MANTECH Publications
Journal of Remote Sensing, Environmental Science & Geotechnical Engineering
Volume 7, Issue 1, January-April, 2022

Observation on Environmental Impact due to the Dhaka MRT Line 6 Project

Arafat Chowdhury[1] , MD. Musfikuzzaman[2], MD. Rahat Hasan Talukdar[3], Shafiqul Islam [4]

Undergraduate Students[1, 2, 3], Assistant Professor[4]

Department of Civil Engineering

Ahsanullah University of Science & Technology, 141 & 142, Love Road,

Tejgaon Industrial Area, Dhaka, Bangladesh

Corresponding Authors' E-mail: *arafatchowdhury51@gmail.com*

Abstract

The construction industry is one of the most promising industries, with the ability to have a substantial impact on the economy of any nation. This is an investment-driven sector, with the government showing a keen interest in megastructure projects particularly. Due to the long-term construction period and the advancement of construction technology, this construction sector has a crucial impact on our environment. The main types of pollution that need to be aware of are our air, water, and noise. Precautionary procedures should be put in place to handle hazardous waste, which may have a direct impact on on-site workers and others who live in the immediate area. These pollutants may cause substantial harm to their health. Dhaka Mass Rapid Transit (DMRT) is such kind of megaproject developed by the Dhaka Mass Transit Company (DMTC) in Dhaka, Bangladesh. This project will significantly affect the overall GDP and the total tax revenue in our country. For the project, a total of five lines (MRT Lines 1, 2, 4, 5, and 6) have been proposed, and MRT Line-6 is the project's first authorized line. This (MRT Line-6) project has an enormous impact on the environment. As this project contributes radically to our economy, it is obvious to identify the environmental concerns associated with it and analyze the effect on the environment. This research analyzes two significant environmental impacts, air and noise pollution, during the construction phase of MRT Line-6, which are discussed precisely. To explore

Page 13-27 © MANTECH PUBLICATIONS 2022. All Rights Reserved

the impact, the required data is taken from the monthly EIA report of Line-6, and the effect is then analyzed according to the project standard limit.

Keywords: *EIA, Environmental Impact, Air and noise pollution, MRT Line 6, DMRT*

INTRODUCTION

The Dhaka Mass Rapid Transit Line 6 (Dhaka MRT Line 6) is the country's first METRO project and is currently under construction. It begins in Uttara III and continues via Pallabi, Mirpur 10, Khamarbari, Farmgate, Shahbagh, TSC, Doel Chattar, Press Club, and concludes at the Bangladesh Bank in the heart of Dhaka's city centre. This 20.1-kilometre-long urban railway line comprises an elevated portion, 16 stations, and a depot at Uttara (Imai et al., 2020). The MRT project construction activities generate Particulate Matter, PM10 and PM2.5 (mostly dust) that can become entrained in the air depending on prevailing site and meteorological conditions. These Particulate Matters pollute the surrounding area and are very dangerous for human health. The problem is made worse during the dry season. Mud and particulates from trucks may be deposited along main transport corridors and in residential neighbourhoods where construction trucks are routed, either from uncovered loads or by shedding from the undercarriage. Particulate MatterMatter, if uncontrolled, is bothersome to pedestrians and people passing in open vehicles; small diameter particulates contribute to respiratory disease. The MRT operation generates noise and vibration. Severe noise is generated by heavy types of machinery and transportation of equipment produce, materials handling equipment, pile driving, etc., during the construction period. Construction activities used to develop sites and construct the project include land preparation, soil stabilization, piling installation, construction of viaduct foundations and piers, erection of precast viaduct sections, and construction of stations and overpass structures. These activities will contribute to noise levels along the project corridor (Slidelegend, 2017). Since this project will significantly impact our economy, it is evident that environmental pollution related to it should be identified and addressed effectively. By surveying the monthly Environmental Impact Assessment (EIA) report, the required data of different pollutants are found the project authority

Page 13-27 © MANTECH PUBLICATIONS 2022. All Rights Reserved

generates that. The pollution level is then determined by comparing those data with the project standard limit of The Environment Conservation Rules, 1997 (ECR,1997). As this project has a massive contribution to our economy, this study presents various mitigation measures taken to overcome these challenges. Finally, other alternatives and economical methods are also suggested in the conclusion.

AMBIENT AIR QUALITY MEASURING METHOD

Ambient air quality is being monitored to assess the breathable air quality in and around the project site. The location and number of monitoring sites depend on the extent of ongoing works and the probable presence or appearance of receptors. A modern deployable air quality monitoring machine, i.e., AQM-09, has been used to measure different parameters of air quality, such as PM2.5, PM10, SPM, SO2, NOx, and CO. The test sample of the air in the atmosphere is pumped to the sensor assembly with a precision flow-controlled membrane pump. The sensor measurement module is based on Gustav Mie particle light scattering theory and combined with Micro-Photoelectric detection technology to produce a complete set of air particle distribution concentration measurement systems.



