, as

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well as the effects of the execution work on the community living in the actual site conditions, will be examined in this study paper. This study activity will be supported by the standards created and the traffic characteristics. Therefore, it is the responsibility of the civil engineer to advise certain traffic diversion strategies and to abide by other relevant rules in order to lessen the existing problem.

This study explores traffic volume study, traffic speed study, analysis of EIA report, analysis of road blockage due to construction, analysis of effects on road users and impact of COVID-19 in the metro rail project construction. This study visualizes how the traffic flow rate and the vehicle speed is being affected and also how the vehicle users, pedestrians and local peoples are suffering because of the adverse effects of metro rail construction at the selected locations of Dhaka city. Therefore, it is the responsibility of the civil engineer to advise certain traffic diversion strategies and to abide by other relevant rules in order to lessen the existing problem.

### MATERIALS & METHODOLOGY

The on field primary data was collected during morning peak hour (8 am to 10 am) and evening peak hour (6 pm to 8 pm) on selected locations. The secondary data was collected from respective institutions authority. First, the study area was selected. As the MRT line-6 is currently under construction, so the route of MRT line-6 was chosen as our study area. All the primary data was collected from the route of MRT line-6 from Mirpur 12 to Agargaon region. The traffic count was conducted in both directions at three selected points of Mirpur 12, Mirpur 10 and Agargaon during a week.

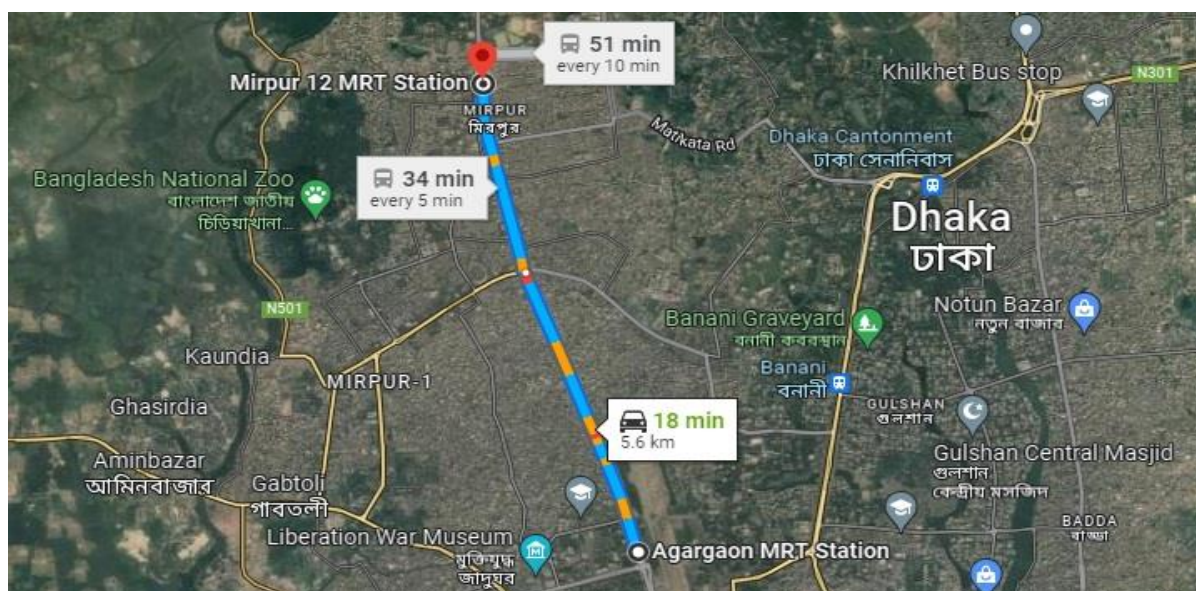


Figure 1: Google map view of selected route (Mirpur 12 to Agargaon)

#### Traffic Volume Study:

##### Methods of Traffic Volume Study

There are two major methods of traffic volume study. They are-

1. Manual Counting Method
2. Automatic Counting Method

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### **Manual Counting Method**

The manual method, which involves assigning a person to record traffic as it passes, is the most popular way to gather data on traffic flow. Although this technique of data gathering can be labor-intensive, it is nonetheless required in the majority of situations when vehicles must be identified and a number of movements must be recorded simultaneously, such as at crossings. There are two methods of manual counting. They are-

- **Direct Method:** Manual enumerators and hand tally are used to count data.
- **Indirect Method:** Data is gathered using a video camera in this method. Data is later acquired by rewinding a video that has been recorded for a long time.

### **Automatic Counting Method**

In the past, the surface of the road has been the main location for performing vehicle presence and road occupancy detection. In recent years, the exploitation of new electromagnetic spectrum and wireless communication media has made it possible for traffic detection to take place above or to the side of the road in a non-intrusive manner. In the upcoming years, detectors that are freed from the road surface will fiercely compete with pavement-based traffic detection, which is currently relatively affordable. The most commonly used detector types are:

- Pneumatic tubes
- Inductive loops
- Piezoelectric sensors
- Magnetic loop

Although manual counting is still the most common technique, new technologies have lately emerged that appear to have great promise. Such as-

- Passive and Active Infra-Red
- Passive Magnetic
- Microwave Radar
- Ultrasonic and Passive Acoustic
- Video Image Detection

### **Selection of Method**

Considering all the advantages and disadvantages of all the methods, depending on our suitability, the Direct Manual Counting Method is used for data collection at the selected location.

### ***Survey Methodology & Data Collection Procedure***

The survey was conducted in five steps. They are-

- Reconnaissance
- Survey Design
- Trial survey
- Problem Identification and
- Final survey.

At first, the data collection locations were selected and site visiting was done at the selected locations to explore the conditions of the area. The purpose of this reconnaissance was to collect data in a feasible and practical way. Then the types of vehicles were observed and the required number of enumerators were determined to count different types of vehicles in the

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selected direction. A suitable spot was selected from where all the vehicles were clearly visible and counting could be done correctly. A total of 5 enumerators of the group conducted the whole survey of data collection. Tally sheets were labeled and arranged for ease of data recording and future calculations. The group members stood safely by the side of the road where they had a transparent view of traffic and different vehicles were counted by different people. One enumerator was selected among us who was to keep watch of the time intervals. The vehicle count was done from the footpath. A trial survey was conducted to identify if there were any problems. During the trial survey, we had faced some problems. After solving the problems, the final survey was done.

Traffic Speed Study:

### **Methods of Spot Speed Study**

There are three major methods of collecting spot speed data. They are-

- Stopwatch Method
- Radar Meter Method, or
- Pneumatic road tube Method

### **Selection of Method**

A spot speed study can be successfully completed using the stopwatch method with a limited number of participants collected over a very short period of time. Speed data can be quickly and affordably collected using a stopwatch. So, the stopwatch method is used to collect spot speed data at selected locations.

### **Survey Methodology & Data Collection Procedure**

The survey was conducted in five steps. They are-

- Reconnaissance
- Survey Design
- Trial survey
- Problem Identification and
- Final survey.

