

# Environmental Impact Assessment

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Project No. 47279-002  
May 2018

## PAK: Karachi Bus Rapid Transit Project

### Appendix I

Prepared by the Transport and Mass Transit Department, Government of Sindh, for the Asian Development Bank.

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# Appendix-I Ambient Air, Noise, Vibration and Drinking water Quality Monitoring Report 2018

Ref: 10405-ES-023



**REPORT ON**

**AMBIENT AIR QUALITY AND NOISE LEVEL**

**MONITORING**

**ALONG**

**BRT RED LINE CORRIDOR, KARACHI**

**(JAN-FEB 2018)**

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**AMBIENT AIR QUALITY AND NOISE LEVEL MONITORING ALONG BRT RED LINE CORRIDOR, KARACHI**

## **DISCLAIMER**

This report containing 72 pages is produced in compliance with the request of M/s MM Pakistan (Pvt.) Ltd. for ascertaining ambient air quality at six (06) sites for 24 hour, vibration monitoring at eight (08) sites, noise level monitoring at twenty five (25) sites and drinking water quality at three (03) sites along BRT-Red Line Corridor in Karachi. The report is prepared for sole and specific use of M/s MMP (Pvt.) Ltd. Therefore, it cannot be used in court of law for any negotiation or standardization. The information contained in this report has been verified by SUPARCO experts and any changes made hereafter would not be the SUPARCO's responsibility.

**AMBIENT AIR QUALITY AND NOISE LEVEL MONITORING ALONG BRT RED LINE CORRIDOR, KARACHI**

**List of Abbreviations**

$\mu\text{g}/\text{m}^3$	Microgram per cubic meter
BRT	Bus Rapid Transit
CO	Carbon Monoxide
dB	Decibel
Leq	Equivalent Continuous Noise Level
$\text{mg}/\text{m}^3$	Miligram per cubic meter
MMP	Mott Macdonald Pakistan
ND	Not Detected
NO <sub>x</sub>	Oxides of Nitrogen
O <sub>3</sub>	Surface Ozone
PM <sub>10</sub>	Particulate Matter less than or equal to 10 micron
PM <sub>2.5</sub>	Particulate Matter less than or equal to 2.5 micron
SEQS	Sindh Environmental Quality Standards
Sindh EPA	Sindh Environmental Protection Agency
SO <sub>2</sub>	Sulphur Dioxide
SPM	Suspended Particulate Matter
SSDWQ	Sindh Standards for Drinking Water Quality
SUPARCO	Pakistan Space & Upper Atmosphere Research Commission
TSP	Total Suspended Particulates
US EPA	Environmental Protection Agency of USA
WHO	World Health Organization

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## **I**NTRODUCTION

### **1.1 BACKGROUND**

M/s MM Pakistan awarded the contract to Pakistan Space and Upper Atmospheric Research Commission (SUPACO) to conduct environmental monitoring at various sites alongside BRT Red Line Corridor in Karachi. In this regard, ambient air monitoring was conducted at six (06) sites. Noise Level Measurement at Twenty Five (25) sites, and Vibration Measurement/Testing at eight (08) locations were also conducted.

Three (03) drinking water samples were also collected.

### **1.2 OBJECTIVES**

The main objective of this study was to conduct environmental monitoring along BRT Red Line Corridor, Karachi to ascertain the existing environmental conditions in and around the BRT Red Line Corridor in Karachi.

**AMBIENT AIR, NOISE AND WATER QUALITY MONITORING ALONG BRT RED LINE CORRIDOR, KARACHI**

**2**

**AMBIENT AIR MONITORING**

**2.1 METHODOLOGY**

To assess the status of ambient air quality, criteria pollutants (NO<sub>x</sub>, NO, NO<sub>2</sub>, SO<sub>2</sub>, CO, O<sub>3</sub>, SPM, PM<sub>10</sub>, PM<sub>2.5</sub> and Pb) were monitored at designated locations as identified by the client along the BRT Red Line Corridor, Karachi. SUPARCO collected the ambient air data using its USEPA recommended monitoring equipment at six (06) sites.

**2.2 DATA ACQUISITION CRITERIA**

The data (air quality parameters and meteorological parameters) was collected with interval of 01 hour for 24 hours. Minimum detection limits for analyzers are given in Table 1 for monitoring the air quality, noise level and vibration.

The meteorological parameters include (Wind Speed, Wind Direction, Pressure, Temperature and Relative Humidity).

**2.3 AMBIENT AIR QUALITY MONITORING METHODS AND AMBIENT AIR QUALITY STANDARDS**

The air quality parameters were measured using the state of the art instruments based upon the USEPA methods as given in Table 2. The ambient air quality standards/guidelines of Sindh EPA, USEPA, WHO and World Bank for data analysis and comparison are given in Table 3.

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**Table 1: Concentration limits of Equipment**

Equipment	Min. Concentration Limits
SO <sub>2</sub> Analyzer	~1 µg/m <sup>3</sup>
CO Analyzer	< 0.5 mg/m <sup>3</sup>
NO <sub>x</sub> (NO+NO <sub>2</sub> ) Analyzer	~ 1 µg/m <sup>3</sup>
PM <sub>2.5</sub> /PM <sub>10</sub> Sampler	0.001 µg/m <sup>3</sup>
O <sub>3</sub> Analyzer	~ 1 µg/m <sup>3</sup>
Noise Level Meter (Model Testo 816)	>30 dB(A)
Vibration Meter, Extech (Model 407860)	~ 0.003mm

**Table 2: Ambient Air Quality Monitoring Methods (USEPA)**

Pollutants	Reference/Equivalent Method	Instruments/ Analyzers
NO <sub>x</sub> (NO & NO <sub>2</sub> )	Reference Method RFNA-0809-186 by US EPA (40 CFR, Part 53)	NO <sub>x</sub> Analyzer, Ecotech, Australia
SO <sub>2</sub>	Equivalent Method EQSA-0509-188 by US EPA (40 CFR, Part 53)	SO <sub>2</sub> Analyzer, Ecotech, Australia
CO	Reference Method RFCA-0509-174 by US EPA (40 CFR, Part 53)	CO Analyzer, Ecotech, Australia
SPM	40 CFR, Part 50, Appendix B	High Volume Sampler
PM <sub>10</sub>	Reference Method RFPS 1287-063	High Volume Sampler
PM <sub>2.5</sub>	Reference Method RFPS-0498-116 by US EPA (40 CFR Part 50, Appendix L)	PQ 200 BGI, USA
O <sub>3</sub>	Equivalent Method EQOA-0809-187 by US EPA (40 CFR, Part 53)	Ozone Analyzer, Ecotech, Australia
Lead	Reference Method EQL-0710-192 by US EPA (40 CFR, Part 50, Appendix B) and US EPA 200.8	High Volume Sampler and ICPMS

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**Table 3: Ambient Air Quality Standards of USEPA, WHO, World Bank and SEQS,**

Pollutants	USEPA		WHO		World Bank		SEQS	
	Avg. Time	Standard	Avg. Time	Standard	Avg. Time	Standard	Avg. Time	Standard
SO <sub>2</sub>	1 HRS	75ppb	24 HRS	20 ug/m <sup>3</sup>	ANNUAL MEAN	80 ug/m <sup>3</sup>	ANNUAL MEAN	80 ug/m <sup>3</sup>
	3 HR	0.5 ppm )	10 min	500 ug/m <sup>3</sup>	24 HRS	150 ug/m <sup>3</sup>	24 HRS	120 ug/m <sup>3</sup>
CO	8 HRS	9 ppm	-	-	-	-	8 HRS	5 mg/m <sup>3</sup>
	1 HR	35 ppm	-	-	-	-	1 HR	10 mg/m <sup>3</sup>
NO	-	-	-	-	-	-	24 HRS	40 ug/m <sup>3</sup>
NO <sub>2</sub>	1 YRS	53 ppb	1 YRS	40 ug/m <sup>3</sup>	ANNUAL MEAN	100 ug/m <sup>3</sup>	24 HRS	80 ug/m <sup>3</sup>
	1 HR	100 ppb	1 HR	200 ug/m <sup>3</sup>	24 HRS	150 ug/m <sup>3</sup>		
O <sub>3</sub>	8 HRS	0.07 ppm	8 HRS	100 ug/m <sup>3</sup>	-	-	1 HR	130 ug/m <sup>3</sup>
SPM	-	-	-	-	A.MEAN	80 ug/m <sup>3</sup>	A.MEAN	360 ug/m <sup>3</sup>
	-	-	-	-	24 HRS	230 ug/m <sup>3</sup>	24 HRS	500 ug/m <sup>3</sup>
PM <sub>10</sub>	24 HRS	150 ug/m <sup>3</sup>	ANNUAL MEAN	20 ug/m <sup>3</sup>	ANNUAL MEAN	50 ug/m <sup>3</sup>	A.MEAN	120 ug/m <sup>3</sup>
			24 HRS	50 ug/m <sup>3</sup>	24 HRS	150 ug/m <sup>3</sup>	24 HRS	150 ug/m <sup>3</sup>
PM <sub>2.5</sub>	24 HRS	35 ug/m <sup>3</sup>	ANNUAL MEAN	10 ug/m <sup>3</sup>	-	-	24 HRS	75 ug/m <sup>3</sup>
			24 HRS	25 ug/m <sup>3</sup>	-	-		
Lead	24 HRS	0.15 ug/m <sup>3</sup>	-	-	-	-	ANNUAL MEAN	1.0 ug/m <sup>3</sup>
			-	-	-	-	24 HRS	1.5 ug/m <sup>3</sup>

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**2.4 WORK PLAN**

The work plan followed for data acquisition was as under;

1<sup>st</sup> Phase:-

**Commencing Date** : 22-01-2018  
**Completion Date** : 27-01-2018  
**Duration** : 05 day

2<sup>nd</sup> Phase:-

**Commencing Date** : 14-02-2018  
**Completion Date** : 16-02-2018  
**Duration** : 03 day

**Supervisor and Field Monitoring Officials:**

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(Manager)
2. Mr. M. Khalid  
(Research Associate)
3. Arif Hussain Solangi  
(Sub Engineer)
4. Mr. M. Zain  
(Sub Engineer-II)

**2.5 AIR QUALITY DATA ACQUISITION PLAN**

**Site 1 – Near Tank Chowrangi (24° 55' 20.3"N, 67° 10' 50.5"E)**

Starting Date:	22-01-2018
Starting Time:	1700
Completion Date:	23-01-2018
Completion Time:	1700
Sampling Duration:	24 Hours

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**Site 2 – Karachi University (24° 55' 50.1"N, 67° 07' 1.1"E)**

Starting Date:	23-01-2018
Starting Time:	1800
Completion Date:	24-01-2018
Completion Time:	1800
Sampling Duration:	24 Hours

**Site 3 – Ashfaq Memorial Hospital (24° 54' 30.4"N, 67° 05' 3.7"E)**

Starting Date:	24-01-2018
Starting Time:	1900
Completion Date:	25-01-2018
Completion Time:	1900
Sampling Duration:	24 Hours

**Site 4 – Near Jamia Masjid Tayyab (24° 52' 43.8"N, 67° 02' 45.8"E)**

Starting Date:	25-01-2018
Starting Time:	2000
Completion Date:	26-01-2018
Completion Time:	2000
Sampling Duration:	24 Hours

**Site 5 – Gulistan-e-Jauhar Bus Depot (24° 56' 2.23"N, 67° 08' 33.64"E)**

Starting Date:	14-02-2018
Starting Time:	1100
Completion Date:	15-02-2018
Completion Time:	1100
Sampling Duration:	24 Hours

**Site 6 – Malir Bus Depot Terminal KBRT (24° 53' 8.21"N, 67° 10' 23.8"E)**

Starting Date:	15-02-2018
Starting Time:	1200
Completion Date:	16-02-2018
Completion Time:	1200
Sampling Duration:	24 Hours

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**Figure 1:** Satellite Image of Ambient Air Quality Monitoring Sites

**2.6 OXIDES OF NITROGEN (NO<sub>x</sub>)**

**Nature and Sources:** Nitrogen oxides (NO<sub>x</sub>), a mixture of Nitric oxide (NO) and Nitrogen dioxide (NO<sub>2</sub>), are produced from natural sources, motor vehicles and other fuel combustion processes. NO is colorless and odorless and is oxidized in the atmosphere to form NO<sub>2</sub>. NO<sub>2</sub> is an odorous, brown, acidic, highly corrosive gas that can affect our health and environment. NO<sub>x</sub> are critical components of photochemical smog and NO<sub>2</sub> also produces the yellowish-brown color of the smog. Nitrogen dioxide belongs to a family of highly reactive gases called Oxides of Nitrogen (NO<sub>x</sub>). These gases form when fuel is burned at high temperatures, and come principally from

motor vehicle exhaust and stationary sources such as electric utilities and industrial boilers. A suffocating, brownish gas, nitrogen dioxide is a strong oxidizing agent that reacts in the air to form corrosive nitric acid, as well as toxic organic nitrates. It also plays a major role in the atmospheric reactions that produce ground-level ozone (or smog).

**2.6.1 Monitoring Results of NO<sub>x</sub>**

The measured minimum concentration of NO along BRT-Red was 0.7µg/m<sup>3</sup> near Tank Chowrangi. Similarly the maximum observed concentration of NO was 61.2µg/m<sup>3</sup> near Karachi University. While, the average concentration (µg/m<sup>3</sup>) of NO was 5.9, 27.2,



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25.0, 27.7, 6.9 and 13.7 at Tank Chowranghi, Karachi University, Ashfaq Memorial Hospital, Jamia Masjid Tayyab, Gulistan-e-Jauhar Bus Depot and Malir Bus Depot Terminal KBRT respectively.