Figure 1 AQM – 09 Machine

Page 13-27 © MANTECH PUBLICATIONS 2022. All Rights Reserved

SAMPLING LOCATION OF AIR QUALITY

Four samples of air were collected from Bijoy Sarani Station, Kawranbazar Station, Pallabi Station & Shewrapara Station.



(a)



(b)

Figure 2. Air Quality Monitoring Locations (a) Pallabi Station & (b) Shewrapara Station.

Page 13-27 © MANTECH PUBLICATIONS 2022. All Rights Reserved

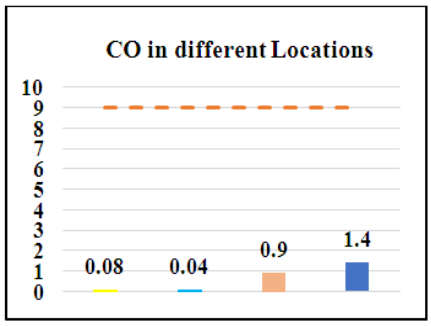
AQI MONITORING RESULT

The Ambient Air Quality Results of the four stations - Bijoy Sarani Station, Kawranbazar Station, Pallabi Station and Shewrapara Station are shown below:

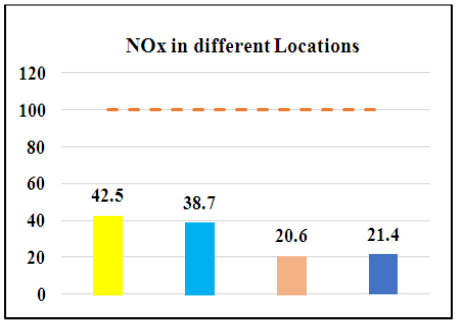
Table - 1: Test Results of the Air Quality (Dhaka MRT Company Limited)

Location		Ambient Air Pollution Concentration					
	Parameters	CO	NOx	PM10	PM2.5	SPM	SO2
	Date / Unit	(ppm)	(µg/m3)	(µg/m3)	(µg/m3)	(µg/m3)	(µg/m3)
Bijoy Sarani Station	04/05/2021	0.08	42.5	73.1	168	178.8	81.22
Kawranbazar Station	04/05/2021	0.04	38.7	98.4	134.8	189.6	120.3
Pallabi Station	09/06/2021	0.9	20.6	235.6	183.9	438.6	124.1
Shewrapara Station	10/06/2021	1.4	21.4	278.2	197.8	506.9	137.5
Duration (hr.)		8	24	24	24	8	24
ECR,1997 and amendment in 2005 standard		9	100 (Annual)	150	65	200	365

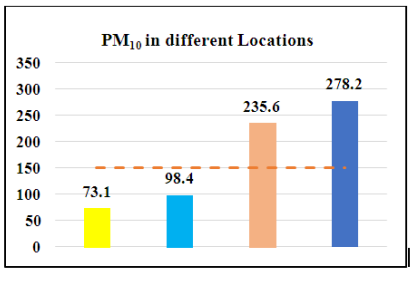
CO (ppm)



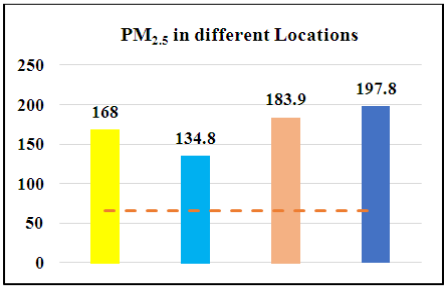
NOx (µg/m3)



PM_{10} (µg/m3)



$PM_{2.5}$ (µg/m3)