At first, the data collection locations were selected, and site visits were done at the selected locations to explore the conditions of the area. The purpose of this reconnaissance was to collect data in a feasible and practical way. Then the types of vehicles were observed, and the required number of enumerators was determined to collect the spot speed data at the selected direction. A suitable spot was selected from where all the vehicles were clearly visible and data could be collected correctly. A total of 5 enumerators of the group conducted the whole survey of data collection. A strip length of 60 ft was set on the road and speed data from 50 cars were taken to estimate spot speed at each direction of the selected location. One enumerator used a stopwatch to record the time in case of recording spot speed data.

### **Environment Impact Assessment Data**

The data of monthly environment impact assessment (EIA) report is collected from Italian-Thai Development Public Company Limited. The data of this report is used for the analysis of the concentration of ambient air pollution in the air due to MRT line-6 construction with the Value of Bangladesh Standards, ECR-1997, Schedule 2 (Standards for Air).

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### Available Road Width Data in the MRT Line-6 Route during Construction

The measurement tape was used to measure the available road width at under-construction area and at the construction-free area during MRT line-6 construction. This collected data is used to visualize the impact of road narrowing and road blockage due to MRT line-6 construction.

### Data of Impact of MRT Line-6 Construction to the Pedestrians and Local Peoples

To visualize the construction's impact on pedestrians and local people, the necessary information was collected, and pictures were captured through the field survey.

### Impact of COVID-19 Outbreak to the MRT Line-6 Construction

The data of monthly construction work progress is collected from Dhaka Mass Transit Company Limited (DMTCL). This data is analyzed and used to visualize the impact of the COVID-19 outbreak in the construction of the MRT line-6 route.

## RESULT AND DISCUSSION

The collected data of the traffic volume study is used to calculate the traffic flow rate to show the comparison of the traffic flow rate before the metro rail construction and during the metro rail construction. The collected data of spot speed study is used to calculate the spot speed of passenger car in the construction-free area and under-construction area to show the comparison in between them. The collected data of ambient air pollution concentration is used to show the comparison of the amount of pollutants in the air with the standard value authorized by ECR, 1997, and amendment in 2005 standard (schedule-2). The collected data of MRT line-6 work progress is used to show the slow progress of work during the COVID-19 period, which extended the sufferings of the road users. Also, the adverse impact of the construction on pedestrians and the local people is also discussed in this section.

### Determination of Traffic Flow Rate

The determination of traffic flow rate (PCU/ hr) from Mirpur to Mirpur-12 in both directions at morning peak hours (8 am to 10 am) and evening peak hours (6 pm to 8 pm) is shown below in **Table-1**:

**Table 1: Traffic Flow from Mirpur 12 to Mirpur 10 both directions**

Locations and time:		Traffic Flow from Mirpur 12 to Mirpur 10 in Morning Peak Hours				Traffic Flow from Mirpur 12 to Mirpur 10 in Evening Peak Hours				Traffic Flow from Mirpur 10 to Mirpur 12 in Evening Peak Hours				Traffic Flow from Mirpur 10 to Agargaon in Morning Peak Hours			
Vehicle Type		Total Vehicle in 2 Hours	PCU Factor	Flow (PCU) in 2 hours	Flow Rate (PCU/hr)	Total Vehicle in 2 Hours	PCU Factor	Flow (PCU) in 2 hours	Flow Rate (PCU/hr)	Total Vehicle in 2 Hours	PCU Factor	Flow (PCU) in 2 hours	Flow Rate (PCU/hr)	Total Vehicle in 2 Hours	PCU Factor	Flow (PCU) in 2 hours	Flow Rate (PCU/hr)
Motorized Vehicle (MV)	Truck	19	3	57	28.5	11	3	33	16.5	17	3	51	25.5	14	3	42	21
	Bus	312	3	936	468	371	3	1113	556.5	403	3	1209	604.5	421	3	1263	631.5
	Car	531	1	531	265.5	542	1	542	271	562	1	562	281	584	1	584	292
	CNG	604	0.75	453	226.5	548	0.75	411	205.5	600	0.75	450	225	658	0.75	493.5	246.75
	Bike	720	0.5	360	180	815	0.5	407.5	203.75	798	0.5	399	199.5	828	0.5	414	207
Non-Motorized Vehicle (NMV)	Rickshaw	308	2	616	308	331	2	662	331	368	2	736	368	347	2	694	347
	Van	12	2	24	12	10	2	20	10	10	2	20	10	7	2	14	7
	Bicycle	146	0.5	73	36.5	131	0.5	65.5	32.75	118	0.5	59	29.5	99	0.5	49.5	24.75
		<b>Total</b>				<b>Total</b>				<b>Total</b>				<b>Total</b>			
		<b>1,525</b>				<b>1,627</b>				<b>1,743</b>				<b>1,777</b>			

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The determination of traffic flow rate (PCU/ hr) from Mirpur 10 to Agargaon in both direction at morning peak hours (8 am to 10 am) and evening peak hours (6 pm to 8 pm) is shown below in **Table-2**:

**Table 2: Traffic Flow from Mirpur 10 to Agargaon**

Locations and time:		Traffic Flow from Mirpur 10 to Agargaon in Morning Peak Hours				Traffic Flow from Mirpur 10 to Agargaon in Evening Peak Hours				Traffic Flow from Agargaon to Mirpur 10 in Morning Peak Hours				Traffic Flow from Agargaon to Mirpur 10 in Evening Peak Hours			
Vehicle Type		Total Vehicle in 2 Hours	PCU Factor	Flow (PCU) in 2 hours	Flow Rate (PCU/hr)	Total Vehicle in 2 Hours	PCU Factor	Flow (PCU) in 2 hours	Flow Rate (PCU/hr)	Total Vehicle in 2 Hours	PCU Factor	Flow (PCU) in 2 hours	Flow Rate (PCU/hr)	Total Vehicle in 2 Hours	PCU Factor	Flow (PCU) in 2 hours	Flow Rate (PCU/hr)
Motorized Vehicle (MV)	Truck	23	3	69	34.5	15	3	45	22.5	20	3	60	30	15	3	45	22.5
	Bus	328	3	984	492	313	3	939	469.5	354	3	1062	531	399	3	1197	598.5
	Car	514	1	514	257	534	1	534	267	593	1	593	296.5	619	1	619	309.5
	CNG	572	0.75	429	214.5	596	0.75	447	223.5	548	0.75	411	205.5	572	0.75	429	214.5
	Bike	675	0.5	337.5	168.75	692	0.5	346	173	707	0.5	353.5	176.75	769	0.5	384.5	192.25
Non-Motorized Vehicle (NMV)	Rickshaw	279	2	558	279	297	2	594	297	307	2	614	307	269	2	538	269
	Van	8	2	16	8	10	2	20	10	6	2	12	6	4	2	8	4
	Bicycle	121	0.5	60.5	30.25	98	0.5	49	24.5	65	0.5	32.5	16.25	51	0.5	25.5	12.75
		<b>Total</b>				<b>Total</b>				<b>Total</b>				<b>Total</b>			
		<b>1,484</b>				<b>1,487</b>				<b>1,569</b>				<b>1,623</b>			