The measured minimum concentration of NO<sub>2</sub> was 10.0µg/m<sup>3</sup> at Tank Chowranghi. Similarly the maximum observed concentration of NO<sub>2</sub> was 105.0µg/m<sup>3</sup> at Karachi University. While, average concentration (µg/m<sup>3</sup>) of NO<sub>2</sub> was

19.7, 50.7, 42.1 and 46.5, 20.1 and 37.9 at Tank Chowranghi, Karachi University, Ashfaq Memorial Hospital, Jamia Masjid Tayyab, Gulistan-e-Jauhar Bus Depot and Malir Bus Depot Terminal KBRT respectively.

The average levels of NO and NO<sub>2</sub> were well also within the prescribed limits of SEQS (see Table 3 for reference) for ambient air quality as shown in Figures 1(a) and 1(b).

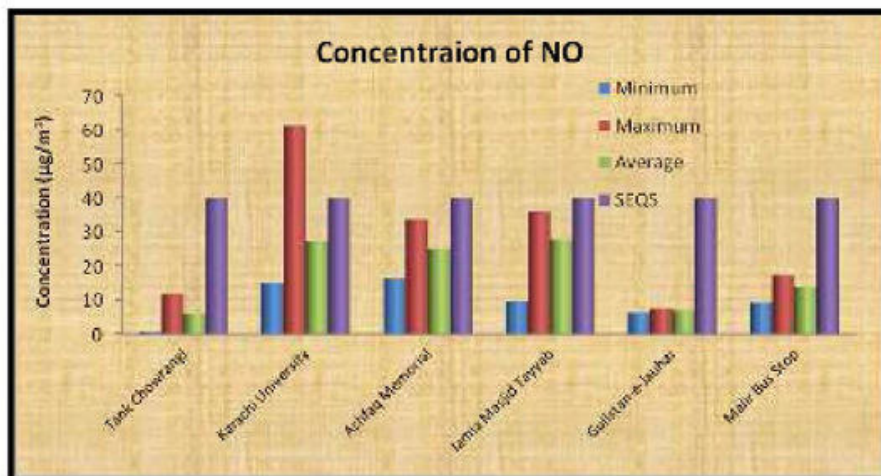
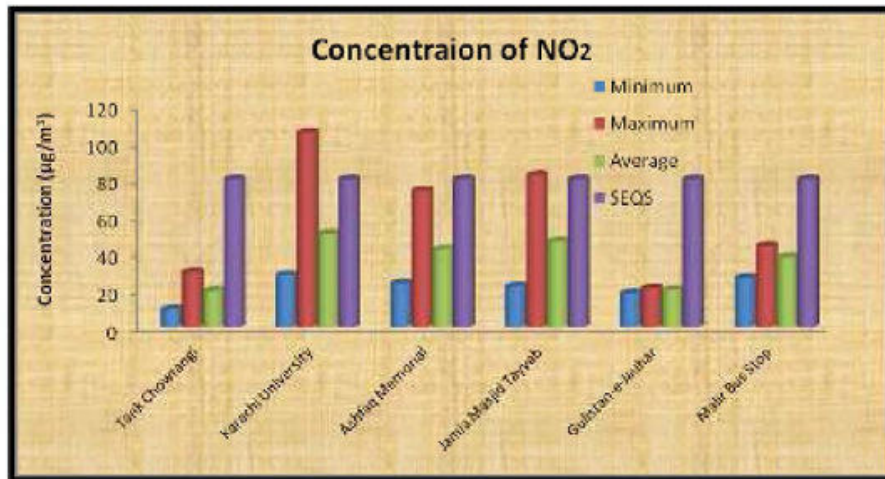


Figure 1 (a): Min, Max & Avg (24 Hrs) Concentration of NO at different sites along the BRT-Red, Karachi

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**Figure 1 (b):** Min, Max & Avg (24 Hrs) Concentration of NO<sub>2</sub> at different sites along the BRT Red Line Corridor, Karachi

**2.7 SULFUR DIOXIDE (SO<sub>2</sub>)**

**Nature and Sources:** Sulfur dioxide belongs to the family of sulfur oxide gases (SO<sub>x</sub>). These gases are formed when fuel containing sulfur (mainly coal and oil) is burned, and during metal smelting and other industrial processes.

**Health and Other Effects:** The major health concerns associated with exposure to high concentrations of SO<sub>2</sub> include effects on breathing, respiratory illness, alterations in pulmonary defenses, and aggravation of existing cardiovascular disease. Major subgroups of the population that are most sensitive to SO<sub>2</sub> include asthmatics and individuals with cardiovascular disease or chronic lung disease (such as bronchitis or emphysema) as well as children and the elderly. Together, SO<sub>2</sub> and NO<sub>x</sub> are the

major precursors to acid rain, which is associated with the acidification of lakes and streams, accelerated corrosion of buildings and monuments, and reduced visibility.

**2.7.1 Monitoring Results of SO<sub>2</sub>**

The measured minimum concentration of SO<sub>2</sub> along BRT-Red was 6.0µg/m<sup>3</sup> at Tank Chowranghi. Similarly the maximum observed concentration of SO<sub>2</sub> was 40.2µg/m<sup>3</sup> at Tayyab Masjid. While, average concentration (µg/m<sup>3</sup>) of SO<sub>2</sub> was 15.3, 18.3, 25.5, 30.0, 23.6 and 35.8 at Tank Chowranghi, Karachi University, Ashfaq Memorial Hospital, Jamia Masjid Tayyab, Gullistan-e-Jauhar Bus Depot and Malir Bus Depot Terminal KBRT respectively.

The average levels of SO<sub>2</sub> were well also within the prescribed limits of

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international and national standards (see Table 4 for reference) for ambient air quality as shown in Figure 2.

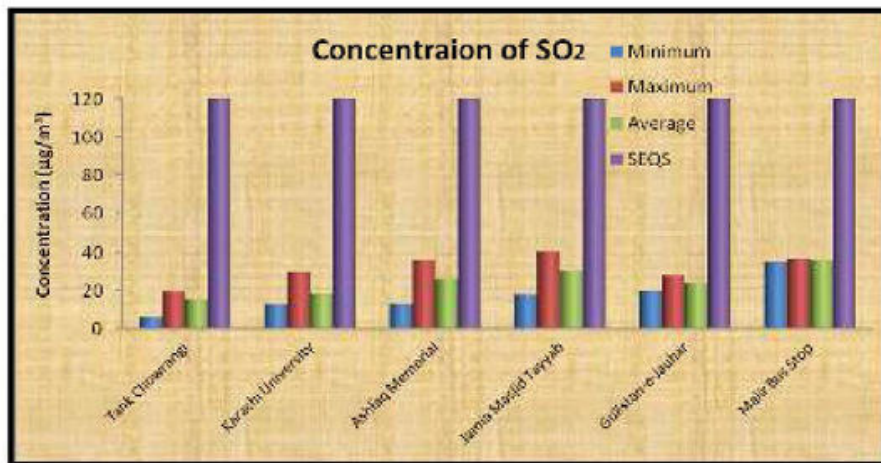


Figure 2: Min, Max & Avg (24 Hrs) Concentration of SO<sub>2</sub> at different sites along the BRT Red Line Corridor, Karachi

**2.8 CARBON MONOXIDE (CO)**

**Nature and Sources:** Carbon monoxide is a colorless odorless poisonous gas formed when carbon in fuels is not burned completely. It is a byproduct of motor vehicle exhaust, which contributes more than two-thirds of all CO emissions nationwide. In cities, automobile exhaust can cause as much as 95 percent of all CO emissions. These emissions can result in high concentrations of CO, particularly in local areas with heavy traffic congestion. Other sources of CO emissions include industrial processes and fuel combustion in sources such as boilers and incinerators. Despite an overall downward trend in

concentrations and emissions of CO, some metropolitan areas still experience high levels of CO.

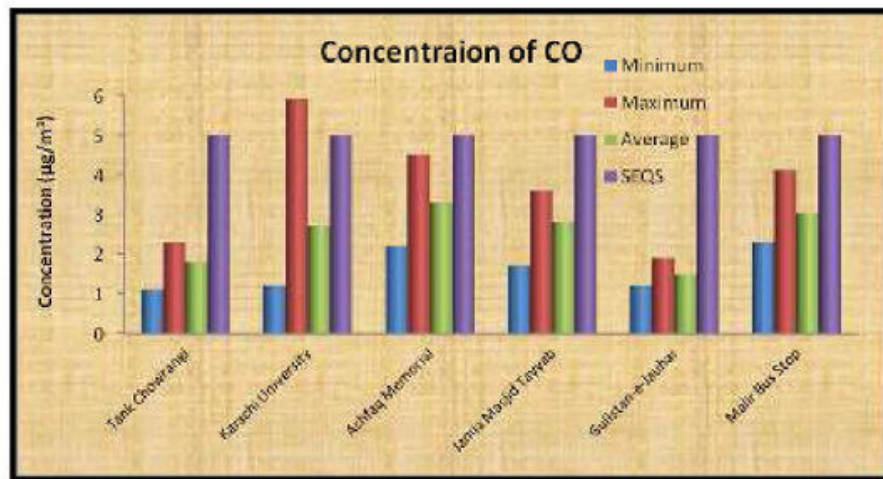
**Health and Other Effects:** Carbon monoxide enters the bloodstream and reduces oxygen delivery to the body's organs and tissues. The health threat from CO is most serious for those who suffer from cardiovascular disease. Healthy individuals are also affected, but only at higher levels of exposure. Exposure to elevated CO levels is associated with visual impairment, reduced work capacity, reduced manual dexterity, poor learning ability, and difficulty in performing complex tasks.

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**2.8.1 Monitoring Results of CO**

The measured minimum concentration of CO along BRT -Red was 1.1mg/m<sup>3</sup> at Tank Chowrangi. Similarly the maximum observed concentration of CO was 5.9mg/m<sup>3</sup> at Karachi University. While, average concentration (mg/m<sup>3</sup>) of CO was 1.8, 2.7, 3.3, 2.8, 1.5 and 3.0 at Tank Chowrangi, Karachi University, Ashfaq Memorial, Jamia Masjid Tayyab, Gulistan-e-Jauhar and Malir Bus Stop respectively.

The average levels of Carbon Monoxide were well within the prescribed limits of SEQs (see Table 3 for reference) for ambient air quality as shown in Figures 3.



**Figure 3:** Minimum, Maximum and Average (24hrs) Concentration of CO along the BRT Red Line Corridor, Karachi

**2.9 OZONE (O<sub>3</sub>)**

**Nature and Sources of the Pollutant:** Ground-level ozone (the primary constituent of smog) is the most complex, difficult to control, and pervasive of the six principal pollutants. Unlike other pollutants, ozone is not emitted directly into the air by specific sources. Ozone is created by sunlight acting on nitrogen oxides (NOx) and volatile organic

compound (VOC) emissions in the air. Some of the more common sources include gasoline vapors, chemical solvents, combustion products of various fuels, and consumer products. They can originate from large industrial facilities, gas stations, and small businesses such as bakeries and dry cleaners. Often these "precursor" gases are emitted in one area, but the actual chemical reactions,

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stimulated by sunlight and temperature, take place in another. Combined emissions from motor vehicles and stationary sources can be carried hundreds of miles from their origins, forming high ozone concentrations over very large regions.

**Potential Health Impacts;** studies indicated that ground-level ozone not only affects people with impaired respiratory systems (such as asthmatics), but healthy adults and children as well. Exposure to ozone for 6 to 7 hours, even at relatively low concentrations, significantly reduces lung function and induces respiratory inflammation in normal, healthy people during periods of moderate exercise. It can be accompanied by symptoms such as chest pain, coughing, nausea, and pulmonary congestion. Recent studies provide evidence of an association between elevated ozone levels and

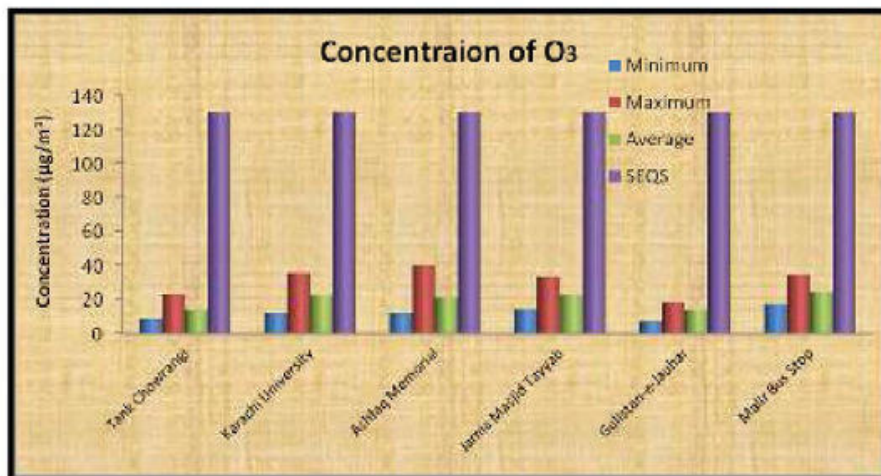
increases in hospital admissions for respiratory problems.

### **2.9.1 Monitoring Results of Ozone**

The measured minimum concentration of Ozone along BRT-Red was  $7.0\mu\text{g}/\text{m}^3$  at Gulistan e Jauhar Bus Depot. Similarly the maximum observed concentration of CO was  $40.0\mu\text{g}/\text{m}^3$  at Ashfaq Memorial Hospital. While, average concentration ( $\mu\text{g}/\text{m}^3$ ) of O<sub>3</sub> was 13.6, 22.4, 21.0, 22.5, 13.4 and 24.4 at Tank Chowrangi, Karachi University, Ashfaq Memorial Hospital, Jamia Masjid Tayyab, Gulistan-e-Jauhar Bus Depot and Malir Bus Depot Terminal KBRT respectively.