Page 13-27 © MANTECH PUBLICATIONS 2022. All Rights Reserved

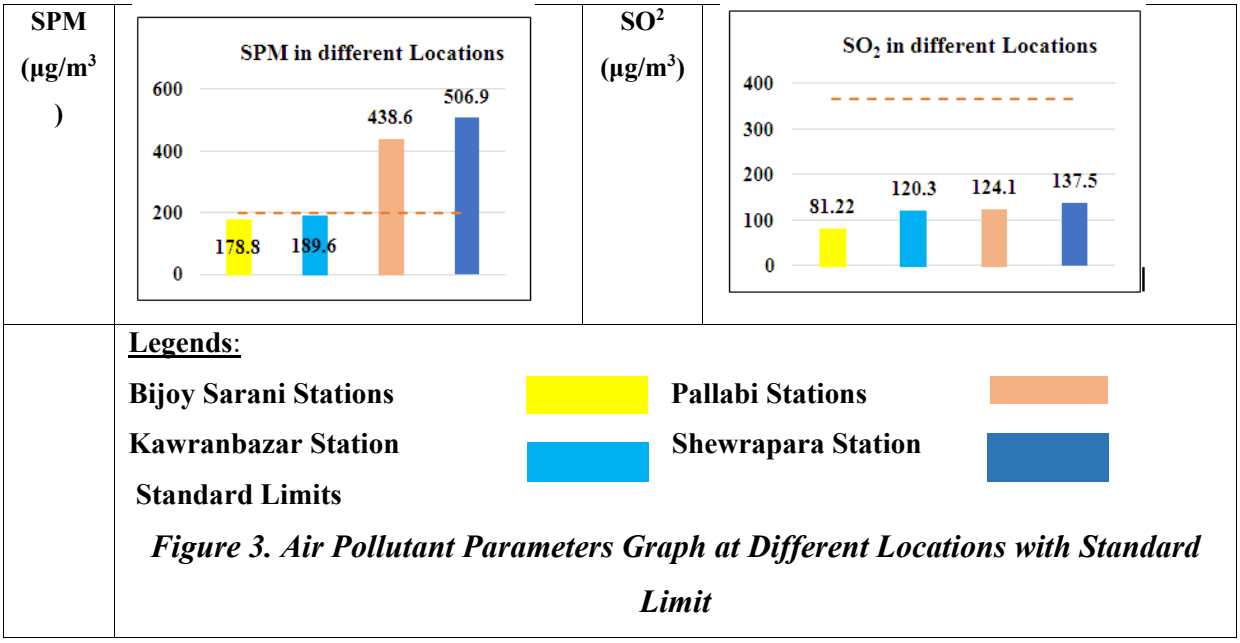


Figure 3. Air Pollutant Parameters Graph at Different Locations with Standard Limit

AQI RESULT ANALYSIS

The results show that the concentration of PM2.5 was found higher than standard limits in all the stations. PM10 and SPM were found higher than standard limits in both Pallabi and Shewrapara stations during monitoring, likely due to the dry weather and high traffic volumes. The concentration of gases like CO, NOx, and SO2 was found below standard in all monitoring locations.

The most threatening station is Shewrapara station because it exceeds the standard limit of Particulate Matter at a very high expanded range. In the perspective of PM10, it goes up to almost 278.2; in PM2.5, it goes through 197.8 and in SPM value, it reaches. 506.9, which is a significant threat for the people around this station. Several important buildings surround each station.

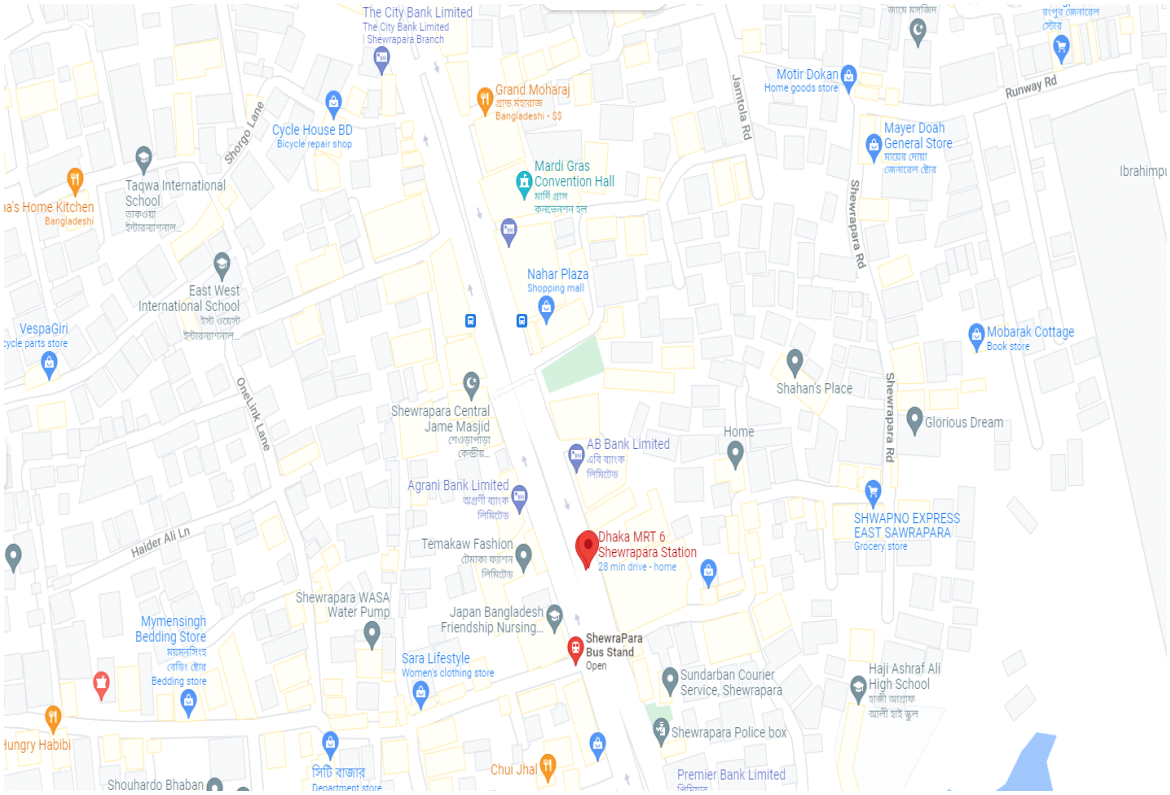
The (Figure-4) map shows that numerous schools, workplaces, and retail complexes are situated near each station. Some local clinics and hospitals are not well-known but may have a large number of patients admitted who are sensitive to these harmful solid particulate MatterMatter. There are numerous underage children in schools, and they are also at risk as a result of air pollution. Because children breathe quicker than adults, and so absorb more contaminants, they are more vulnerable to the effects of air pollution. They also remain closer to the ground, where some toxins are most concentrated, at a time when their brains and bodies are still growing.