The determination of traffic flow rate (PCU/ hr) from Agargaon to Farmgate in both direction at morning peak hours (8 am to 10 am) and evening peak hours (6 pm to 8 pm) is shown below in **Table-3**:

**Table 3: Traffic Flow from Agargaon to Farmgate Both Direction**

Locations and time:		Traffic Flow from Mirpur 10 to Agargaon in Morning Peak Hours				Traffic Flow from Mirpur 10 to Agargaon in Evening Peak Hours				Traffic Flow from Agargaon to Mirpur 10 in Morning Peak Hours				Traffic Flow from Agargaon to Mirpur 10 in Evening Peak Hours			
Vehicle Type		Total Vehicle in 2 Hours	PCU Factor	Flow (PCU) in 2 hours	Flow Rate (PCU/hr)	Total Vehicle in 2 Hours	PCU Factor	Flow (PCU) in 2 hours	Flow Rate (PCU/hr)	Total Vehicle in 2 Hours	PCU Factor	Flow (PCU) in 2 hours	Flow Rate (PCU/hr)	Total Vehicle in 2 Hours	PCU Factor	Flow (PCU) in 2 hours	Flow Rate (PCU/hr)
Motorized Vehicle (MV)	Truck	23	3	69	34.5	15	3	45	22.5	20	3	60	30	15	3	45	22.5
	Bus	328	3	984	492	313	3	939	469.5	354	3	1062	531	399	3	1197	598.5
	Car	514	1	514	257	534	1	534	267	593	1	593	296.5	619	1	619	309.5
	CNG	572	0.75	429	214.5	596	0.75	447	223.5	548	0.75	411	205.5	572	0.75	429	214.5
	Bike	675	0.5	337.5	168.75	692	0.5	346	173	707	0.5	353.5	176.75	769	0.5	384.5	192.25
Non-Motorized Vehicle (NMV)	Rickshaw	279	2	558	279	297	2	594	297	307	2	614	307	269	2	538	269
	Van	8	2	16	8	10	2	20	10	6	2	12	6	4	2	8	4
	Bicycle	121	0.5	60.5	30.25	98	0.5	49	24.5	65	0.5	32.5	16.25	51	0.5	25.5	12.75
		<b>Total</b>				<b>Total</b>				<b>Total</b>				<b>Total</b>			
		<b>1,484</b>				<b>1,487</b>				<b>1,569</b>				<b>1,623</b>			

Now, after calculating the traffic flow rate in MRT line-6 construction route in 2022, the comparison between traffic flow rate before MRT line-6 construction and the traffic rate flow during MRT line-6 construction in 2022 from the obtained result is shown in Table 4 at below-



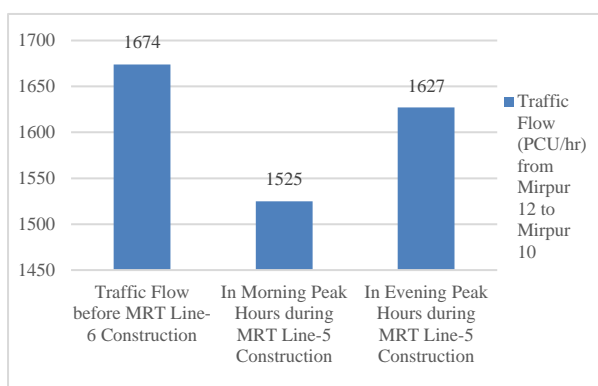
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**Table 4: Comparison of Traffic Flow**

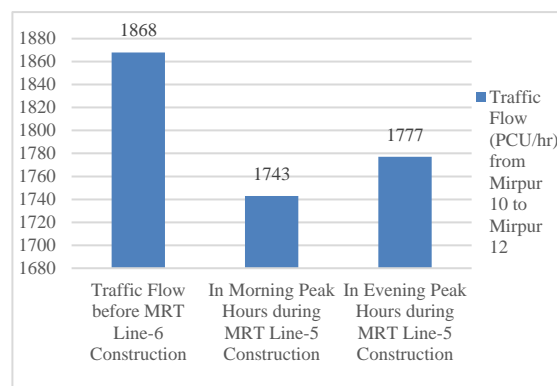
Survey Location	Direction	Traffic Flow before MRT Line-6 Construction (PCU)	Traffic Flow during MRT Line-6 Construction in 2022 (PCU)		Remarks
			In Morning Peak Hours	In Evening Peak Hours	
Mirpur 12	Mirpur 12 to Mirpur 10	1674	1,525	1,627	Traffic flow is 8.90% and 2.81% less than before in morning and evening peak hours respectively.
	Mirpur 10 to Mirpur 12	1868	1,743	1,777	Traffic flow is 6.69% and 4.87% less than before in morning and evening peak hours respectively.
Mirpur 10	Mirpur 10 to Agargaon	2623	1,484	1,487	Traffic flow is 43.42% less in morning and 43.31% less in evening peak hours than before.
	Agargaon to Mirpur 10	2489	1,569	1,623	Traffic flow is 36.96% and 34.79% less than before in morning and evening peak hours respectively.
Agargaon	Agargaon to Farmgate	2802	2,073	2,130	Traffic flow is 26.02% and 23.98% less than before in morning and evening peak hours respectively.
	Farmgate to Agargaon	2409	1,925	1,961	Traffic flow is 20.09% and 18.60% less than before in morning and evening peak hours respectively.

According to the above table, the average traffic flow is 23.68% less in morning peak hours and 21.39% less in evening peak hours than it was before metro rail construction. A significant portion of the highway from Mirpur to Agargaon has been blocked for metro rail construction which is causing massive traffic jam and it is responsible for the decrease of traffic flow during metro rail construction.

The comparison of traffic flow (PCU/hr) between before MRT line-6 construction and during MRT line-6 construction in 2022 is shown in Figure (2- 7)



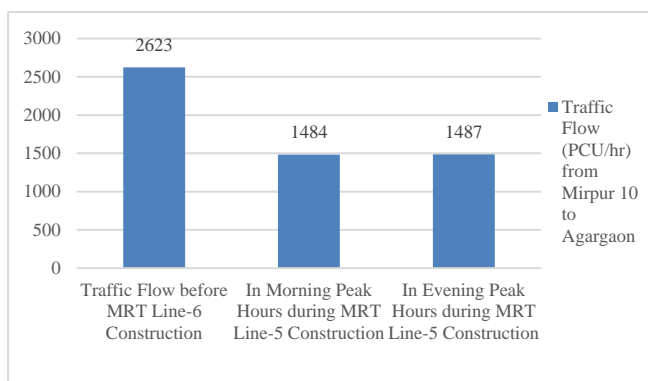
**Figure 2: Comparison of Traffic Flow from Mirpur 12 to Mirpur 10**