The average levels of Ozone were well within the prescribed limits of SEQS (see Table 3 for reference) for ambient air quality as shown in Figures 4.

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**Figure 4:** Minimum, Maximum and Average (24hrs) Concentration of O<sub>3</sub> along the BRT Red Line Corridor, Karachi

**2.10 Particulate Matter (PM<sub>10</sub>, PM<sub>2.5</sub> and SPM)**

**Nature and Sources:** Particulate matter is the term for solid or liquid particles found in the air. Some particles are large or dark enough to be seen as soot or smoke. Others are so small they can be detected only with an electron microscope. Because particles originate from a variety of mobile and stationary sources (diesel trucks, wood stoves, power plants, etc.), their chemical and physical compositions vary widely. Particulate matter (PM) is a complex mixture consisting of varying combinations of dry solid fragments, solid cores with liquid coatings and small droplets of liquid. These tiny particles vary greatly in shape, size and chemical

composition, and can be made up of different materials such as metals, soot, soil and dust. PM may also contain sulfate particles. PM may be divided into many size fractions, measured in microns (a micron is one-millionth of a meter). Sindh EPA regulates three classes of particles - particles up to 10 microns (PM<sub>10</sub>), particles up to 2.5 microns in size (PM<sub>2.5</sub>) and Suspended Particulate Matter as SPM. PM<sub>2.5</sub> particles are a subset of PM<sub>10</sub> whereas PM<sub>10</sub> particles are subset of SPM.

**Health and Other Effects:** Health Major concerns for human health from exposure to particulate matter are: effects on breathing and respiratory systems, damage to lung tissue, cancer, and premature death. The elderly, children, and people with chronic lung disease,

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influenza, or asthma, tend to be especially sensitive to the effects of particulate matter. Acidic particulate matter can also damage manmade materials and is a major cause of reduced visibility

### **2.10.1 Monitoring Results of PM<sub>2.5</sub>**

The average concentration ( $\mu\text{g}/\text{m}^3$ ) of PM<sub>2.5</sub> was 57, 68, 65, 49, 39 and 62 at Tank Chowrangi, Karachi University, Ashfaq Memorial Hospital, Jamia Masjid Tayyab, Gulistan-e-Jauhar Bus Depot and Malir Bus Depot Terminal KBRT respectively.

The measured concentrations of PM<sub>2.5</sub> ( $\mu\text{g}/\text{m}^3$ ) were well also within the prescribed limits of SEQs (see Table 3 for reference) for ambient air quality as shown in Figures 5(a).

### **2.10.2 Monitoring Results of PM<sub>10</sub>**

The average concentration ( $\mu\text{g}/\text{m}^3$ ) of PM<sub>10</sub> was 114, 133, 126, 128, 109 and 141 at Tank Chowrangi, Karachi University, at Ashfaq Memorial Hospital, Jamia Masjid

Tayyab, Gulistan-e-Jauhar Bus Depot and Malir Bus Depot Terminal KBRT respectively.

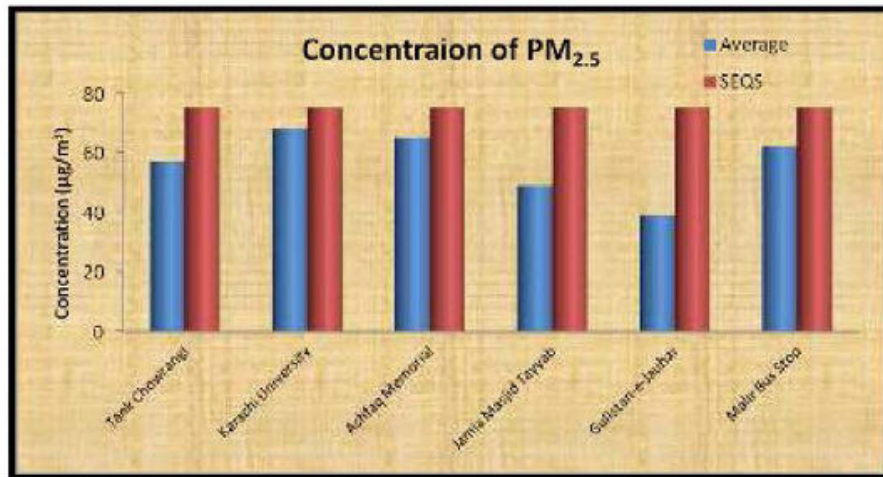
The measured concentrations of PM<sub>10</sub> ( $\mu\text{g}/\text{m}^3$ ) were well also within the prescribed limits of SEQs (see Table 3 for reference) for ambient air quality as shown in Figures 5(b).

### **2.10.3 Monitoring Results of SPM**

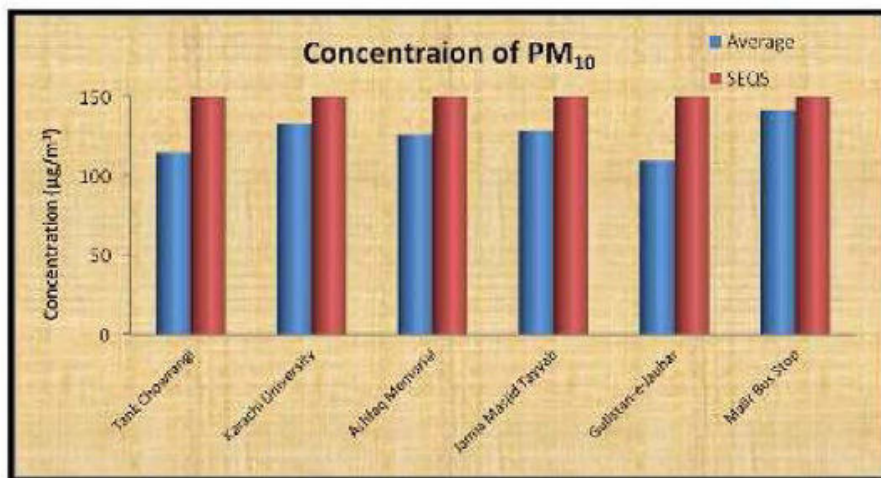
The average concentration ( $\mu\text{g}/\text{m}^3$ ) of SPM was 361, 391, 410, 390, 254 and 368 at Tank Chowrangi, Karachi University, Ashfaq Memorial Hospital, Jamia Masjid Tayyab, Gulistan-e-Jauhar Bus Depot and Malir Bus Depot Terminal KBRT respectively.

The measured concentrations of SPM ( $\mu\text{g}/\text{m}^3$ ) were well also within the prescribed limits of SEQs (see Table 3 for reference) for ambient air quality as shown in Figures 5(c).

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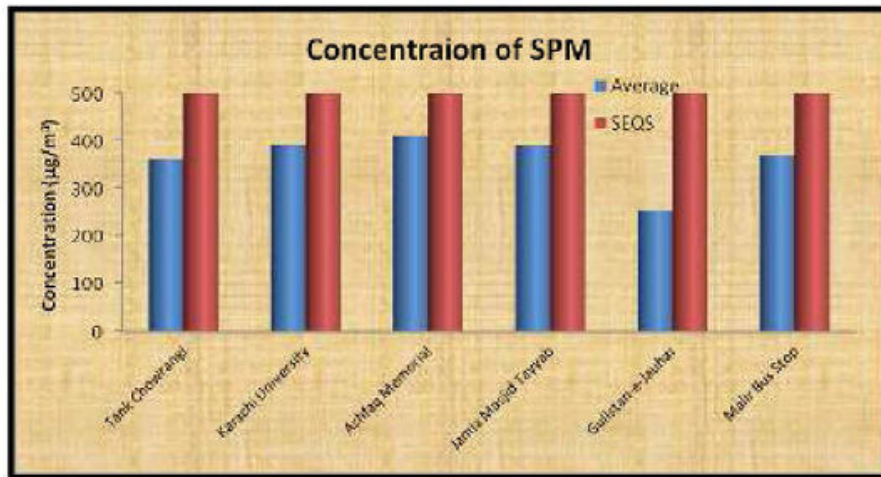
**Figure 5(a):** Average (24hrs) Concentration of PM<sub>2.5</sub> along the BRT Red Line Corridor, Karachi



**Figure 5(b):** Average (24hrs) Concentration of PM<sub>10</sub> along the BRT Red Line Corridor, Karachi



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**Figure 5(c):** Average (24hrs) Concentration of SPM along the BRT Red Line Corridor, Karachi

**2.11 LEAD IN AMBIENT AIR**

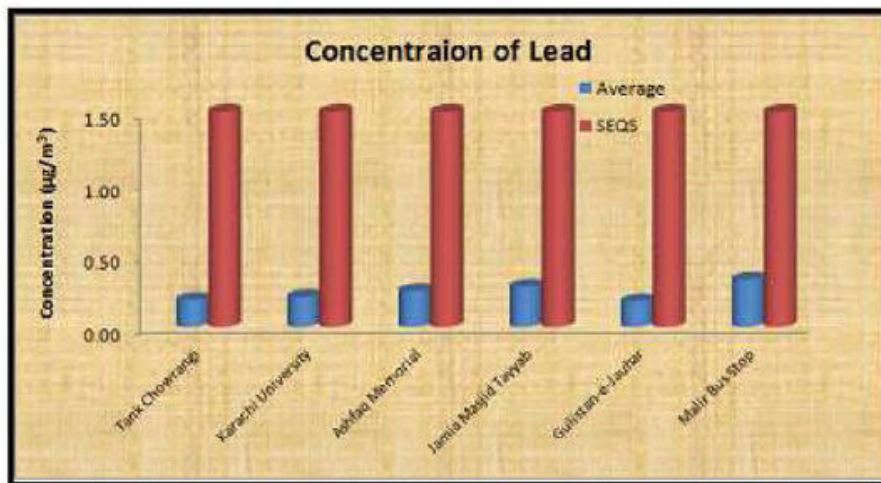
Lead (Pb) is a metal found naturally in the environment as well as in manufactured products. The major sources of lead emissions have historically been from fuels in on-road motor vehicles (such as cars and trucks) and industrial sources. The highest levels of lead in air are usually found near lead smelters. The major sources of lead emissions to the air today are ore and metals processing and piston-engine aircraft operating on leaded aviation gasoline.

**2.11.1 Testing Results of Lead**

The concentration (µg/m<sup>3</sup>) of lead was 0.19, 0.21, 0.25, 0.28, 0.18 and 0.33 at Tank Chowranghi, Karachi University, Ashfaq Memorial Hospital, Jamia Masjid Tayyab, Gulistan-e-Jauhar Bus Depot and Malir Bus Depot Terminal KBRT respectively.

The concentration of Lead (µg/m<sup>3</sup>) was also within the prescribed limits of SEQS for ambient air quality as shown in Figures 6.

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**Figure 6:** Concentration of Lead along the BRT Red Line Corridor, Karachi

**2.12 Meteorological Data**

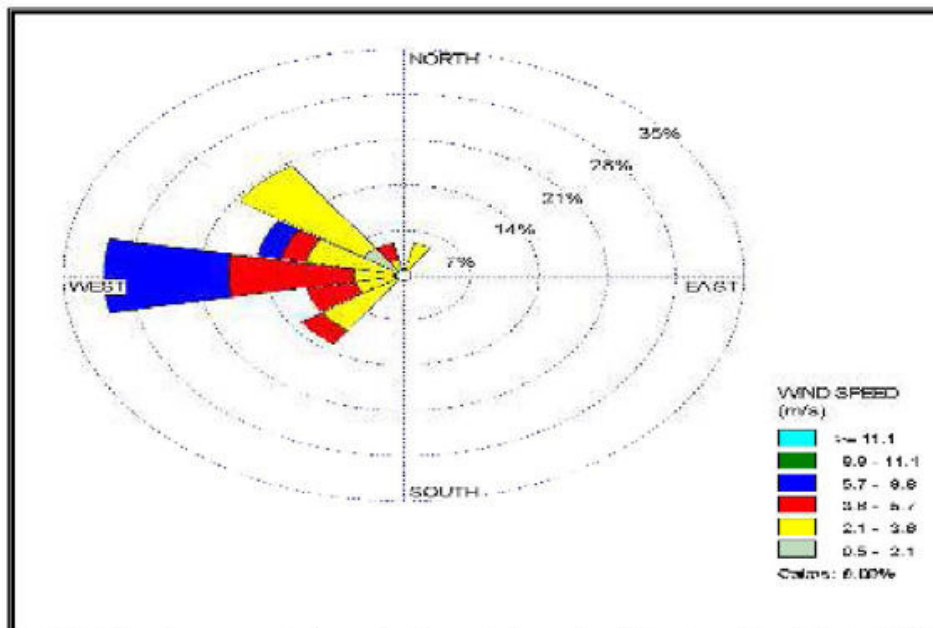
In this study, meteorological parameters including wind speed, wind direction, ambient temperature, pressure and relative humidity were measured at each site. The detailed meteorological data of these parameters are given in Annexure-A, while the prevailing wind speed and wind direction at each site is produced as wind roses.