Page 13-27 © MANTECH PUBLICATIONS 2022. All Rights Reserved

Children are more likely to be at risk for a variety of reasons, including the fact that their lungs are still developing, they spend more time outside participating in physical activities, and they are more likely to have asthma or acute respiratory diseases, which can be exacerbated by high particle levels (Particle Pollution and Your Health, 2010).

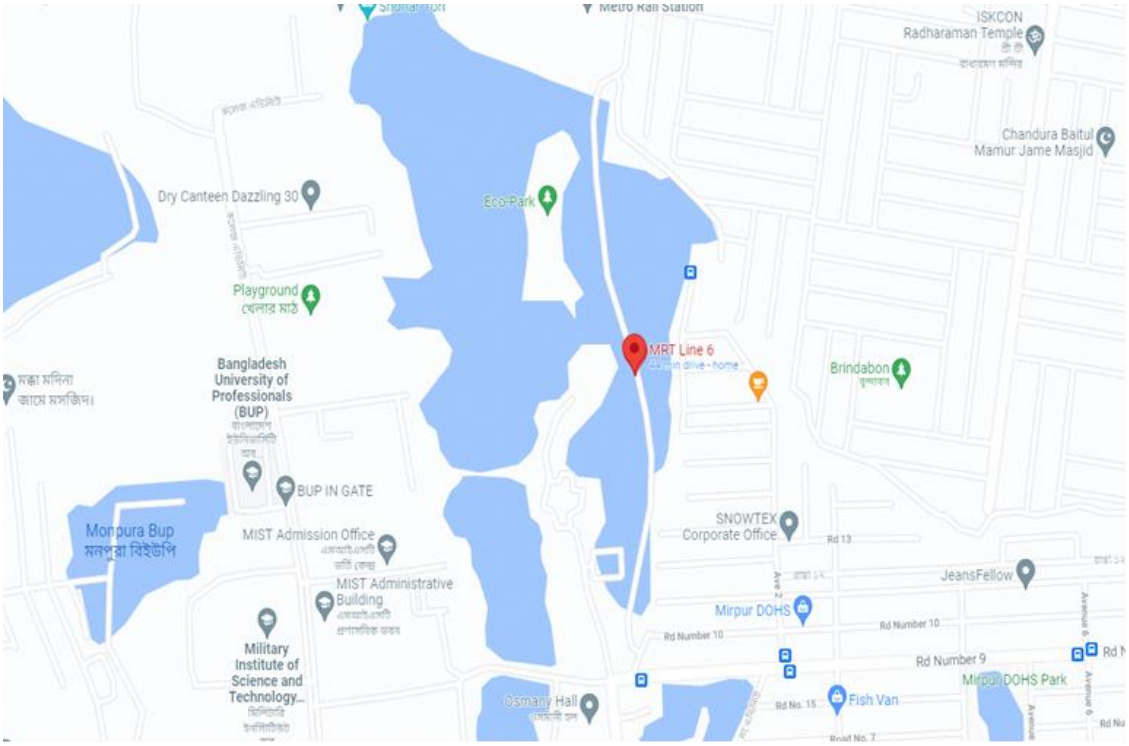
Furthermore, these areas are often congested, and the individuals who live near this station must move about while breathing in these toxins and particulate MatterMatter on a daily basis. As a result, they are at high risk of health consequences and numerous illnesses (O'Brien & Wilder, 2013). Short-term particle exposure (hours or days) may worsen lung illness, produce asthma episodes and acute bronchitis, and increase susceptibility to respiratory infections.