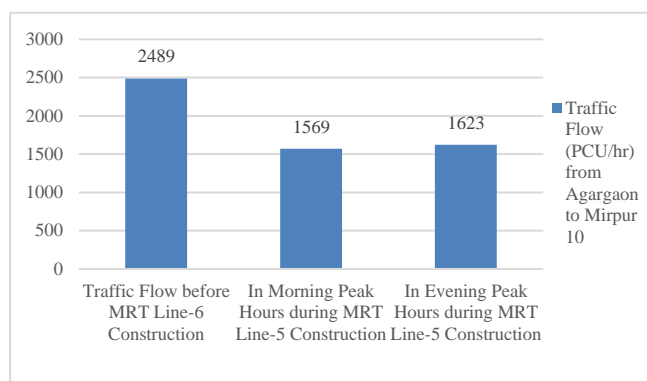
**Figure 3: Comparison of Traffic Flow from Mirpur 10 to Mirpur 12**



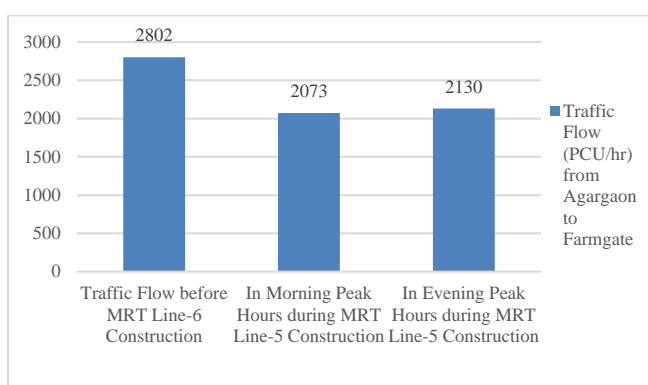
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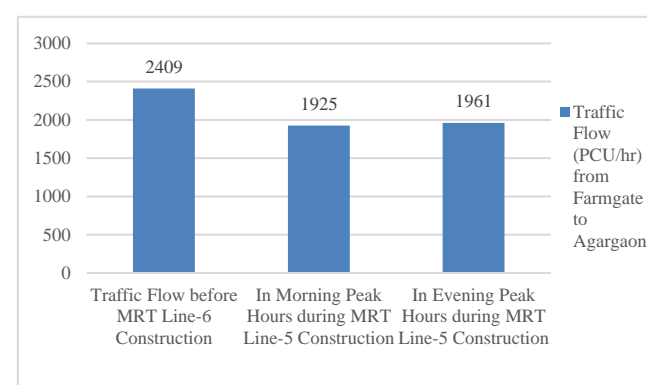
**Figure 4: Comparison of Traffic Flow from Mirpur 10 to Agargaon**



**Figure 5: Comparison of Traffic Flow from Agargaon to Mirpur 10**



**Figure 6: Comparison of Traffic Flow from Agargaon to Farmgate Direction.**



**Figure 7: Comparison of Traffic Flow from Farmgate to Agargaon Direction.**

### Determination of Spot Speed

The comparison between average spot speeds (kmph) at under construction area with the average spot speed at construction free area during MRT line-6 construction in 2022 is shown in **Table 5-**

**Table 5: Spot Speed (km/hr) From Mirpur 12 to Mirpur 10**

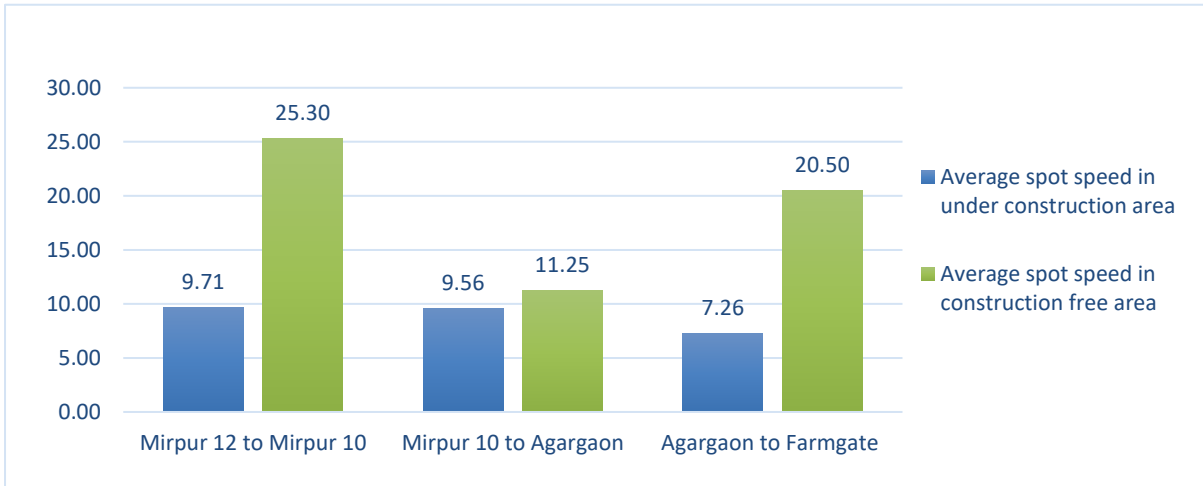
Location		Mirpur 12 to Mirpur 10				Mirpur 10 to Agargaon				Agargaon to Farmgate			
C a r N o.	Distance (ft)	Time (sec)		Speed (kmph)		Time (sec)		Speed (kmph)		Time (sec)		Speed (kmph)	
		At Under Construction Area	At Construction Free Area	At Under Construction Area	At Construction Free Area	At Under Construction Area	At Construction Free Area	At Under Construction Area	At Construction Free Area	At Under Construction Area	At Construction Free Area	At Under Construction Area	At Construction Free Area
1	60	7.78	3.62	8.46	18.18	4.07	10.75	16.17	6.12	10.71	3.73	6.15	17.65
2	60	10.03	2.87	6.56	22.93	4.38	11.12	15.03	5.92	9.83	2.78	6.70	23.68
3	60	8.92	2.35	7.38	28.01	4.03	10.52	16.33	6.26	9.37	3.13	7.02	21.03
4	60	7.54	3.22	8.73	20.44	4.91	11.56	13.41	5.69	11.12	3.7	5.92	17.79
5	60	6.27	2.7	10.50	24.38	5.06	10.74	13.01	6.13	10.07	4.12	6.54	15.98
6	60	6.73	3.01	9.78	21.87	4.17	10.92	15.78	6.03	10.81	2.7	6.09	24.38
7	60	5.78	3.12	11.39	21.10	3.73	11.31	17.65	5.82	8.42	3.15	7.82	20.90
8	60	6.7	2.29	9.82	28.74	4.22	9.26	15.60	7.11	9.73	3.64	6.76	18.08
9	60	7.37	2.64	8.93	24.93	4.53	11.4	14.53	5.77	10.08	4.15	6.53	15.86
10	60	9.16	2.77	7.19	23.76	3.5	10.73	18.81	6.13	7.62	2.5	8.64	26.33