**2.12.1 Monitoring Results of Meteorological Data**

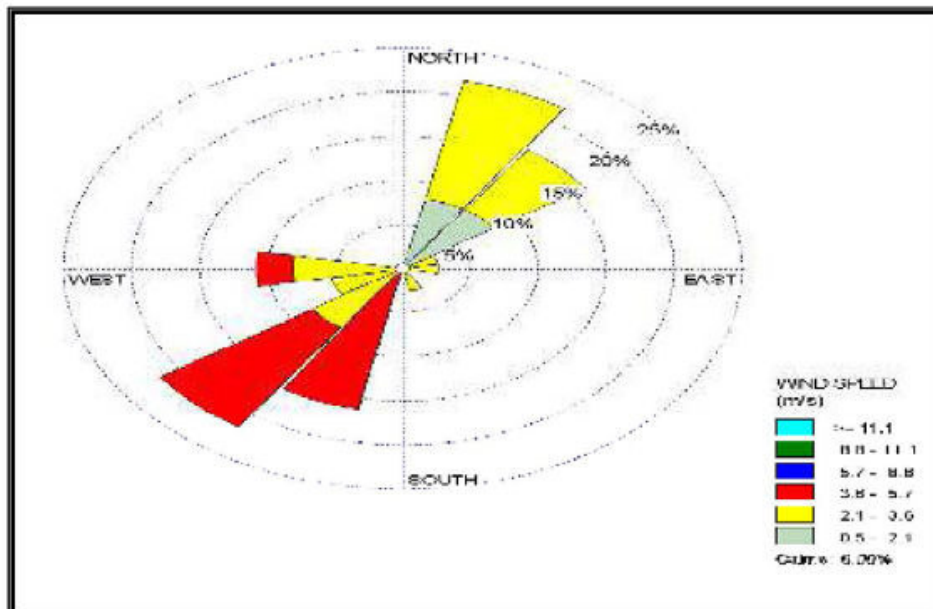
The average value of temperature, humidity and pressure were 20.5°C, 28.3% and 1011.9 hPa at Tank Chowranghi respectively along BRT-Red Karachi. While average value of temperature,

humidity and pressure were 18.6°C, 47.5 % and 1013.6hPa at Karachi University; respectively along the BRT-Red in Karachi. The average values of temperature, humidity and Pressure at Ashfaq Memorial Hospital were 19.0°C, 59.1% and 1013.1 hPa, respectively. While, the average values of temperature, humidity and Pressure at Jamia Masjid Tayyab were 19.7°C, 64.8% and 1012.8hPa, respectively. Similarly, the average values of temperature, humidity and Pressure at Gulistan-e-Jauhar Bus Depot were 21.1°C, 37.9% and 1021.8hPa, respectively. Moreover, the average values of temperature, humidity and Pressure at Malir Bus Depot Terminal KBRT were 22.0°C, 42.2% and 1020.6 hPa, respectively.

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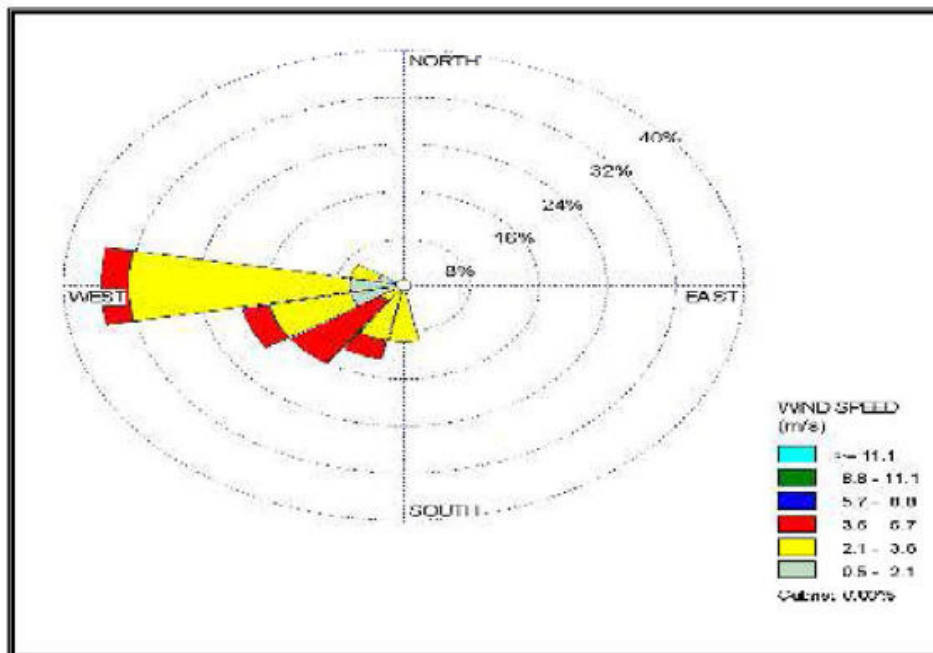


**Fig 2.1:** 24-hourly average wind rose plot for upwind speed and direction at Site-1 during 22th & 23rd January, 2018

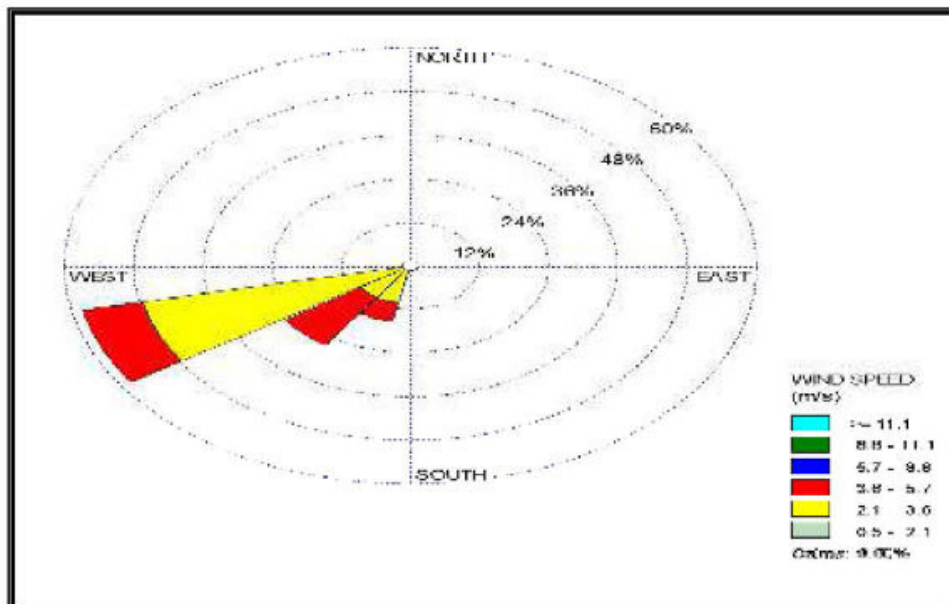


**Fig 2.2:** 24-hourly average wind rose plot for upwind speed and direction at Site-2 during 23th & 24th January, 2018

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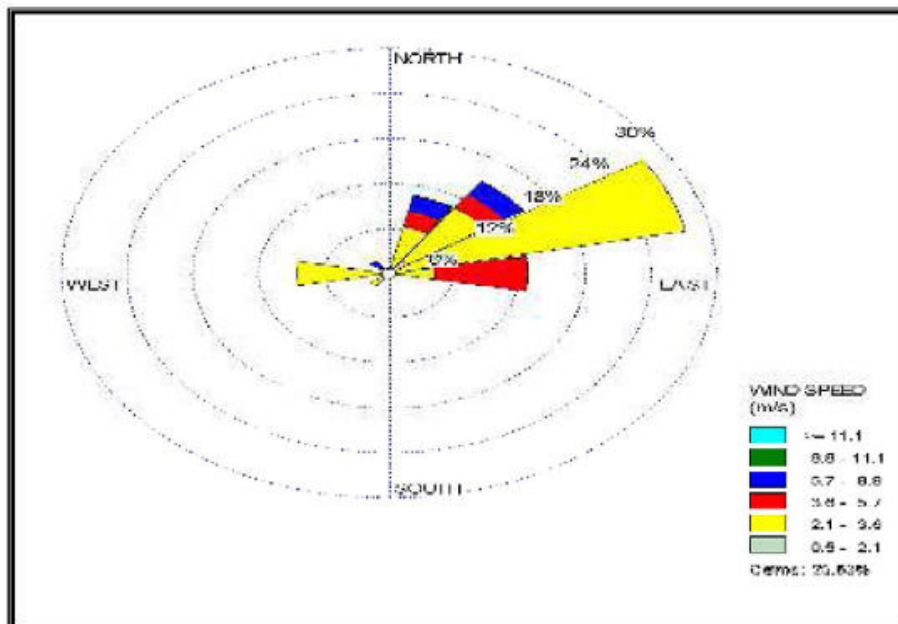


**Fig 2.3:** 24-hourly average wind rose plot for upwind speed and direction at Site-3 during 24<sup>th</sup> & 25<sup>th</sup> January, 2018

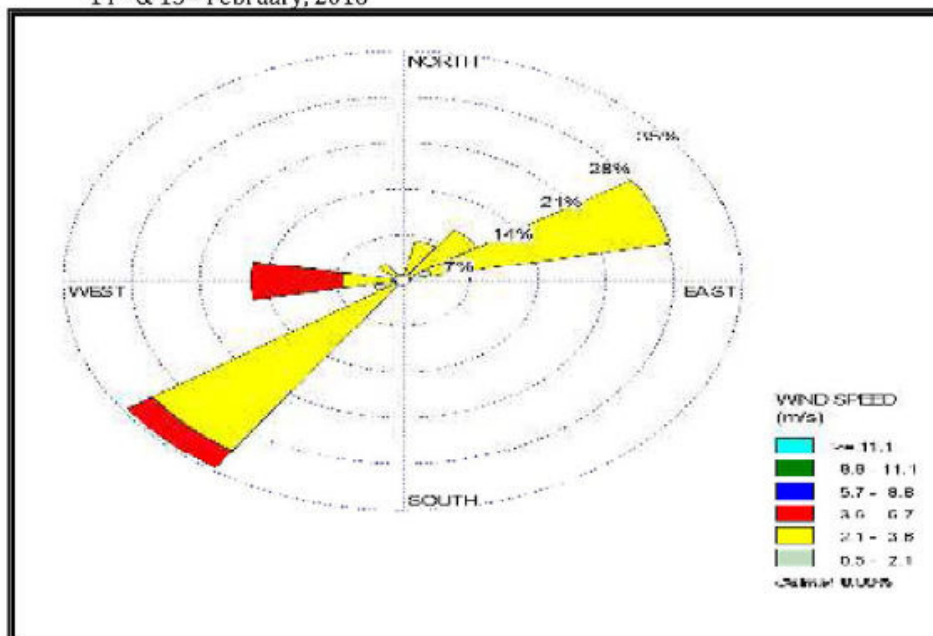


**Fig 2.4:** 24-hourly average wind rose plot for upwind speed and direction at Site-4 during 25<sup>th</sup> & 26<sup>th</sup> January, 2018

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**Fig 2.5:** 24-hourly average wind rose plot for upwind speed and direction at Site-5 during 14<sup>th</sup> & 15<sup>th</sup> February, 2018



**Fig 2.6:** Fig 2.4: 24-hourly average wind rose plot for upwind speed and direction at Site-6 during 15<sup>th</sup> & 16<sup>th</sup> February, 2018

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**D R I N K I N G W A T E R T E S T I N G**

**3.1 METHODOLOGY**

To assess the status of drinking water quality at identified locations by the client. SUPARCO collected the three (03) drinking water sample (Tap Water) from the near Race-course, near Ashfaq Memorial Hospital and near Dawood Engineering University, according to criteria specified by USEPA and standard methods. The samples were tested in SUPARCO Environmental Lab (SEL).

**3.2 DATA ACQUISITION CRITERIA**

- a. Three (03) drinking water samples were collected along the BRT-Red. The samples were analyzed in SEL.
- b. The results of drinking water analysis are compared to check their compliance with SEQS, where applicable.

**3.3 DRINKING WATER TESTING**

Three (03) drinking water samples were collected at KWSB Water Hydrant

near Racecourse (24° 56' 15.29"N; 67° 09' 55.05"E), near Ashfaq Memorial Hospital (24° 54' 33.3"N; 67° 05' 4.4"E) and near Dawood Engineering University (24° 52' 43.36"N; 67° 02' 50.87"E) along the BRT Red Line Corridor, Karachi. The samples were analyzed in SUPARCO Environmental Lab. The samples were tested for microbiological, chemical and physical parameters to check their compliance with Sindh Environmental Quality Standards for Drinking Water Quality.

The results showed that the drinking water samples were non-compliant with E.Coli and Total Coliform suggesting the presence of bacterial contamination and hence was unfit for human consumption.

**AMBIENT AIR, NOISE AND WATER QUALITY MONITORING ALONG BRT RED LINE CORRIDOR, KARACHI**

**3.4 Results and Discussion**

**3.4.1 Physical Parameters**

The drinking water samples were analyzed for physical parameters including Temperature, Turbidity, Color, Taste, Odor, Total dissolved solids (TDS), and pH value. **Table 3.1, 3.2 & 3.3** show the compliance status of the physical parameters with the SEQs.

**3.4.2 Biological Parameters**

The drinking water samples were analyzed for biological parameters such as E-coli form, Fecal coliform and Total coliform. **Table 3.1, 3.2 & 3.3** show the

compliance status of the biochemical parameters with the SEQs.

**3.4.3 Chemical Parameters**

The drinking water samples were analyzed for various chemical parameters including Total Hardness, Chloride (as Cl<sup>-</sup>), Fluoride (as F<sup>-</sup>), Cyanide (as CN<sup>-</sup>), Nitrate (NO<sub>3</sub><sup>-</sup>), Nitrite(NO<sub>2</sub><sup>-</sup>), Cadmium (Cd), Chromium (Cr), Antimony (Sb), Aluminum (Al), Copper (Cu), Lead (Pb), Mercury (Hg), Selenium (Se), Nickel (Ni), Zinc (Zn), Arsenic (As), Barium (Ba), Manganese (Mn), Boron (B) and Chlorine. **Table 3.1, 3.2 & 3.3** show the compliance status of the chemical parameters with the SEQs.