Short-term exposures have been associated with heart attacks in patients with heart disease. People who have heart or lung problems, such as coronary artery disease, congestive heart failure, asthma, or chronic obstructive pulmonary disease (COPD), are more vulnerable since particles may worsen these conditions (Science Daily, 2017).

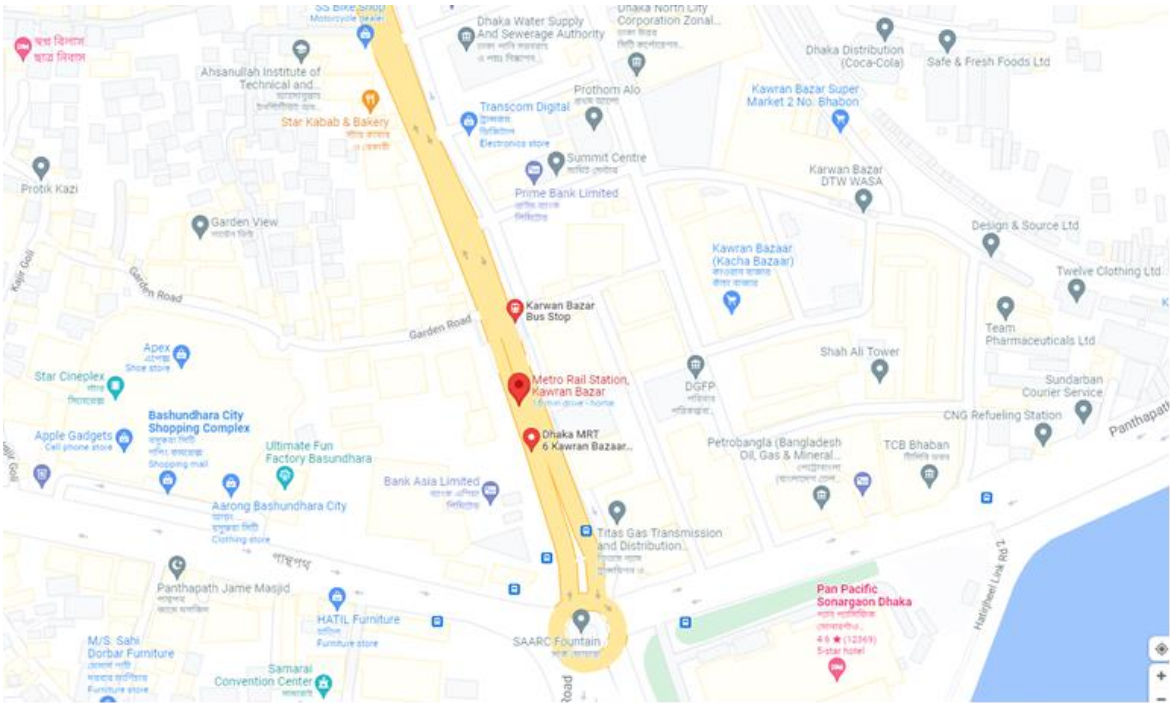


(a)