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11	60	7.23	2.41	9.10	27.31	4.17	11.92	15.78	5.52	8.49	4.35	7.75	15.13		
12	60	6.78	2.13	9.71	30.90	5.22	10.9	12.61	6.04	8.92	3.62	7.38	18.18		
13	60	5.23	2.26	12.59	29.12	4.85	11.77	13.57	5.59	10.03	2.84	6.56	23.18		
14	60	4.92	2.12	13.38	31.05	4.67	12.51	14.09	5.26	9.6	3.99	6.86	16.50		
15	60	7.67	3.69	8.58	17.84	4.12	12.1	15.98	5.44	9.17	2.07	7.18	31.80		
16	60	10.27	2.7	6.41	24.38	3.95	11.39	16.66	5.78	11.1	2.99	5.93	22.01		
17	60	8.01	2.89	8.22	22.78	5.72	12.45	11.51	5.29	9.8	3.86	6.72	17.05		
18	60	6.76	2.63	9.74	25.03	4.6	10.86	14.31	6.06	9.07	5.7	7.26	11.55		
19	60	7.84	2.54	8.40	25.91	4.92	11.32	13.38	5.81	7.76	4.23	8.48	15.56		
C a r N o.	Distance (ft)	Time (sec)		Speed (kmph)		Time (sec)		Speed (kmph)		Time (sec)		Speed (kmph)			
		At Under Construction Area	At Construction Free Area	At Under Construction Area	At Construction Free Area	At Under Construction Area	At Construction Free Area	At Under Construction Area	At Construction Free Area	At Under Construction Area	At Construction Free Area	At Under Construction Area	At Construction Free Area		
20	60	5.28	4.25	12.47	15.49	3.78	10.99	17.41	5.99	8.82	3.15	7.46	20.90		
21	60	8.13	1.99	8.10	33.08	9.26	4.7	7.11	14.00	7.03	3.7	9.36	17.79		
22	60	6.26	3.41	10.51	19.30	11.32	5.23	5.81	12.59	6.25	2.88	10.53	22.85		
23	60	4.99	2.81	13.19	23.42	10.98	6.45	5.99	10.20	9.03	2.12	7.29	31.05		
24	60	5.92	2.26	11.12	29.12	10.76	4.23	6.12	15.56	8.11	3.01	8.12	21.87		
25	60	8.74	3.89	7.53	16.92	11.46	3.65	5.74	18.03	9.56	2.76	6.88	23.85		
26	60	7.73	2.23	8.51	29.52	12.13	4.36	5.43	15.10	11.13	3.34	5.91	19.71		
27	60	6.11	2.62	10.77	25.12	11.77	4.13	5.59	15.94	8.72	2.28	7.55	28.87		
28	60	7.23	2.19	9.10	30.05	10.99	4.67	5.99	14.09	8.03	3.94	8.20	16.71		
29	60	9.21	2.11	7.15	31.19	12.87	5.02	5.11	13.11	6.73	2.96	9.78	22.24		
30	60	6.82	2.97	9.65	22.16	11.26	4.56	5.85	14.43	8.88	4.17	7.41	15.78		
31	60	5.38	3.81	12.23	17.28	11.89	4.14	5.54	15.90	7.91	3.27	8.32	20.13		
32	60	4.76	2.26	13.83	29.12	12.13	3.77	5.43	17.46	10.07	3.03	6.54	21.72		
33	60	7.47	2.17	8.81	30.33	11.1	4.7	5.93	14.00	9.11	2.8	7.23	23.51		
34	60	8.46	3.23	7.78	20.38	11.67	5.12	5.64	12.86	8.7	3.61	7.57	18.23		
35	60	8.12	1.93	8.11	34.10	10.84	4.36	6.07	15.10	8.11	2.02	8.12	32.58		
36	60	7.38	2.56	8.92	25.71	10.32	4.92	6.38	13.38	9.25	2.77	7.12	23.76		
37	60	6.17	3.7	10.67	17.79	11.07	4.15	5.95	15.86	10.62	3.15	6.20	20.90		
38	60	5.96	2.73	11.04	24.11	10.58	5.02	6.22	13.11	7.78	3.5	8.46	18.81		
39	60	6.1	3.08	10.79	21.37	13.03	4.66	5.05	14.12	9.86	4.06	6.68	16.21		
40	60	6.73	2.7	9.78	24.38	11.84	3.87	5.56	17.01	7.99	3.19	8.24	20.63		
41	60	7.92	1.78	8.31	36.98	10.91	5.6	6.03	11.75	9.56	2.7	6.88	24.38		
42	60	6.78	2.66	9.71	24.74	11.35	4.22	5.80	15.60	10.24	3.16	6.43	20.83		
43	60	8.23	3.03	8.00	21.72	11.92	3.87	5.52	17.01	8.67	2.56	7.59	25.71		
44	60	7.24	1.96	9.09	33.58	10.34	4.1	6.37	16.05	9.76	4.52	6.74	14.56		
45	60	6.01	2.51	10.95	26.22	10.92	4.52	6.03	14.56	10.65	3.48	6.18	18.91		
46	60	5.93	2.2	11.10	29.92	11.06	4.17	5.95	15.78	7.97	6.01	8.26	10.95		
47	60	6.77	2.9	9.72	22.70	11.48	3.93	5.73	16.75	12.56	3.57	5.24	18.44		
48	60	4.78	2.11	13.77	31.19	10.07	4.03	6.54	16.33	9.08	4.02	7.25	16.37		
49	60	6.25	2.86	10.53	23.01	11.62	4.72	5.66	13.94	10.61	3.11	6.20	21.16		
50	60	7.13	2.5	9.23	26.33	10.86	4.35	6.06	15.13	9.55	2.9	6.89	22.70		
<b>Total speed (kmph)</b>				<b>485.34</b>	<b>1264.99</b>					<b>477.82</b>	<b>562.51</b>			<b>362.92</b>	<b>1024.75</b>
<b>Average speed (kmph)</b>				<b>9.71</b>	<b>25.30</b>					<b>9.56</b>	<b>11.25</b>			<b>7.26</b>	<b>20.50</b>

**The Impact of MRT Line-6 Construction Work on The Environment, Road Users, and Traffic During the Construction Period**

The comparison of Average Spot Speed at under construction area and Average Spot Speed at construction free area during MRT line-6 construction in 2022 is shown in **Figure: 8** at below-