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Figure 7: Satellite Image of Water Sampling Sites



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**Table 3.1:** Drinking Water Monitoring Results of KWSB Water Hydrant near Racecourse

S. No.	Parameters	Unit	*NSDWQ	Results	Method	Remarks
1	E. Coliform	MPN	Must not be detected in any 100ml sample	27	HACH 10029	Does not Comply with limit
2	Fecal Coliform	MPN	Must not be detected in any 100ml sample	42	HACH 10029	Does not Comply with limit
3	Total Coliform	MPN	Must not be detected in any 100ml sample	69	HACH 10029	Does not Comply with limit
4	pH	-	6.5 - 8.5	8.11	ASTM D 1293 / US-EPA 150.2	Comply with limit
5	Color	TCU	≤ 15	2	HACH 8025	Comply with limit
6	Taste	-	Objectionable / Acceptable	Acceptable	Sensory Test	Comply with limit
7	Odor	-	Objectionable / Acceptable	Acceptable	Sensory Test	Comply with limit
8	Turbidity	NTU	< 5	0.93	US-EPA 180.1	Comply with limit
9	Total Hardness	mg/l	< 500	270	HACH 8213	Comply with limit
10	TDS	mg/l	< 1000	423	US-EPA 160.1	Comply with limit
11	Aluminium	mg/l	≤ 0.2	0.041	USEPA 7000B	Comply with limit
12	Antimony	mg/l	≤ 0.005	ND	USEPA 7000B	Comply with limit
13	Arsenic	mg/l	≤ 0.05	ND	USEPA 206.3	Comply with limit
14	Barium	mg/l	0.7	0.13	USEPA 7000B	Comply with limit
15	Boron	mg/l	0.3	ND	HACH 8015	Comply with limit
16	Cadmium	mg/l	0.01	ND	USEPA 7000B	Comply with limit
17	Chloride	mg/l	< 250	79	US-EPA 300.1 / HACH 8206	Comply with limit
18	Chromium	mg/l	≤ 0.05	0.007	USEPA 7000B	Comply with limit
19	Copper	mg/l	2	0.012	USEPA 7000B	Comply with limit
20	Cyanide	mg/l	≤ 0.05	ND	HACH 8027	Comply with limit
21	Fluoride	mg/l	≤ 1.5	0.11	US-EPA 300.1 / HACH 8029	Comply with limit
22	Lead	mg/l	≤ 0.05	ND	USEPA 7000B	Comply with limit
23	Manganese	mg/l	≤ 0.5	ND	USEPA 7000B	Comply with limit
24	Mercury	mg/l	≤ 0.001	ND	USEPA 245.1	Comply with limit
25	Nickel	mg/l	≤ 0.02	ND	USEPA 7000B	Comply with limit
26	Nitrate	mg/l	≤ 50	2.8	US-EPA 300.1 / HACH 8171	Comply with limit
27	Nitrite	mg/l	≤ 3	ND	HACH 8507	Comply with limit
28	Selenium	mg/l	0.01	ND	D3859-93A	Comply with limit
29	Residual Chlorine	mg/l	0.2 - 0.5	0.04	HACH 8210	Does not Comply with limit
30	Zinc	mg/l	5	0.064	USEPA 7000B	Comply with limit

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**Table 3.2: Drinking Water Monitoring Results near Ashfaq Memorial Hospital**

S. No.	Parameters	Unit	*NSDWQ	Results	Method	Remarks
1	E. Coliform	MPN	Must not be detected in any 100ml sample	32	HACH 10029	Does not Comply with limit
2	Fecal Coliform	MPN	Must not be detected in any 100ml sample	56	HACH 10029	Does not Comply with limit
3	Total Coliform	MPN	Must not be detected in any 100ml sample	88	HACH 10029	Does not Comply with limit
4	pH	-	6.5 – 8.5	7.92	ASTM D 1293 / US-EPA 150.2	Comply with limit
5	Color	TCU	≤ 15	2	HACH 8025	Comply with limit
6	Taste	-	Objectionable / Acceptable	Acceptable	Sensory Test	Comply with limit
7	Odor	-	Objectionable / Acceptable	Acceptable	Sensory Test	Comply with limit
8	Turbidity	NTU	< 5	1.08	US-EPA 180.1	Comply with limit
9	Total Hardness	mg/l	< 500	713	HACH 8213	Does not Comply with limit
10	TDS	mg/l	< 1000	1285	US-EPA 160.1	Does not Comply with limit
11	Aluminium	mg/l	≤ 0.2	0.16	USEPA 7000B	Comply with limit
12	Antimony	mg/l	≤ 0.005	ND	USEPA 7000B	Comply with limit
13	Arsenic	mg/l	≤ 0.05	0.014	USEPA 206.3	Comply with limit
14	Barium	mg/l	0.7	0.197	USEPA 7000B	Comply with limit
15	Boron	mg/l	0.3	ND	HACH 8015	Comply with limit
16	Cadmium	mg/l	0.01	ND	USEPA 7000B	Comply with limit
17	Chloride	mg/l	< 250	179	US-EPA 300.1 / HACH 8206	Comply with limit
18	Chromium	mg/l	≤ 0.05	0.019	USEPA 7000B	Comply with limit
19	Copper	mg/l	2	0.008	USEPA 7000B	Comply with limit
20	Cyanide	mg/l	≤ 0.05	ND	HACH 8027	Comply with limit
21	Fluoride	mg/l	≤ 1.5	0.23	US-EPA 300.1 / HACH 8029	Comply with limit
22	Lead	mg/l	≤ 0.05	ND	USEPA 7000B	Comply with limit
23	Manganese	mg/l	≤ 0.5	ND	USEPA 7000B	Comply with limit
24	Mercury	mg/l	≤ 0.001	ND	USEPA 245.1	Comply with limit
25	Nickel	mg/l	≤ 0.02	ND	USEPA 7000B	Comply with limit
26	Nitrate	mg/l	≤ 50	8	US-EPA 300.1 / HACH 8171	Comply with limit
27	Nitrite	mg/l	≤ 3	ND	HACH 8507	Comply with limit
28	Selenium	mg/l	0.01	ND	D3859-93A	Comply with limit
29	Residual Chlorine	mg/l	0.2 - 0.5	ND	HACH 8210	Does not Comply with limit
30	Zinc	mg/l	5	0.141	USEPA 7000B	Comply with limit

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**Table 3.3:** Drinking Water Monitoring Results of near Dawood Engineering University

S. No.	Parameters	Unit	*NSDWQ	Results	Method	Remarks
1	E. Coliform	MPN	Must not be detected in any 100ml sample	ND	HACH 10029	Comply with limit
2	Fecal Coliform	MPN	Must not be detected in any 100ml sample	ND	HACH 10029	Comply with limit
3	Total Coliform	MPN	Must not be detected in any 100ml sample	ND	HACH 10029	Comply with limit
4	pH	-	6.5 – 8.5	7.92	ASTM D 1293 / US-EPA 150.2	Comply with limit
5	Color	TCU	≤ 15	2	HACH 8025	Comply with limit
6	Taste	-	Objectionable / Acceptable	Acceptable	Sensory Test	Comply with limit
7	Odor	-	Objectionable / Acceptable	Acceptable	Sensory Test	Comply with limit
8	Turbidity	NTU	< 5	1.18	US-EPA 180.1	Comply with limit
9	Total Hardness	mg/l	< 500	279	HACH 8213	Comply with limit
10	TDS	mg/l	< 1000	431	US-EPA 160.1	Comply with limit
11	Aluminium	mg/l	≤ 0.2	0.05	USEPA 7000B	Comply with limit
12	Antimony	mg/l	≤ 0.005	ND	USEPA 7000B	Comply with limit
13	Arsenic	mg/l	≤ 0.05	ND	USEPA 206.3	Comply with limit
14	Barium	mg/l	0.7	0.112	USEPA 7000B	Comply with limit
15	Boron	mg/l	0.3	ND	HACH 8015	Comply with limit
16	Cadmium	mg/l	0.01	ND	USEPA 7000B	Comply with limit
17	Chloride	mg/l	< 250	81	US-EPA 300.1 / HACH 8206	Comply with limit
18	Chromium	mg/l	≤ 0.05	0.006	USEPA 7000B	Comply with limit
19	Copper	mg/l	2	0.013	USEPA 7000B	Comply with limit
20	Cyanide	mg/l	≤ 0.05	ND	HACH 8027	Comply with limit
21	Fluoride	mg/l	≤ 1.5	0.14	US-EPA 300.1 / HACH 8029	Comply with limit
22	Lead	mg/l	≤ 0.05	ND	USEPA 7000B	Comply with limit
23	Manganese	mg/l	≤ 0.5	ND	USEPA 7000B	Comply with limit
24	Mercury	mg/l	≤ 0.001	ND	USEPA 245.1	Comply with limit
25	Nickel	mg/l	≤ 0.02	ND	USEPA 7000B	Comply with limit
26	Nitrate	mg/l	≤ 50	3	US-EPA 300.1 / HACH 8171	Comply with limit
27	Nitrite	mg/l	≤ 3	ND	HACH 8507	Comply with limit
28	Selenium	mg/l	0.01	ND	D3859-93A	Comply with limit
29	Residual Chlorine	mg/l	0.2 - 0.5	0.05	HACH 8210	Does not Comply with limit
30	Zinc	mg/l	5	0.049	USEPA 7000B	Comply with limit

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**NOISE LEVEL MONITORING**

Noise levels were recorded by using noise level meter at client identified locations/points. Measurement of noise level was made at different distance from the source while facing the instruments towards the road side. The measurement of noise levels was made on the "A weighted Scale" in slow response mode in terms of decibel scale dB(A). 24 readings were taken at each site on hourly interval basis. In every hour at each site, three readings have been taken for duration 1.5 minutes with an interval of ½ minute. The entire noise measured data are presented in dB(A) Leq in the table 4.1(a), 4.1 (b) and 4.1 (c).

The recorded data of noise is compared for compliance with SEQs for Ambient Noise. The following color scheme is adopted to better understand the compliance status of each reading.

Color Scheme	
	Below SEQs
	Higher than SEQs

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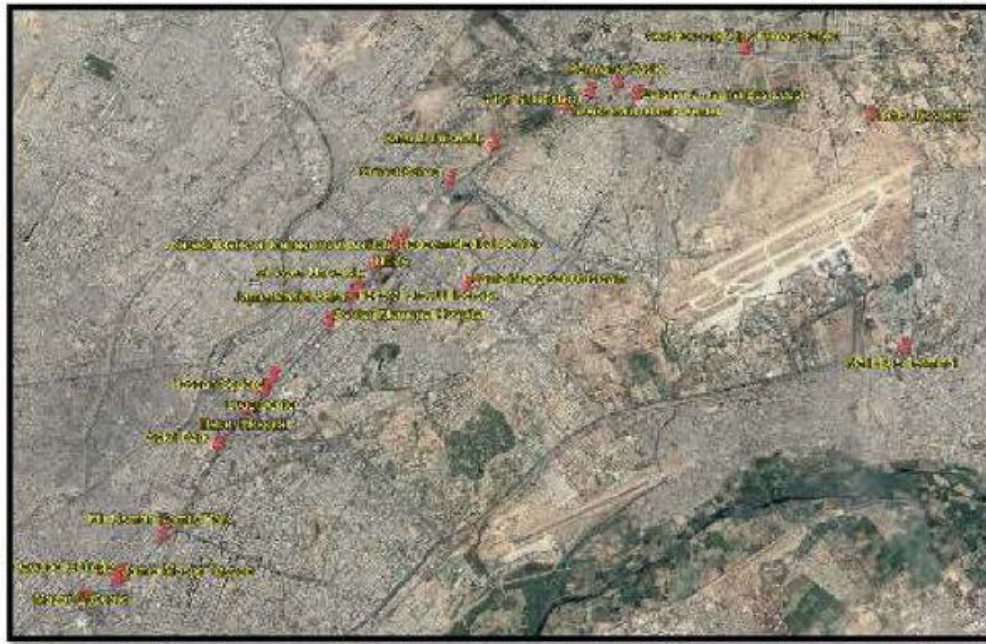


Figure 8: Satellite Image of Noise Levels Monitoring Sites

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**Table 4.1(a) : Noise Level Monitoring in results dB(A) Leq**