Page 13-27 © MANTECH PUBLICATIONS 2022. All Rights Reserved

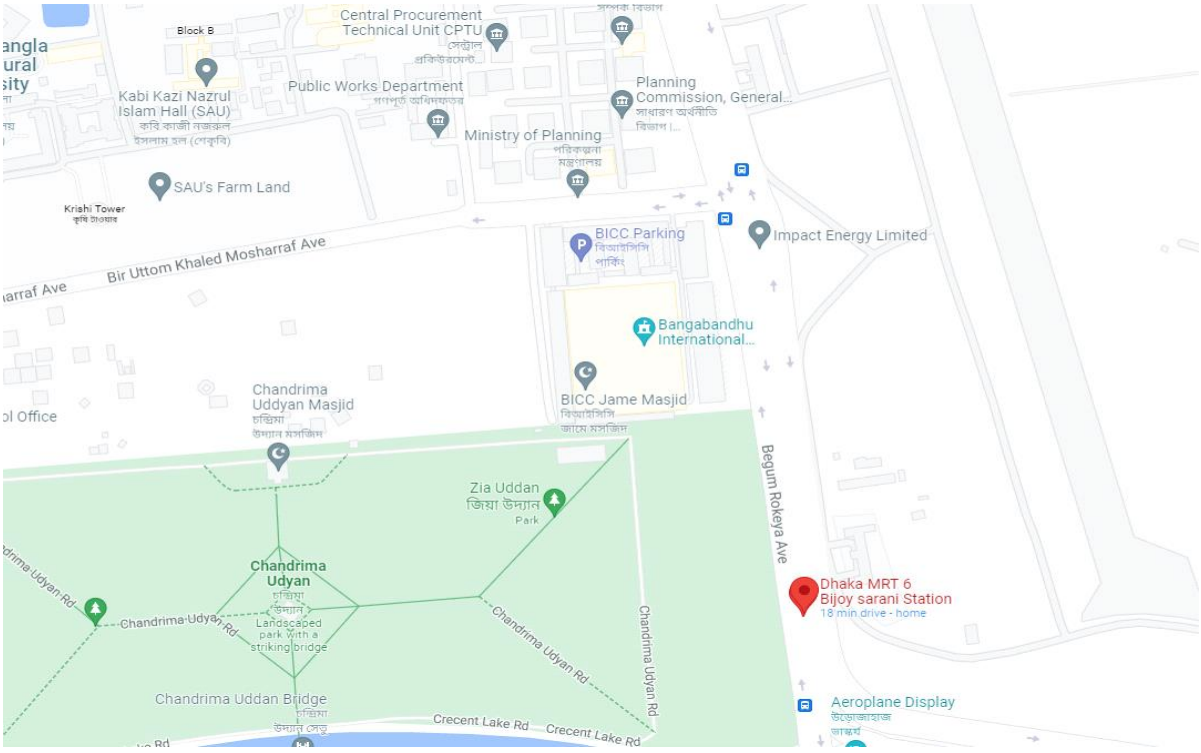


(b)



(c)

Page 13-27 © MANTECH PUBLICATIONS 2022. All Rights Reserved



(d)

Figure 4. Significant infrastructures around the ambient air quality monitoring locations (a) Shewrapara Station, (b) Pallabi Station, (c) Kawranbazar Station & (d) Bijoy Sarani Station

NOISE LEVEL MONITORING METHOD

Many methods were taken to monitor the noise level at the project site. To begin, the monitoring locations have been chosen throughout the project. A nearby sensitive receptor placement was also considered when selecting a monitoring location. Second, the noise level was measured using a portable data logger/noise level recorder equipment for one hour. By averaging the readings per second, the device captures one reading per minute. The cumulative noise level was then estimated using the Leq10 min method from sixty readings collected for an hour of device operation.

A standard in Bangladesh does not regulate construction noise; target noise limits for construction depend on ambient noise conditions and standards used in other countries. Therefore, target noise limits are set for construction as the Japanese standard limit (85 dBA). Finally, the aggregate result was compared to the project standard of 85 dBA to determine the project's noise impact.

Page 13-27 © MANTECH PUBLICATIONS 2022. All Rights Reserved

SAMPLING LOCATION OF NOISE LEVEL

The noise level was measured in eight different locations. The monitoring locations are Bijoy Sarani Station, Farmgate Station, Karwanbazar Station, Agargaon Station, Mirpur 10 Station, Shewrapara Station, Uttara South station, and Uttara North station.

During monitoring, platform slab work such as construction and formwork removal, steel roof work, architectural work such as brickwork, plastering, painting, pump room work, and MEP work were all in progress. During noise level monitoring, concourse slab building work was ongoing at Shewrapara station, Agargaon station, and Mirpur 10 station.

NOISE LEVEL MONITORING RESULT

Noise level monitoring results of eight stations – Bijoy Sarani Station, Farmgate Station, Karwanbazar Station, Agargaon station, Mirpur 10 Station, Shewrapara station, Uttara south station, and Uttara north station also have been shown below.



Pictures of noise level monitoring at shewrapara station.

Figure 5. Noise Monitoring at Shewrapara station

Page 13-27 © MANTECH PUBLICATIONS 2022. All Rights Reserved

NOISE LEVEL RESULT IN ANALYSIS

From the above table, it is observed that the noise level was within the project standard. But in most cases, ambient noise levels along the MRT corridor (see Figure-18) already exceed these values according to the standard limit (70 dBA) of the World Health Organization (WHO). The most crucial location is stated at Uttara North Station, where the sound level reaches up to almost 83 dBA, which is almost near to the project standard. The World Health Organization (WHO) defines noise above 65 decibels (dB) as noise pollution. To be precise, noise becomes harmful when it exceeds 75 decibels (dB) and is painful above 120 dB.

As a consequence, it is recommended noise levels be kept below 65 dB during the day and indicates that restful sleep is impossible with nighttime ambient noise levels over 30 dB (Noise pollution: how to reduce the impact of an invisible threat?, 2022)..So the people around the monitoring station are affected by noise pollution continuously due to the construction noise.