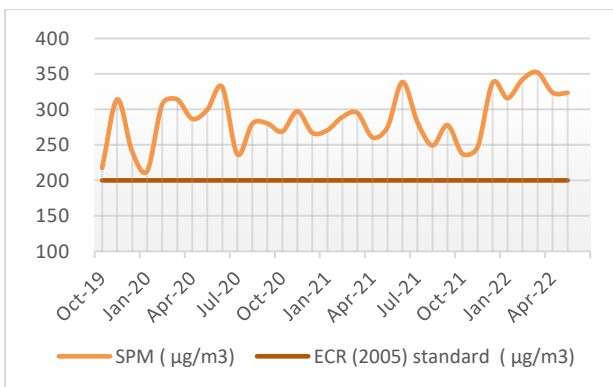


**Figure 8: Comparison of Average Spot Speed from Mirpur 12 to Farmgate**

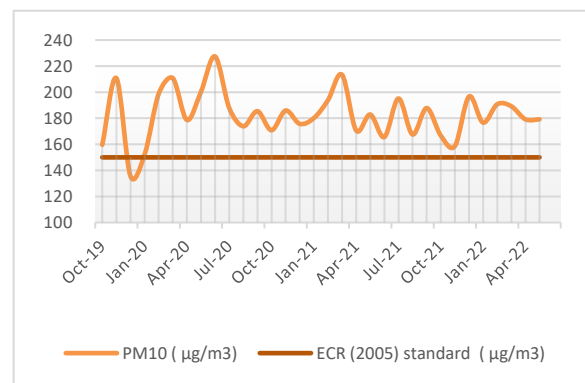
From the above figures, it is clearly visible that the average spot speed in under-construction areas of all the selected locations is very much less than the average spot speed in all the construction-free areas. The reason behind this huge difference in average vehicle spot speed is because of the fact that a significant portion of the metro rail line-6 route including the highway from Mirpur 12 to Agargaon in both directions has been blocked for metro rail construction which is responsible for narrowing of the road width. It is causing huge traffic congestion and resulting in a massive traffic jam in all the highways from Mirpur 12 to Agargaon and it is responsible for the decrease of both traffic flow and average spot speed of all the vehicles during metro rail construction in under-construction areas.

**Environmental Impact Assessment**

Comparison of Ambient Air Pollution Concentration during MRT Line-6 Construction from October 2019 to May 2022 with the Bangladesh Standards, ECR-1997, Schedule 2 (Standard for Air) is shown below in Figure: (9-14). The data was collected from the Environmental Monthly Report. Dhaka: Italian-Thai Development Public Company Limited [8].

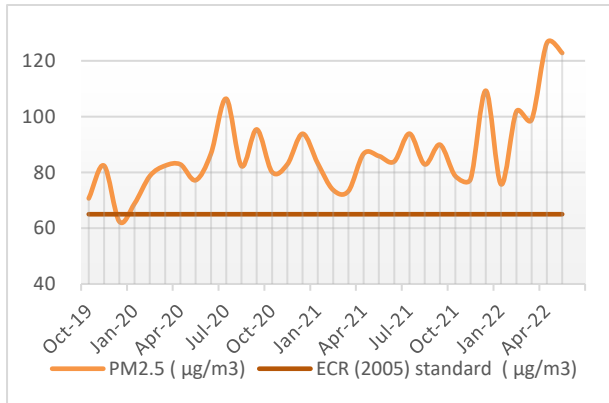


**Figure 9: Comparison of SPM (µg/m<sup>3</sup>) Concentration 2019 to May,2022**

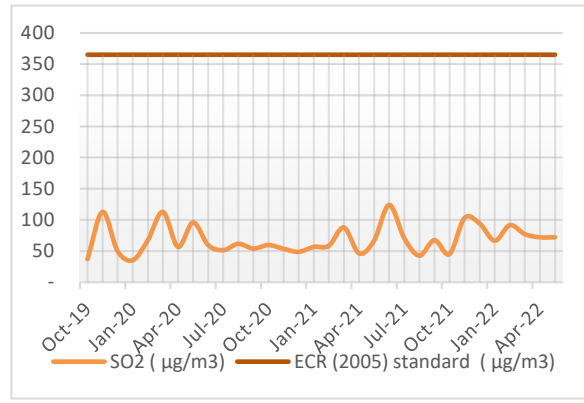


**Figure 10: Comparison of PM<sub>10</sub> (µg/m<sup>3</sup>) from Oct,2019 to May,2022**

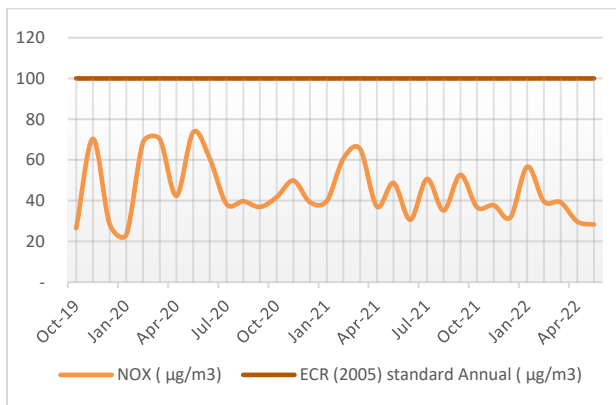
## The Impact of MRT Line-6 Construction Work on The Environment, Road Users, and Traffic During the Construction Period



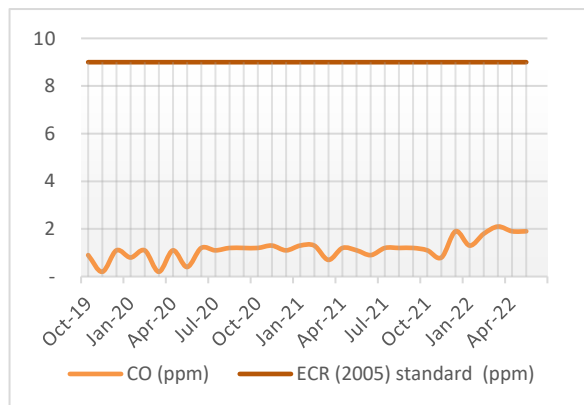
**Figure 11: Comparison of PM<sub>2.5</sub> (µg/m<sup>3</sup>) Concentration from Oct, 2019 to May,2022**



**Figure 12: Comparison of SO<sub>2</sub> (µg/m<sup>3</sup>) Concentration from Oct,2019 to May,2022**



**Figure 13: Comparison of NO<sub>x</sub> (µg/m<sup>3</sup>) Concentration from Oct, 2019 to May,2022**



**Figure 14: Comparison of CO (ppm) Concentration from Oct, 2019 to May,2022**

The EIA report shows that the air pollution concentration in metro rail areas from October 2019 to May 2022 exceeds Bangladesh Standards, with suspended particulate matter, PM<sub>10</sub>, and PM<sub>2.5</sub> exceeding the standards. Gaseous substances like CO, NO<sub>x</sub>, and SO<sub>2</sub> are below standards. This poor air quality can cause long-term health problems for road users, pedestrians, locals, workers, engineers, and construction workers. Excessive SPM, PM<sub>10</sub>, and PM<sub>2.5</sub> can cause lung damage, respiratory diseases, and irritation [8].