Time	Site Names/Locations									
	Mazar e quaid	Dawood College	Mir Usman Family Park	Askri Park	Babar Hospital	Civic Center	Federal Urdu University	NEPA	Hasan Sq.	Jamia Masjid Akbar
	15,16 (Feb-18)	15,16 (Feb-18)	15,16 (Feb-18)	15,16 (Feb-18)	15,16 (Feb-18)	15,16 (Feb-18)	15,16 (Feb-18)	15,16 (Feb-18)	15,16 (Feb-18)	16,17 (Feb-18)
	Latitude and Longitude									
	24° 52' 36.94"	24° 52' 44.53"	24° 52' 59.58"	24° 53' 38.35"	24° 53' 53.22"	24° 54' 1.17"	24° 54' 41.64"	24° 55' 3.17"	24° 54' 6.83"	24° 54' 43.55"
	67° 02' 27.05"	67° 02' 50.41"	67° 03' 13.69"	67° 03' 50.85"	67° 04' 9.51"	67° 04' 20.89"	67° 05' 20.1"	67° 05' 49.17"	67° 04' 26.83"	67° 05' 23.92"
0000	60.1	58.1	46.8	50.5	51.1	49	56.3	52.8	59.2	50.1
0100	60.6	56.8	48.1	50.1	52.8	48.5	56.6	50.5	48.1	45.5
0200	57.7	54.5	43.5	51	50.8	43.8	50.3	48.5	46.2	46.5
0300	53.5	56.3	42.5	45.3	49.1	42.8	49.3	50.3	43.5	45.4
0400	50.7	50.8	44.1	44.1	49	42.8	46.8	51	50.1	47.5
0500	51.1	51.8	47.1	48.1	44.7	47.1	46.5	47.6	54.5	46.3
0600	57	60.1	46.2	48.1	47.8	45.8	50.5	48.5	61.6	45.8
0700	61.5	62.1	51	50.6	51.8	73.8	54.8	64.8	63	52.1
0800	69.1	70.6	51.1	56.2	53.3	77.6	70.5	59.1	68	54.3
0900	73.8	73.1	50.5	58.1	52.5	78.1	73.1	54.3	72.5	60.1
1000	77.1	79.1	52.8	60.1	54.1	83	76.8	77.1	75.5	64.1
1100	79.7	82.5	55.8	62.3	59.1	82.3	80.3	80.6	75.9	72
1200	77.5	82.4	57.8	63.3	61.8	83.1	82.8	76.6	72.9	74.1
1300	79.6	82.3	59.5	66.1	65.1	83.8	77.5	82.3	76.6	75.7
1400	77.6	77.6	69.5	64.8	66.2	82.3	77.3	78.8	78.5	78.8
1500	79.8	80.5	67.8	67.1	69.1	78.5	80.3	81.2	79.5	76.6
1600	82	82.3	69.8	72.3	73.8	79.8	81.1	81.1	81.1	82.3
1700	82.3	84.6	70.8	72.3	76.5	83.3	75.3	77.1	79	78.5
1800	77.6	82.1	72.8	76.2	77.5	76.5	75.7	77.6	77.6	79.1
1900	77.8	80.8	70.3	76.6	77.6	78.1	74.3	76.5	70	70.5
2000	73.8	79.8	66.8	77.5	79.1	75.8	69.6	72.3	76.8	72.5
2100	69.5	76	60	71.8	73.1	72.5	66.5	70.6	72.3	69.5
2200	63.6	74	53.3	69.5	68.5	68.5	60	67	70.3	64.6
2300	62.3	60	50.5	59.2	59	59.5	56.8	63.8	64.8	59.2

Legends	
	Below SEQs
	Higher than SEQs

**AMBIENT AIR, NOISE AND WATER QUALITY MONITORING ALONG BRT RED LINE CORRIDOR, KARACHI**

**Table 4.1 (b):** Noise Level Monitoring in results dB(A) Leq

Time	Site Names/Locations								
	Sir Syed University	Nadeem Medical Center	Karachi National Mgt. Instute	Jamia Madarsa t-ul-Islam	Chiniot School	Shiekh Zaid Islamic Centre	Govt Girls School	Rehmani a Mosque	GBGP School
	16,17 (Feb-18)	16,17 (Feb-18)	16,17 (Feb-18)	16,17 (Feb-18)	16,17 (Feb-18)	16,17 (Feb-18)	16,17 (Feb-18)	16,17 (Feb-18)	16,17 (Feb-18)
	Latitude and Longitude								
	24° 54' 55.11"	24° 55' 5"	24° 55' 7.06"	24° 54' 33.23"	24° 55' 35.46"	24° 56' 4.41"	24° 56' 8.84"	24° 56' 11.44"	24° 56' 15.62"
	67° 05' 36.21"	67° 05' 49.93"	67° 05' 55.63"	67° 06' 26.7"	67° 06' 30.84"	67° 07' 49.08"	67° 08' 6.57"	67° 08' 25.1"	67° 09' 47.7"
0000	53.5	51.3	49.8	50	51.8	63.7	61.3	48.8	65.1
0100	54	51.4	48.3	51	51.9	59.8	63.7	45	61.6
0200	49.5	49	45.3	48.3	50.3	55	58.5	46.5	61
0300	49.5	43.8	42.8	46.8	48.5	53.7	56.4	44.6	57.3
0400	44.4	41.1	44.4	44	47.3	53.9	54.1	42	53.8
0500	38.8	41.1	41.1	45	43.8	51.1	49.8	43.5	49.7
0600	39.8	46	43.8	45.8	45.8	46.8	46.1	44	48.2
0700	52.7	48.8	45.6	49.8	44.6	57	51	48.7	54.9
0800	71	58.7	47.2	58.7	55.1	59.9	58.3	50.4	62.1
0900	70.5	63.5	51.8	61	56	61.3	60.4	52.3	61.3
1000	71.8	71.8	53.1	65.9	61.1	63.3	63.8	62.5	67.4
1100	69.9	75.7	59.1	64.5	68.9	64.4	66	57.3	65.8
1200	71.8	79.3	65.8	66.4	71.4	64.7	67.2	64.7	71.9
1300	80.5	78.6	69.8	68.6	73.9	72.1	72.7	69	70.4
1400	78.2	79.4	73.5	68	70.7	74.9	71.1	67.9	75
1500	69	78.5	71.7	69.5	72.7	73.5	71	69.4	68.1
1600	77.2	80.8	76	74.7	75.9	76.9	74.5	72.6	75.9
1700	80.8	81.8	75.9	78.3	77.1	78.3	76.5	71.8	74.7
1800	80.8	79.1	76.5	73.5	76.1	75.9	76.4	69.3	70.5
1900	76.8	77.8	72.4	72.8	71.8	75.1	74.1	65.1	69
2000	80	77.5	72	71.1	70.3	71.3	71.7	60.8	70.1
2100	72.7	73.1	70.6	68.5	71.5	68.3	69	58.8	65.5
2200	69.5	68.9	70.1	64.3	65.6	68.2	66.5	60.2	67.9
2300	61.8	65.5	68.6	55	59.7	65.1	62.3	54.4	65

Legends	
	Below SEQs
	Higher than SEQs

**AMBIENT AIR, NOISE AND WATER QUALITY MONITORING ALONG BRT RED LINE CORRIDOR, KARACHI**

**Table 4.1 (c) : Noise Level Monitoring in results dB(A) Leq**

Time	Site Names/Locations					
	Tank Chowrangi	Karachi University	Ashfaq Memorial Hospital	Jamia Masjid Tayyab	Gulistan-e-Jauhar Bus Depot	Malir Bus Terminal
	22,23 (Jan-18)	23,24 (Jan-18)	24,25 (Jan-18)	25,26 (Jan-18)	14,15 (Feb-18)	15,16 (Feb-18)
	Latitude and Longitude					
	24° 55' 20.3"	24° 55' 50.1"	24° 54' 30.4"	24° 52' 43.8"	24° 56' 2.23"	24° 56' 2.23"
	67° 10' 50.5"	67° 07' 1.1"	67° 05' 3.7"	67° 02' 45.8"	67° 08' 33.64"	67° 08' 33.64"
0000	56.5	56.3	65.6	58.3	47.7	57.8
0100	59.8	52.6	61	56.9	44.6	55.4
0200	57	57.8	63.3	54.2	46.8	51.7
0300	58.6	52.4	60.8	59.4	43.9	55.9
0400	55.5	55.9	57.9	63.9	49.1	57
0500	53.3	60.6	56.2	67.2	45.6	58.8
0600	52.4	65.9	58.4	74.6	51.6	60.2
0700	54.9	67.3	66.4	76.5	56.4	63.3
0800	53.3	69.2	78.5	68.9	61.7	63.9
0900	70.1	62.7	77.1	65.7	59.2	66.2
1000	63.3	68.2	72.8	70.5	60.3	60.4
1100	64.9	65.6	68.2	66.3	60.1	60.8
1200	67.4	66.7	71.6	67.8	60.8	64.7
1300	71.1	64.3	68.2	72.9	62.8	61.6
1400	65.8	67.5	70.1	74.7	62.3	60.3
1500	69.3	68.7	66.9	78.1	64.4	65.4
1600	78.4	70.3	68.5	79.5	63.1	64.3
1700	77.1	72.8	72.4	74.7	60.6	62.1
1800	75.9	71.9	80.6	73.5	59	60.1
1900	71.4	65.6	78.9	75.3	60.1	58.2
2000	71.3	70.1	70.6	70.4	58.7	59.1
2100	61.8	67.8	75.1	65.1	57.6	58.6
2200	62.1	69.9	72.8	59.6	56.6	59.7
2300	57.5	61.5	76.8	61.8	54.7	62.3

Legends	
	Below SEQS
	Higher than SEQS



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**AMBIENT AIR, NOISE AND WATER QUALITY MONITORING ALONG BRT RED LINE CORRIDOR, KARACHI**

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**5.0 Conclusion**

The study report indicates that the average levels of Oxides of Nitrogen, Sulphur Dioxide, Carbon Monoxide, Ozone, Particulate Matter (PM<sub>2.5</sub>, PM<sub>10</sub> and SPM) and Lead were well within the prescribed limits of SEQs (see Table 3 for reference). Similarly, most of the parameters were compliant with the SSDWQ for drinking water samples except E.Coli, Fecal Coliform and Total Coliform at Ashfaq Memorial Hospital and Hydrant Water of Race course. Moreover, noise levels were found higher than prescribed limits in SEQs at different sites.

**AMBIENT AIR, NOISE AND WATER QUALITY MONITORING ALONG BRT RED LINE CORRIDOR, KARACHI**

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# **Annexure-A**

## **(Detail Monitoring Data)**

### AMBIENT AIR, NOISE AND WATER QUALITY MONITORING ALONG BRT RED LINE CORRIDOR, KARACHI

<b>PROJECT</b>	Ambient Air Quality and Noise Level Monitoring along BRT Red Karachi	<b>CLIENT</b>	MM Pakistan (Pvt.) Ltd.
<b>SITE ID</b>	Near Tank Chowrangi	<b>COORDINATES</b>	24° 55' 20.3"N, 67°10' 50.5"E

S. No	Date	Time	NO ( $\mu\text{g}/\text{m}^3$ )	NO <sub>2</sub> ( $\mu\text{g}/\text{m}^3$ )	NO <sub>x</sub> ( $\mu\text{g}/\text{m}^3$ )	CO ( $\text{mg}/\text{m}^3$ )	SO <sub>2</sub> ( $\mu\text{g}/\text{m}^3$ )	O <sub>3</sub> ( $\mu\text{g}/\text{m}^3$ )	PM <sub>2.5</sub> ( $\mu\text{g}/\text{m}^3$ )	PM <sub>10</sub> ( $\mu\text{g}/\text{m}^3$ )	SPM ( $\mu\text{g}/\text{m}^3$ )	Lead ( $\mu\text{g}/\text{m}^3$ )
1	22/01/2018	1800	6.6	19.3	25.9	1.9	17.3	21	57	114	361	0.19
2	22/01/2018	1900	8.1	23.8	31.9	2.3	16.9	23				
3	22/01/2018	2000	8.38	29.77	38.15	2.3	16.8	19				
4	22/01/2018	2100	5.6	20.4	26	1.9	16.8	15				
5	22/01/2018	2200	4.3	14.9	19.2	2.0	16.8	14				
6	22/01/2018	2300	5.2	20.1	25.3	1.8	16.8	15				
7	22/01/2018	0000	4.3	12.8	17.1	2.0	17.4	15				
8	22/01/2018	0100	5.2	16.5	21.7	2.3	17.2	15				
9	22/01/2018	0200	2.2	11.1	13.3	1.9	18.9	14				
10	22/01/2018	0300	2.7	10	12.7	1.9	17.9	13				
11	22/01/2018	0400	2.4	10.1	12.5	2.0	18.4	13				
12	22/01/2018	0500	1.6	10.6	12.2	2.1	17.2	11				
13	23/01/2018	0600	4.9	17.2	22.1	1.9	16.1	10				
14	23/01/2018	0700	7.9	25.7	33.6	2.0	17.4	10				

**AMBIENT AIR, NOISE AND WATER QUALITY MONITORING ALONG BRT RED LINE CORRIDOR, KARACHI**

15	23/01/2018	0800	7.8	26.1	33.9	1.9	15.7	9				
16	23/01/2018	0900	8.3	23.9	32.2	1.4	16.8	9				
17	23/01/2018	1000	0.7	26.4	27.1	2.0	16.7	12				
18	23/01/2018	1100	11.7	27.5	39.2	2.2	8.5	12				
19	23/01/2018	1200	10.5	23.8	34.3	1.3	6.0	16				
20	23/01/2018	1300	8.7	20.1	28.8	1.1	15.4	13				
21	23/01/2018	1400	6.3	12.9	19.2	1.1	12.7	12				
22	23/01/2018	1500	5.7	18.1	23.8	1.2	15.9	12				
23	23/01/2018	1600	7.6	22.2	29.8	1.2	11.2	10				
24	23/01/2018	1700	8.7	24.6	33.3	1.2	13.7	12				
25	23/01/2018	1800	2.8	25.2	28	1.1	9.1	15				
<b>Max</b>			<b>11.7</b>	<b>29.8</b>	<b>39.2</b>	<b>2.3</b>	<b>18.9</b>	<b>23.0</b>	<b>57</b>	<b>114</b>	<b>361</b>	<b>0.19</b>
<b>Min</b>			<b>0.7</b>	<b>10.0</b>	<b>12.2</b>	<b>1.1</b>	<b>6.0</b>	<b>8.8</b>				
<b>Avg</b>			<b>5.9</b>	<b>19.7</b>	<b>25.7</b>	<b>1.8</b>	<b>15.3</b>	<b>13.6</b>				

### AMBIENT AIR, NOISE AND WATER QUALITY MONITORING ALONG BRT RED LINE CORRIDOR, KARACHI

<b>PROJECT</b>	Ambient Air Quality and Noise Level Monitoring along BRT Red Karachi	<b>CLIENT</b>	MM Pakistan (Pvt.) Ltd.
<b>SITE ID</b>	Karachi University	<b>COORDINATES</b>	24° 55' 50.1" N, 67°07' 1.1" E