Table - 2: The summary result of in-house noise level monitoring

Date	Starting Time (1 hour)	Location	Max Leq10min (dBA)	Project Standard (dBA)	WHO Standard (dBA)	Remarks
4/5/2021	9:30 AM	Bijoy Sarani Station	78.1	85	70	Within limit
4/5/2021	11:45 AM	Farmgate Station	68.5	85	70	Within limit
4/5/2021	2:50 PM	Karwanbazar Station	80.7	85	70	Within limit
10/6/2021	9:00 AM	Agargaon Station	75.86	85	70	Within limit
10/6/2021	10:30 AM	Mirpur 10 Station	79.13	85	70	Within limit
10/6/2021	2:30 PM	Shewrapara Station	83.58	85	70	Within limit
10/6/2021	1:45 PM	Uttara South station	77.53	85	70	Within limit
10/6/2021	3:20 PM	Uttara North Station	82.59	85	70	Within limit

Page 13-27 © MANTECH PUBLICATIONS 2022. All Rights Reserved

There are many important structures located at every station and the people staying there are in great danger due to this extreme noise. WHO says that long-term or excessive noise exposure has been linked to a variety of health issues, including stress, poor concentration, lost productivity at work, communication difficulties, and fatigue from a lack of sleep, as well as more serious issues like cardiovascular disease, cognitive impairment, tinnitus, and hearing loss. As well as damaging our hearing by causing tinnitus or deafness, constant loud noise can damage human health in many ways, particularly in the very young and the very old (Bambhaniya, 2022).

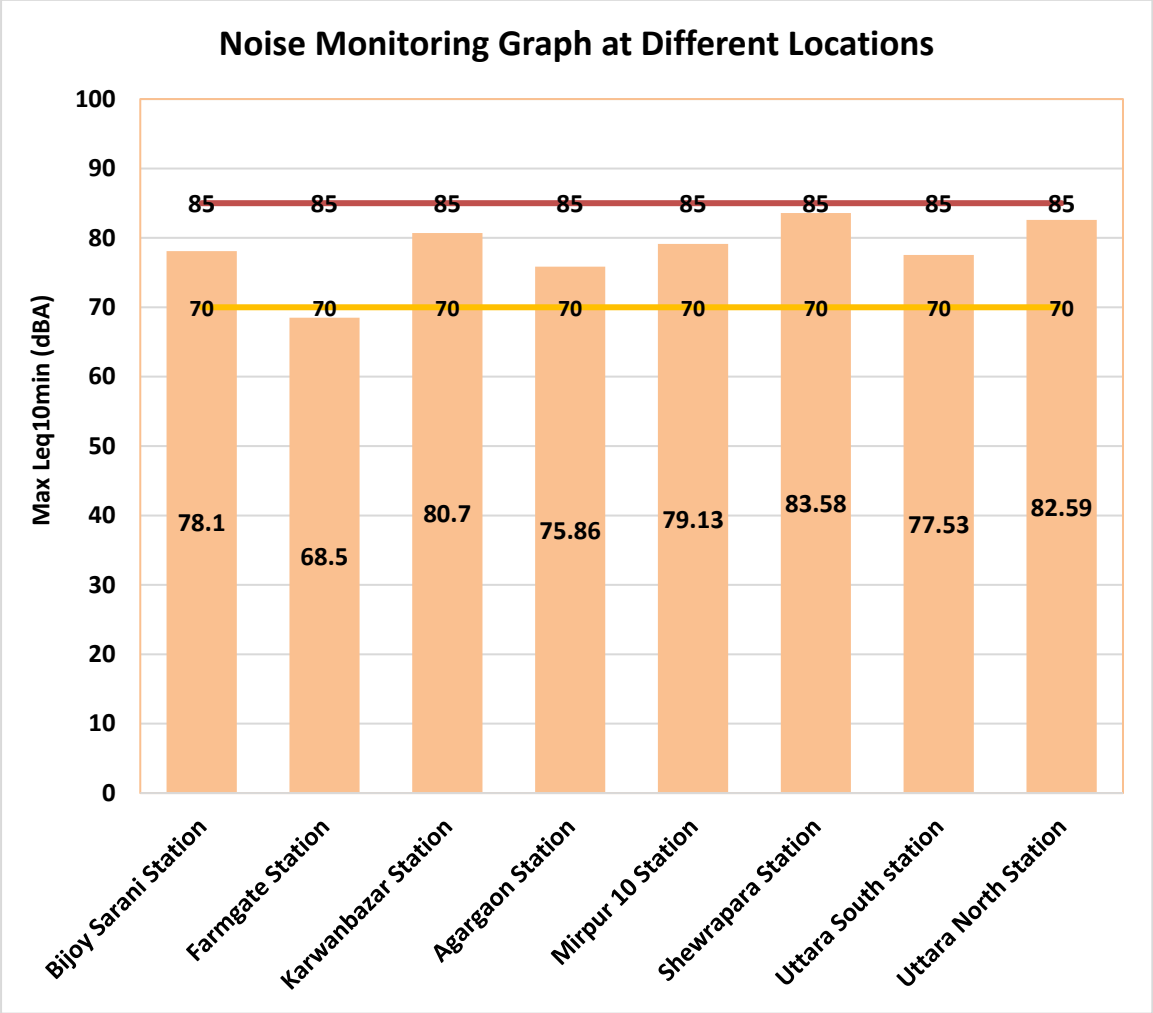


Figure 6. Noise Level Monitoring Graph at Different Locations with Standard Limit