### **Impact of Road Blockage Due to Construction**

The construction of the Dhaka metro rail line-6 has led to significant congestion and reduced traffic flow, causing a decrease in average spot speed and working hours for road users. The construction has resulted in a narrow road, turning two-lane highways into one-lane ones, and causing slow movement of traffic. This has increased the risk of accidents and increased the number of working hours for road users. The poor condition of the highway, as depicted in attached pictures, highlights the need for urgent action to improve traffic flow and safety.

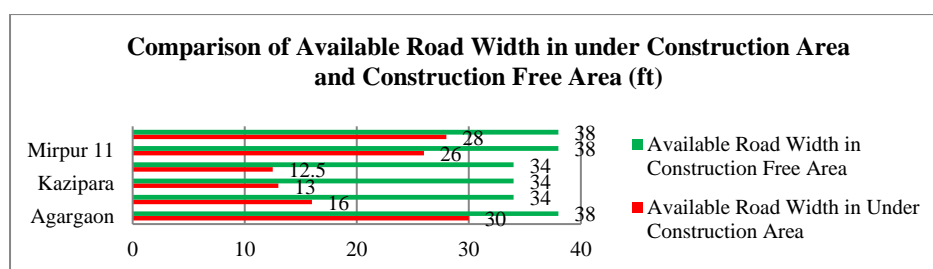


## The Impact of MRT Line-6 Construction Work on The Environment, Road Users, and Traffic During the Construction Period



**Figure 15: Road Blockage Due to MRT Line 6 Construction**

Metro rail construction has led to a decrease in road width, but the increasing number of vehicles has worsened traffic conditions and slow vehicle movement. The under-construction area has significantly less available road width than the construction-free area, as shown in **Figure 16-**



**Figure 16: Comparison of Available Road Width in under Construction Area and Construction Free Area**

### **Effect on Pedestrian Movement and Local People Due to MRT Line-6 Construction**

The construction of MRT line-6 has caused significant suffering for pedestrians and locals. After doing the field survey, the following adverse effects of the construction of MRT line-6 has been identified-

- The narrow footpaths, health hazards from waterlogging, and obstructions in the middle of the road have made daily movement difficult.
- Excavation difficulties have also affected people, businesses, and adjacent institutions.
- Local businessmen are struggling with limited day light and electric lights.
- The construction has also blocked entrances to offices, shops, and other institutions, leading to increased discomfort and financial loss for residents.
- The demolition of footbridges for metro rail track increased the risk of pedestrians passing vehicles on highways, causing increased accidents.

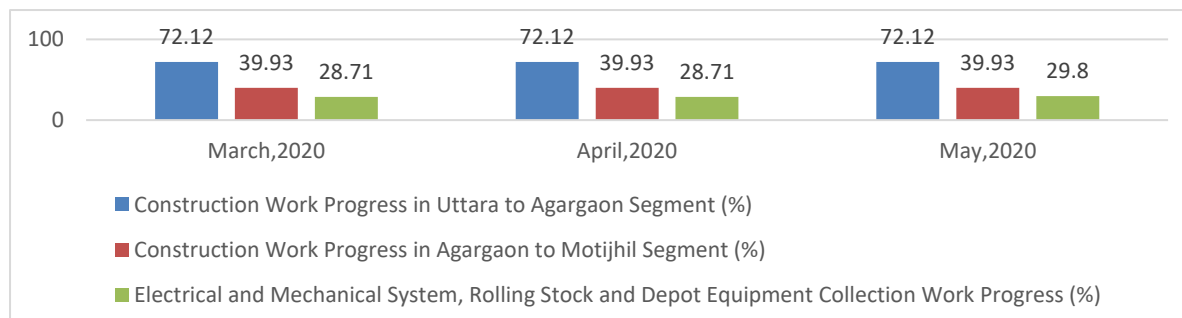


**Figure 17: Blocked and Narrowed Footpath for Pedestrian Movement Impact of COVID-19 in MRT Line-6 Construction**



## The Impact of MRT Line-6 Construction Work on The Environment, Road Users, and Traffic During the Construction Period

The MRT line-6 project in Bangladesh faced delays due to the COVID-19 outbreak, resulting in increased completion time and longer suffering for road users. The first case was confirmed on March 8, 2020, and the lockdown began on March 23, 2020, and ended on May 31, 2020. The progress of the project during the lockdown is depicted in **Figure 18**



**Figure 18: Construction Work Progress of Segments at Different Location during COVID-19 lockdown from March 2020, to May, 2020.**

The COVID-19 outbreak significantly impacted the construction work progress of MRT line-6. From March to May 2020, construction work was completely stopped due to the lockdown. The second phase of the outbreak resulted in another lockdown from July to August 2021, reducing the pace of construction work. The construction work of MRT line-6 was initially at a good pace before the outbreak, but after the outbreak, it became slow due to the infection of workers, engineers, and staff, and the division of duties into half shifts [9]

## CONCLUSIONS

The objective of this study was to perform volume study and the traffic speed study at selected locations in the route of MRT line-6 in Dhaka city. These studies were conducted in three locations. They are- Mirpur 12, Mirpur 10 and Agargaon. These studies were used to determine traffic flow rate and average vehicle spot speed at selected locations of MRT line-6 route. Also, the statistical analysis of environmental impact assessment, impact of road narrowing and blockage, effect on the pedestrians and local people and impact COVID-19 to the delay of construction and extension of sufferings of the adverse effects of metro rail construction were shown in the study.

The findings of the performed studies are provided below:

### **Traffic Volume Study**

The traffic volume study was conducted in three locations to determine the traffic flow rate. They are- Mirpur 12, Mirpur 10 and Agargaon. The obtained results from these locations are-

- The average traffic flow from Mirpur 12 to Mirpur 10 direction during the MRT line-6 construction in 2022 is found 1576 PCU/hr. The statistical analysis of this obtained data showed that the traffic flow in Mirpur 12 to Mirpur 10 direction in 2022 is 5.85% less than the traffic flow of before MRT line-6 construction.
- The average traffic flow from Mirpur 10 to Mirpur 12 direction during the MRT line-6 construction in 2022 is found 1760 PCU/hr. The statistical analysis of this obtained data showed that the traffic flow in Mirpur 10 to Mirpur 12 direction in 2022 is 5.78% less than the traffic flow of before MRT line-6 construction.
- The average traffic flow from Mirpur 10 to Agargaon direction during the MRT line-6 construction in 2022 is found 1486 PCU/hr. The statistical analysis of this obtained

## **The Impact of MRT Line-6 Construction Work on The Environment, Road Users, and Traffic During the Construction Period**

data showed that the traffic flow in Mirpur 10 to Agargaon direction in 2022 is 43.35% less than the traffic flow of before MRT line-6 construction.