S. No	Date	Time	NO ( $\mu\text{g}/\text{m}^3$ )	NO <sub>2</sub> ( $\mu\text{g}/\text{m}^3$ )	NO <sub>x</sub> ( $\mu\text{g}/\text{m}^3$ )	CO ( $\text{mg}/\text{m}^3$ )	SO <sub>2</sub> ( $\mu\text{g}/\text{m}^3$ )	O <sub>3</sub> ( $\mu\text{g}/\text{m}^3$ )	PM <sub>2.5</sub> ( $\mu\text{g}/\text{m}^3$ )	PM <sub>10</sub> ( $\mu\text{g}/\text{m}^3$ )	SPM ( $\mu\text{g}/\text{m}^3$ )	Lead ( $\mu\text{g}/\text{m}^3$ )
1	23/01/2018	1900	22.7	32.4	55.1	2.5	12.6	22	57	133	391	0.21
2	23/01/2018	2000	22.6	48.5	71.1	2.7	14.1	17				
3	23/01/2018	2100	25.1	52.3	77.4	2.9	15.2	21				
4	23/01/2018	2200	29.4	43.7	73.1	3.1	16	18				
5	23/01/2018	2300	22.5	36.2	58.7	2.2	12.4	18				
6	24/01/2018	0000	24	41.1	65.1	1.9	13.9	15				
7	24/01/2018	0100	19.8	34.3	54.1	1.8	14.2	12				
8	24/01/2018	0200	17.3	35.8	53.1	1.6	17.9	14				
9	24/01/2018	0300	15.3	28.2	43.5	1.5	16.5	14				
10	24/01/2018	0400	16.7	33.5	50.2	1.3	13.1	13				
11	24/01/2018	0500	15.7	42.7	58.4	1.2	16.3	14				

**AMBIENT AIR, NOISE AND WATER QUALITY MONITORING ALONG BRT RED LINE CORRIDOR, KARACHI**

12	24/01/2018	0600	22.5	49.1	71.6	1.9	18.2	12				
13	24/01/2018	0700	32.6	48.6	81.2	2.4	21.0	18				
14	24/01/2018	0800	29.8	50.4	80.2	3.2	22.0	22				
15	24/01/2018	0900	33.2	65.5	98.7	3.3	21.0	22				
16	24/01/2018	1000	61.2	105	166.2	3.7	20.0	31				
17	24/01/2018	1100	51.62	84.95	136.5	5.9	22.6	32				
18	24/01/2018	1200	23.5	73.4	96.9	3.4	25.1	34				
19	24/01/2018	1300	26.7	45.9	72.6	2.6	29.4	32				
20	24/01/2018	1400	28.4	55.2	83.6	2.9	20.2	32				
21	24/01/2018	1500	15.1	48.5	63.6	2.7	12.5	36				
22	24/01/2018	1600	20.8	66.4	87.2	2.5	17.6	31				
23	24/01/2018	1700	32.7	53.1	85.8	3.2	22.8	34				
24	24/01/2018	1800	36.6	49.1	85.7	3.3	23.3	24				
25	24/01/2018	1900	34.9	43.3	78.2	3.8	18.7	22				
<b>Max</b>			<b>61.2</b>	<b>105.0</b>	<b>166.2</b>	<b>5.9</b>	<b>29.4</b>	<b>36.0</b>	57	133	391	0.21
<b>Min</b>			<b>15.1</b>	<b>28.2</b>	<b>43.5</b>	<b>1.2</b>	<b>12.4</b>	<b>12.0</b>				
<b>Avg</b>			<b>27.2</b>	<b>50.7</b>	<b>77.9</b>	<b>2.7</b>	<b>18.3</b>	<b>22.4</b>				

### AMBIENT AIR, NOISE AND WATER QUALITY MONITORING ALONG BRT RED LINE CORRIDOR, KARACHI

<b>PROJECT</b>	Ambient Air Quality and Noise Level Monitoring along BRT Red Karachi	<b>CLIENT</b>	MM Pakistan (Pvt.) Ltd.
<b>SITE ID</b>	Ashfaq Memorial Hospital	<b>COORDINATES</b>	24° 54' 30.4" N, 67°05' 3.7" E

S. No	Date	Time	NO ( $\mu\text{g}/\text{m}^3$ )	NO <sub>2</sub> ( $\mu\text{g}/\text{m}^3$ )	NO <sub>x</sub> ( $\mu\text{g}/\text{m}^3$ )	CO ( $\text{mg}/\text{m}^3$ )	SO <sub>2</sub> ( $\mu\text{g}/\text{m}^3$ )	O <sub>3</sub> ( $\mu\text{g}/\text{m}^3$ )	PM <sub>2.5</sub> ( $\mu\text{g}/\text{m}^3$ )	PM <sub>10</sub> ( $\mu\text{g}/\text{m}^3$ )	SPM ( $\mu\text{g}/\text{m}^3$ )	Lead ( $\mu\text{g}/\text{m}^3$ )
1	24/01/2018	2000	31.4	54.8	86.2	3.9	25.2	17	65	126	410	0.25
2	24/01/2018	2100	22.9	39.1	62	4.1	27.6	15				
3	24/01/2018	2200	25.7	43.1	68.8	3.8	30.8	16				
4	24/01/2018	2300	18.2	45.9	64.1	4.1	31.9	18				
5	24/01/2018	0000	16.4	23.7	40.1	3.5	25.5	12				
6	25/01/2018	0100	22.7	29.2	51.9	3.0	28.2	15				
7	25/01/2018	0200	20.9	25.7	46.6	2.6	22.1	14				
8	25/01/2018	0300	18.1	29.2	47.3	2.5	18.4	15				
9	25/01/2018	0400	17.6	30.4	48	2.2	18.7	15				
10	25/01/2018	0500	20.2	32.1	52.3	2.4	20.3	17				
11	25/01/2018	0600	21.4	33.8	55.2	2.2	12.9	15				

**AMBIENT AIR, NOISE AND WATER QUALITY MONITORING ALONG BRT RED LINE CORRIDOR, KARACHI**

12	25/01/2018	0700	20.8	35.1	55.9	2.7	12.6	17				
13	25/01/2018	0800	29.7	40.5	70.2	3.4	16.7	18				
14	25/01/2018	0900	30.9	55.3	86.2	4.1	24.5	21				
15	25/01/2018	1000	32.1	69.2	101.3	4.5	32.5	25				
16	25/01/2018	1100	32.4	73.7	106.1	4.2	35.7	40				
17	25/01/2018	1200	33.6	51.9	85.5	3.6	34.9	21				
18	25/01/2018	1300	29.5	42.6	72.1	3.2	32.1	23				
19	25/01/2018	1400	27.3	37.7	65	3.4	28.5	27				
20	25/01/2018	1500	22.9	36.2	59.1	3.0	23.9	34				
21	25/01/2018	1600	20.7	35.1	55.8	2.5	32.5	35				
22	25/01/2018	1700	28.2	34.8	63	2.7	30.2	33				
23	25/01/2018	1800	22.9	36.9	59.8	3.3	28.5	23				
24	25/01/2018	1900	25.9	54.9	80.8	3.6	22.6	20				
25	25/01/2018	2000	32.1	62.5	94.6	3.5	20.2	20				
<b>Max</b>			<b>33.6</b>	<b>73.7</b>	<b>106.1</b>	<b>4.5</b>	<b>35.7</b>	<b>40.0</b>	<b>65</b>	<b>126</b>	<b>410</b>	<b>0.25</b>
<b>Min</b>			<b>16.4</b>	<b>23.7</b>	<b>40.1</b>	<b>2.2</b>	<b>12.6</b>	<b>12.0</b>				
<b>Avg</b>			<b>25.0</b>	<b>42.1</b>	<b>67.1</b>	<b>3.3</b>	<b>25.5</b>	<b>21.0</b>				



### AMBIENT AIR, NOISE AND WATER QUALITY MONITORING ALONG BRT RED LINE CORRIDOR, KARACHI

<b>PROJECT</b>	Ambient Air Quality and Noise Level Monitoring along BRT Red Karachi	<b>CLIENT</b>	MM Pakistan (Pvt.) Ltd.
<b>SITE ID</b>	Jamia Masjid Tayyab	<b>COORDINATES</b>	24° 52' 43.8" N, 67°02' 45.8" E

S. No	Date	Time	NO ( $\mu\text{g}/\text{m}^3$ )	NO <sub>2</sub> ( $\mu\text{g}/\text{m}^3$ )	NO <sub>x</sub> ( $\mu\text{g}/\text{m}^3$ )	CO ( $\text{mg}/\text{m}^3$ )	SO <sub>2</sub> ( $\mu\text{g}/\text{m}^3$ )	O <sub>3</sub> ( $\mu\text{g}/\text{m}^3$ )	PM <sub>2.5</sub> ( $\mu\text{g}/\text{m}^3$ )	PM <sub>10</sub> ( $\mu\text{g}/\text{m}^3$ )	SPM ( $\mu\text{g}/\text{m}^3$ )	Lead ( $\mu\text{g}/\text{m}^3$ )
1	25/01/2018	2100	32.1	76.2	108.3	3.2	32.1	14	49	128	390	0.28
2	25/01/2018	2200	33.5	67.7	101.2	2.9	31.7	15				
3	25/01/2018	2300	34.4	82.2	116.6	3.1	29.5	16				
4	26/01/2018	0000	27.3	65.3	92.6	3.0	27.8	17				
5	26/01/2018	0100	12.7	41.5	54.2	2.8	25.1	17				
6	26/01/2018	0200	10.2	22.1	32.3	2.7	19.7	22				
7	26/01/2018	0300	9.5	24.3	33.8	2.6	18.2	18				
8	26/01/2018	0400	9.7	24.8	34.5	2.1	18.8	19				
9	26/01/2018	0500	10.6	27.2	37.8	1.8	17.6	18				
10	26/01/2018	0600	11.9	28.7	40.6	1.7	19.2	18				
11	26/01/2018	0700	16.3	29.2	45.5	2.2	19.1	19				

**AMBIENT AIR, NOISE AND WATER QUALITY MONITORING ALONG BRT RED LINE CORRIDOR, KARACHI**

12	26/01/2018	0800	31.4	30.9	62.3	2.9	26.5	20				
13	26/01/2018	0900	34.8	42.3	77.1	3.3	30.6	21				
14	26/01/2018	1000	34.3	58.4	92.7	3.2	32.2	21				
15	26/01/2018	1100	34.8	63.7	98.5	3.6	33.4	20				
16	26/01/2018	1200	35.3	65.9	101.2	3.2	33.9	22				
17	26/01/2018	1300	33.8	52.1	85.9	3.3	34.7	28				
18	26/01/2018	1400	34.9	55.4	90.3	2.1	35.8	33				
19	26/01/2018	1500	35.9	48.8	84.7	1.9	36.6	33				
20	26/01/2018	1600	35.7	43.5	79.2	2.2	34.2	32				
21	26/01/2018	1700	33.6	43.7	77.3	2.5	37.9	27				
22	26/01/2018	1800	34.1	42.8	76.9	3.3	38.3	31				
23	26/01/2018	1900	34.7	39.4	74.1	3.2	39.5	30				
24	26/01/2018	2000	34.2	42.4	76.6	3.4	40.2	27				
25	26/01/2018	2100	35.8	43.6	79.4	3.1	37.6	25				
<b>Max</b>			<b>35.9</b>	<b>82.2</b>	<b>116.6</b>	<b>3.6</b>	<b>40.2</b>	<b>33.0</b>	<b>49</b>	<b>128</b>	<b>390</b>	<b>0.28</b>
<b>Min</b>			<b>9.5</b>	<b>22.1</b>	<b>32.3</b>	<b>1.7</b>	<b>17.6</b>	<b>14.0</b>				
<b>Avg</b>			<b>27.7</b>	<b>46.5</b>	<b>74.1</b>	<b>2.8</b>	<b>30.0</b>	<b>22.5</b>				

### AMBIENT AIR, NOISE AND WATER QUALITY MONITORING ALONG BRT RED LINE CORRIDOR, KARACHI

<b>PROJECT</b>	<b>Ambient Air Quality and Noise Level Monitoring along BRT Red Karachi</b>	<b>CLIENT</b>	<b>MM Pakistan (Pvt.) Ltd.</b>
<b>SITE ID</b>	<b>Gulistan-e-Jauhar Bus Depot</b>	<b>COORDINATES</b>	<b>24° 56' 2.23" N, 67°08' 33.64" E</b>

S. No	Date	Time	NO ( $\mu\text{g}/\text{m}^3$ )	NO <sub>2</sub> ( $\mu\text{g}/\text{m}^3$ )	NO <sub>x</sub> ( $\mu\text{g}/\text{m}^3$ )	CO ( $\text{mg}/\text{m}^3$ )	SO <sub>2</sub> ( $\mu\text{g}/\text{m}^3$ )	O <sub>3</sub> ( $\mu\text{g}/\text{m}^3$ )	PM 2.5 ( $\mu\text{g}/\text{m}^3$ )	PM 10 ( $\mu\text{g}/\text{m}^3$ )	SPM ( $\mu\text{g}/\text{m}^3$ )	Lead ( $\mu\text{g}/\text{m}^3$ )
1	14-02-18	1100	6.6	20.1	26.6	1.8	22.4	15	39	109	254	0.18
3	14-02-18	1200	7.0	20.9	27.9	1.8	23.1	16				
5	14-02-18	1300	6.4	20.7	27.1	1.8	21.1	16				
7	14-02-18	1400	7.1	20.5	27.6	1.9	22.0	16				
9	14-02-18	1500	6.8	20.1	26.9	1.7	19.2	15				
11	14-02-18	1600	6.7	19.6	26.3	1.9	20.5	16				
13	14-02-18	1700	6.8	18.7	25.5	1.7	21.8	16				
15	14-02-18	1800	6.9	20.3	27.2	1.7	23.3	16				
17	14-02-18	1900	7.3	20.5	27.8	1.6	25.8	14				
19	14-02-18	2000	7.1	21.1	28.2	1.6	26.2	12				
21	14-02-18	2100	7.4	21.1	28.5	1.5	26.9	12				
23	14-02-18	2200	6.9	21.1	28.0	1.2	27.5	13				
25	14-02-18	2300	6.9	20.3	27.2	1.2	24.5	13				
27	15-02-18	0000	6.9	20.3	27.1	1.2	23.2	7				