Page 13-27 © MANTECH PUBLICATIONS 2022. All Rights Reserved

CONCLUSION

The comprehensive data of Particulate Matter (PM) is collected from Bijoy Sarani, Kawranbazar, Pallabi and Shewrapara station, and this resultant data is concluded below:

a) At Pallabi station, PM10 data is assessed 235.6, and at Shewrapara station, it is 278.2. So these data exceed the standard limit of ECR,1997 (which is 150) by successively 1.58 times and 1.85 times.

b) At Bijay Sarani, Kawranbazar, Pallabi and Shewrapara station, the PM2.5 resultant data is figured out respectively 168, 134.8, 183.9 and 197.8. These data also surpass the standard limit of ECR,1997 (which is 65) by successively 2.58, 2.07, 2.82 and 3.04 times, which means almost 2 to 3 times which is a considerable amount of fluctuation.

c) Again at Pallabi and Shewrapara station, the aftermath data of SPM(Solid Particulate Matter) is found subsequently 438.6 and 506.9. These findings also outstrip the standard limit of ECR,1997 (which is 200) by correspondingly 2.193 times and 2.534 times which is also a pretty much variation.

RECOMMENDATION

To control the dust manually, water sprinkle method was applied regularly on time to time basis. But it is seen that the emission of particulate MatterMatter from the construction site exceeds the standard parameters according to ECR,1997.

So several effective techniques also could be applied to minimize dust emission, and these are discussed below:

(a) Mulch and Vegetation:

Mulching is one of the most frequent agricultural tactics, and it is also an 80 percent success rate on construction projects. As the most outstanding alternative to water, this' green' technique may help prevent soil erosion and maintain loose soil. (Sigma Test & Research Centre, 2021)

(b) Dumping sand and other material:

Construction sand dumped in the air can significantly contribute to dust dispersion. As a result, whether loading or unloading, such items should be kept close to the ground or in the back of the vehicle. (Sigma Test & Research Centre, 2021)

(c) Tackifiers and Soil Stabilizers:

This dust-control method can build a fiber-to-seed-to-soil connection (without hardening), minimizing the need for

Page 13-27 © MANTECH PUBLICATIONS 2022. All Rights Reserved

reseeding and soil erosion. The polymer material absorbs water during a wetting event, enabling the tackifier to return to the solution. After curing, a new seal forms over the soil, effectively eliminating the dust control problem on construction sites.

(d) Polymers as Dust Control:

After putting a polymer on the top of the soil, spray water to create a seal over the loose dirt. On the other hand, this fundamental method works well on low-traffic sites. (Sigma Test & Research Centre, 2021)

REFERENCES

1. Bambhaniya, H. (2022). What Is Noise Pollution?- Sources, And Effect. Retrieved from www.engineeringchoice.com: https://www.engineeringchoice.com/noise-pollution/

2. European Respiratory Society (ERS). (2017, September 21). Treating asthma or COPD with a steroid inhaler increases the risk of hard-to-treat infections. ScienceDaily. Retrieved February 16, 2022, from www.sciencedaily.com/releases/2017/09/170921095513.htm

3. Imai, Y., Kuriki, M., Okuda, M. & Muhammad, S., 2020. Observation on consolidation settlement of ground improved by Sand compaction pile and Prefabricated vertical drain applied to Dhaka MRT Line 6. In: P. D. Long & N. T. Dung, eds. Geotechnics for Sustainable Infrastructure Development. Gateway East, Singapore: Springer, pp. 605-610.

4. Noise pollution: how to reduce the impact of an invisible threat? (2022). Retrieved from www.iberdrola.com: https://www.iberdrola.com/sustainability/what-is-noise-pollution-causes-effects-solutions

5. O'Brien, J., & Wilder, G. (2013). Report from the Legislative Work Group on. Particle Pollution and Your Health. (2010). Retrieved from National Service Center for Environmental Publications (NSCEP): https://www.sciencedaily.com/releases/2017/09/170921095513.html

6. Position Paper: Ambient Air Pollution by Particulate Matter. (1997, April 8). Retrieved from

Page 13-27 © MANTECH PUBLICATIONS 2022. All Rights Reserved

slidelegend.com:
https://slidelegend.com/position-paper-ambient-air-pollution-by-particulate-matter-european-_59edce3a1723ddfb5b804928.html

Page 13-27 © MANTECH PUBLICATIONS 2022. All Rights Reserved