- The average traffic flow from Agargaon to Mirpur 10 direction during the MRT line-6 construction in 2022 is found 1596 PCU/hr. The statistical analysis of this obtained data showed that the traffic flow in Agargaon to Mirpur 10 direction in 2022 is 35.88% less than the traffic flow of before MRT line-6 construction.
- The average traffic flow from Agargaon to Farmgate direction during the MRT line-6 construction in 2022 is found 2102 PCU/hr. The statistical analysis of this obtained data showed that the traffic flow in Agargaon to Farmgate direction in 2022 is 25.00% less than the traffic flow of before MRT line-6 construction.
- The average traffic flow from Farmgate to Agargaon direction during the MRT line-6 construction in 2022 is found 1943 PCU/hr. The statistical analysis of this obtained data showed that the traffic flow in Agargaon to Mirpur 10 direction in 2022 is 19.34% less than the average traffic flow of before MRT line-6 construction.
- The statistical analysis of this obtained data showed that the average overall traffic flow is 22.54% less than the traffic flow of before MRT line-6 construction.

### ***Traffic Speed Study***

The speed study was also conducted in three locations to determine the average spot speed of the vehicle. They are- Mirpur 12, Mirpur 10 and Agargaon. The obtained results from these locations are-

- From Mirpur 12 to Mirpur 10 direction, the average spot speed at under construction area is found 9.71 kmph and the average spot speed at construction free area is found 25.30 kmph in 2022.
- From Mirpur 10 to Agargaon direction, the average spot speed at under construction area is found 9.56 kmph and the average spot speed at construction free area is found 11.25 kmph in 2022.
- From Agargaon to Farmgate direction, the average spot speed at under construction area is found 7.26 kmph and the average spot speed at construction free area is found 20.50 kmph in 2022.

### **Environmental Impact Assessment at under Construction Locations**

By analyzing of the monthly EIA reports from October,2019 to May,2022, the statistical analysis of the comparison of ambient air pollution concentration during MRT line-6 construction with the Bangladesh Standards, ECR, Schedule 2 (Standard for Air), it has been found that the amount of suspended particulate matter (SPM), PM<sub>10</sub> and PM<sub>2.5</sub> is higher than the value of Bangladesh Standards, ECR-1997, schedule-2 (Standards for Air) and the concentration of gaseous substances like CO, NO<sub>x</sub> and SO<sub>2</sub> are found below-standards in both monitoring locations in almost every month from October,2019 to May, 2022.

### **Impact of Road Blockage due to MRT Line-6 Construction**

By the statistical analysis of the obtained data, the available road width at under construction area is found to be very much less than the available road width at construction free area because of the blockage in roads due to MRT line-6 construction. It is one of the main reasons behind traffic congestion at under construction sites. The result of the statistical analysis of the available road width at under construction area and the construction free area shows that-



## The Impact of MRT Line-6 Construction Work on The Environment, Road Users, and Traffic During the Construction Period

- In Mirpur 12, the available road width at under construction area is found 28 ft which is very much less than the obtained available road width at construction free area 38 ft.
- In Mirpur 11, the available road width at under construction area is found 26 ft which is very much less than the obtained available road width at construction free area 38 ft.
- In Mirpur 10, the available road width at under construction area is found 12.5 ft which is very much less than the obtained available road width at construction free area 34 ft.
- In Kazipara, the available road width at under construction area is found 13 ft which is very much less than the obtained available road width at construction free area 34 ft.
- In Shewrapara, the available road width at under construction area is found 16 ft which is very much less than the obtained available road width at construction free area 34 ft.
- In Agargaon, the available road width at under construction area is found 30 ft which is very much less than the obtained available road width at construction free area 38 ft.

### Effect on Pedestrian Movement and Local People due to MRT Line-6 Construction

From the field survey, it has been found that the footpath has been blocked in a fair margin due to the MRT line-6 construction and the pedestrians and the local people are having a lot of problem in daily their movement. The local businessmen are facing losses and also adverse health impact on both pedestrians and these local people are visible due to the construction.

### Impact of COVID-19 in MRT Line-6 Construction

From the statistical analysis of MRT line-6 construction during COVID-19 pandemic, it has been found that the progress of MRT line-6's construction was slowed down by the COVID-19 epidemic. For a very long time, the pace of construction activity was exceedingly slow. As a result, it took longer to complete the entire project. As a result, the road users suffered for a longer period due to the project's delayed completion.

### Recommendations

- After data collection and data analysis, a lot of problems were identified. Some recommendations based on those identified problems are discussed below:
- This study will create awareness for the upcoming construction projects of all the MRT lines considering the big traffic issue, environmental concern as well as health concern and sufferings of the pedestrians and local people.
- Temporary alternative effective routes for the vehicles to pass through and alternative ways of pedestrian movement should be provided during the construction.

## REFERENCES

- [1] Wikipedia contributors. (2022, September 16). Dhaka Metro Rail - Wikipedia. Retrieved from [https://en.wikipedia.org/wiki/Dhaka\\_Metro\\_Rail](https://en.wikipedia.org/wiki/Dhaka_Metro_Rail)
- [2] Report of Dhaka Mass Transit Company Limited (DMTCL, 2019-2022). Retrieved September 15, 2022, from <https://dmtcl.gov.bd>
- [3] Kokusai Kyōryoku Kikō. (2011). *JICA Annual Report*. Japan International Cooperation Agency
- [4] Ahmed, A., Parvin, R., & Hasanath, A. (2019). Metro Rail Construction And Its Effects On Road Users. *World Journal of Science and Engineering (WJSE)* 4 2019, 51-57.

## The Impact of MRT Line-6 Construction Work on The Environment, Road Users, and Traffic During the Construction Period

- [5] Bhutani, R., Ram, S., & Ravinder, K. (2016). Impact of metro rail construction work zone on traffic environment. *Transportation Research Procedia*, 17, 586-595.
- [6] Geometric Design Standard Manual for Roads and Highway Department of Bangladesh (RHD, 2005). <https://www.rhd.gov.bd>. Retrieved from [https://www.rhd.gov.bd/Documents/StandardManual/Geometric\\_Design\\_Standard\\_Manual\\_Revised\\_2005.pdf](https://www.rhd.gov.bd/Documents/StandardManual/Geometric_Design_Standard_Manual_Revised_2005.pdf)
- [7] Gupta, P., & Apte, M., (2017). Importance of Traffic Management during Execution of Metro Rail. *IJSRD - International Journal for Scientific Research & Development* | Vol. 5, Issue 10, 2017 | ISSN (online): 2321-0613
- [8] Dhaka: Italian-Thai Development Public Company Limited. *Environmental monthly report*. Retrieved from [https://dmtcl.portal.gov.bd/sites/default/files/files/dmtcl.portal.gov.bd/page/49fc464a\\_d253\\_4590\\_9655\\_637c9873bd97/2021-08-11-06-0925f996d9cd1bb00ef667f516aa1314a9.pdf](https://dmtcl.portal.gov.bd/sites/default/files/files/dmtcl.portal.gov.bd/page/49fc464a_d253_4590_9655_637c9873bd97/2021-08-11-06-0925f996d9cd1bb00ef667f516aa1314a9.pdf)
- [9] Noman, M. (2020, July 4). Launch of metro rail likely to be delayed. *The Business Standard*. Retrieved from <https://www.tbsnews.net>

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### ***Conflict of Interest***

The author(s) declared no conflict of interest.

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