**AMBIENT AIR, NOISE AND WATER QUALITY MONITORING ALONG BRT RED LINE CORRIDOR, KARACHI**

29	15-02-18	0100	6.9	20.3	27.1	1.2	19.2	7				
31	15-02-18	0200	7.0	20.3	27.3	1.2	20.5	8				
33	15-02-18	0300	6.9	20.3	27.1	1.2	21.8	7				
35	15-02-18	0400	6.9	20.1	27.0	1.3	23.3	9				
37	15-02-18	0500	7.1	20.2	27.2	1.5	25.8	11				
39	15-02-18	0600	6.7	21.0	27.7	1.5	26.2	12				
41	15-02-18	0700	6.8	21.0	27.8	1.6	26.9	14				
43	15-02-18	0800	6.8	18.7	25.5	1.6	27.5	18				
45	15-02-18	0900	6.4	18.4	24.9	1.6	24.5	16				
47	15-02-18	1000	6.6	18.4	25.0	1.7	23.2	18				
48	15-02-18	1100	6.3	19.0	25.3	1.6	23.5	18				
<b>Max</b>			7.4	21.1	28.5	1.9	27.5	18.0	39	109	254	0.18
<b>Min</b>			6.3	18.4	24.9	1.2	19.2	7.0				
<b>Avg</b>			6.9	20.1	27.0	1.5	23.6	13.4				

### AMBIENT AIR, NOISE AND WATER QUALITY MONITORING ALONG BRT RED LINE CORRIDOR, KARACHI

<b>PROJECT</b>	Ambient Air Quality and Noise Level Monitoring along BRT Red Karachi	<b>CLIENT</b>	MM Pakistan (Pvt.) Ltd.
<b>SITE ID</b>	Malir Bus Depot Terminal KBRT	<b>COORDINATES</b>	24° 53' 8.21" N, 67°10' 23.8" E

S. No	Date	Time	NO ( $\mu\text{g}/\text{m}^3$ )	NO <sub>2</sub> ( $\mu\text{g}/\text{m}^3$ )	NO <sub>x</sub> ( $\mu\text{g}/\text{m}^3$ )	CO ( $\text{mg}/\text{m}^3$ )	SO <sub>2</sub> ( $\mu\text{g}/\text{m}^3$ )	O <sub>3</sub> ( $\mu\text{g}/\text{m}^3$ )	PM <sub>2.5</sub> ( $\mu\text{g}/\text{m}^3$ )	PM <sub>10</sub> ( $\mu\text{g}/\text{m}^3$ )	SPM ( $\mu\text{g}/\text{m}^3$ )	Lead ( $\mu\text{g}/\text{m}^3$ )
1	15-02-18	1200	9.3	26.7	36.0	2.3	35.5	21	62	141	368	0.33
3	15-02-18	1300	9.3	34.7	44.0	2.5	36.0	23				
5	15-02-18	1400	12	30.7	42.7	2.5	36.0	24				
7	15-02-18	1500	13.3	34.7	48.0	2.9	36.8	25				
9	15-02-18	1600	15.9	33.4	49.3	2.9	36.2	20				
11	15-02-18	1700	14.6	38.7	53.3	3.2	36.1	24				
13	15-02-18	1800	15.9	37.3	53.2	2.9	35.9	25				
15	15-02-18	1900	17.3	37.3	54.6	3.2	35.9	17				
17	15-02-18	2000	15.9	38.7	54.6	3.3	35.9	19				
19	15-02-18	2100	14.6	40.0	54.6	3.3	35.8	20				
21	15-02-18	2200	14.6	42.7	57.3	3.2	35.4	19				
23	15-02-18	2300	15.9	44.0	59.9	3.1	35.3	28				

**AMBIENT AIR, NOISE AND WATER QUALITY MONITORING ALONG BRT RED LINE CORRIDOR, KARACHI**

25	16-02-18	0000	15.9	42.7	58.6	3.5	34.8	31				
27	16-02-18	0100	17.3	41.3	58.6	3.3	35.0	33				
29	16-02-18	0200	15.9	44.0	59.9	2.9	35.0	35				
31	16-02-18	0300	15.9	42.7	58.6	2.7	36.1	25				
33	16-02-18	0400	15.9	38.7	54.6	2.5	36.2	24				
35	16-02-18	0500	12	38.7	50.7	2.7	36.5	24				
37	16-02-18	0600	12	38.7	50.7	2.5	35.9	23				
39	16-02-18	0700	10.6	40.0	50.6	2.3	35.6	28				
41	16-02-18	0800	9.3	37.3	46.6	2.8	35.8	27				
43	16-02-18	0900	12	38.7	50.7	3.2	35.8	25				
45	16-02-18	1000	10.6	34.7	45.3	3.8	35.9	27				
47	16-02-18	1100	13.3	36.0	49.3	3.7	35.5	21				
48	16-02-18	1200	12	36.0	48.0	4.1	35.5	23				
<b>Max</b>			<b>17.3</b>	<b>44.0</b>	<b>59.9</b>	<b>4.1</b>	<b>36.8</b>	<b>35</b>	62	141	368	0.33
<b>Min</b>			<b>9.3</b>	<b>26.7</b>	<b>36.0</b>	<b>2.3</b>	<b>34.8</b>	<b>17</b>				
<b>Avg</b>			<b>13.7</b>	<b>37.9</b>	<b>51.6</b>	<b>3.0</b>	<b>35.8</b>	<b>24.4</b>				

### AMBIENT AIR, NOISE AND WATER QUALITY MONITORING ALONG BRT RED LINE CORRIDOR, KARACHI

<b>PROJECT</b>	Ambient Air Quality and Noise Level Monitoring along BRT Red Karachi	<b>CLIENT</b>	MM Pakistan (Pvt.) Ltd.
<b>SITE ID</b>	Near Tank Chowrangi	<b>COORDINATES</b>	24° 55' 20.3" N, 67° 10' 50.5" E

Date	Time	Meteorological Parameters Measurements				
		Air Temperature (°C)	Humidity (%)	Pressure (hPa)	Wind direction (degree)	Wind speed (m/s)
22-01-18	1730	25	29	1009	270	5.7
22-01-18	1800	22	46	1011	270	5.1
22-01-18	1830	23	33	1009	270	5.1
22-01-18	1900	23	38	1010	270	5.1
22-01-18	1930	22	43	1010	270	4.6
22-01-18	2000	22	43	1010	270	6.2
22-01-18	2030	22	38	1011	225	2.2
22-01-18	2100	14	67	1012	Calm	Calm
22-01-18	2130	21	46	1011	270	4.6
22-01-18	2200	21	43	1012	250	4.1

### AMBIENT AIR, NOISE AND WATER QUALITY MONITORING ALONG BRT RED LINE CORRIDOR, KARACHI

22-01-18	2230	21	43	1012	250	3.1
22-01-18	2300	22	43	1012	270	6.2
22-01-18	2330	22	39	1012	270	6.2
23-01-18	0000	22	38	1012	270	6.2
23-01-18	0030	21	31	1012	270	6.2
23-01-18	0100	20	24	1011	290	6.2
23-01-18	0130	20	21	1011	290	3.6
23-01-18	0200	20	21	1011	315	2.6
23-01-18	0230	20	17	1011	259	2.1
23-01-18	0300	19	23	1011	315	2.1
23-01-18	0330	18	26	1011	259	2.6
23-01-18	0400	16	29	1011	290	3.1
23-01-18	0430	15	34	1012	225	3.1
23-01-18	0500	15	19	1011	315	2.1
23-01-18	0530	14	36	1012	315	2.6
23-01-18	0600	14	36	1012	340	3.1
23-01-18	0630	14	33	1012	340	4.1
23-01-18	0700	15	31	1012	315	1.5
23-01-18	0730	15	31	1012	315	1.5
23-01-18	0800	15	35	1012	Calm	Calm



### AMBIENT AIR, NOISE AND WATER QUALITY MONITORING ALONG BRT RED LINE CORRIDOR, KARACHI

23-01-18	0830	14	38	1013	Calm	Calm
23-01-18	0900	17	30	1014	Calm	Calm
23-01-18	0930	19	24	1014	Calm	Calm
23-01-18	1000	20	21	1015	Calm	Calm
23-01-18	1030	21	20	1015	Calm	Calm
23-01-18	1100	22	17	1015	Calm	Calm
23-01-18	1130	22	15	1015	315	2.1
23-01-18	1200	24	15	1014	Calm	Calm
23-01-18	1230	24	15	1014	290	2.1
23-01-18	1300	25	14	1013	25	2.6
23-01-18	1330	25	12	1012	315	2.1
23-01-18	1400	25	14	1012	290	2.6
23-01-18	1430	26	15	1011	290	2.6
23-01-18	1500	26	13	1012	250	2.1
23-01-18	1530	26	14	1011	25	2.1
23-01-18	1600	25	14	1011	225	2.6
23-01-18	1630	25	24	1011	225	5.1
23-01-18	1700	25	18	1011	225	2.1
23-01-18	1730	23	29	1012	250	3.6

### AMBIENT AIR, NOISE AND WATER QUALITY MONITORING ALONG BRT RED LINE CORRIDOR, KARACHI

<b>PROJECT</b>	Ambient Air Quality and Noise Level Monitoring along BRT Red Karachi	<b>CLIENT</b>	MM Pakistan (Pvt.) Ltd.
<b>SITE ID</b>	Karachi University	<b>COORDINATES</b>	24° 55' 50.1" N, 67°07' 1.1" E

Date	Time	Meteorological Parameters Measurements				
		Air Temperature (°C)	Humidity (%)	Pressure (hPa)	Wind direction (degree)	Wind speed (m/s)
23-01-18	1830	22	29	1012	225	4.6
23-01-18	1900	21	33	1012	200	3.6
23-01-18	1930	20	35	1013	250	2.6
23-01-18	2000	20	27	1011	225	2.1
23-01-18	2030	20	34	1014	270	4.6
23-01-18	2100	19	40	1014	270	2.6
23-01-18	2130	17	45	1014	Calm	Calm
23-01-18	2200	16	48	1014	Calm	Calm
23-01-18	2230	16	52	1014	Calm	Calm
23-01-18	2300	16	52	1014	Calm	Calm

### AMBIENT AIR, NOISE AND WATER QUALITY MONITORING ALONG BRT RED LINE CORRIDOR, KARACHI

23-01-18	2330	14	55	1014	Calm	Calm
24-01-18	0000	13	58	1013	Calm	Calm
24-01-18	0030	13	58	1013	25	2.1
24-01-18	0100	12	58	1013	25	1.5
24-01-18	0130	12	62	1013	45	1
24-01-18	0200	12	62	1013	Calm	Calm
24-01-18	0230	12	62	1013	45	1.5
24-01-18	0300	12	62	1013	25	1.5
24-01-18	0330	11	67	1013	25	2.1
24-01-18	0400	11	87	1013	Calm	Calm
24-01-18	0430	11	67	1013	45	3.1
24-01-18	0500	11	67	1013	45	1.5
24-01-18	0530	11	67	1013	25	2.1
24-01-18	0600	11	67	1014	25	2.1
24-01-18	0630	11	54	1014	Calm	Calm
24-01-18	0700	13	63	1014	25	2.1
24-01-18	0730	15	59	1015	25	1.5
24-01-18	0800	18	49	1015	45	2.1
24-01-18	0830	20	46	1016	90	2.6
24-01-18	0900	23	38	1016	70	2.6

**AMBIENT AIR, NOISE AND WATER QUALITY MONITORING ALONG BRT RED LINE CORRIDOR, KARACHI**

24-01-18	0930	23	38	1016	250	2.6
24-01-18	1000	23	29	1016	Calm	Calm
24-01-18	1030	24	38	1015	270	2.6
24-01-18	1100	25	34	1015	Calm	Calm
24-01-18	1130	25	32	1014	225	2.6
24-01-18	1200	26	34	1014	225	3.6
24-01-18	1230	26	34	1013	150	2.6
24-01-18	1300	26	34	1013	45	2.6
24-01-18	1330	26	34	1013	270	2.1
24-01-18	1400	26	34	1013	225	5.1
24-01-18	1430	25	34	1013	200	4.1
24-01-18	1500	25	34	1013	200	5.1
24-01-18	1530	24	41	1013	225	5.1
24-01-18	1600	24	41	1013	200	5.1
24-01-18	1630	24	33	1013	225	2.1
24-01-18	1700	23	44	1013	225	4.1
24-01-18	1730	23	44	1013	225	5.1
24-01-18	1800	22	46	1013	200	4.1
24-01-18	1830	22	46	1013	200	4.1

### AMBIENT AIR, NOISE AND WATER QUALITY MONITORING ALONG BRT RED LINE CORRIDOR, KARACHI

<b>PROJECT</b>	Ambient Air Quality and Noise Level Monitoring along BRT Red Karachi	<b>CLIENT</b>	MM Pakistan (Pvt.) Ltd.
<b>SITE ID</b>	Ashfaq Memorial Hospital	<b>COORDINATES</b>	24° 54' 30.4" N, 67°05' 3.7" E

Date	Time	Meteorological Parameters Measurements				
		Air Temperature (°C)	Humidity (%)	Pressure (hPa)	Wind direction (degree)	Wind speed (m/s)
24-01-18	1930	21	53	1014	225	4.1
24-01-18	2000	21	56	1014	200	3.1
24-01-18	2030	21	56	1014	Calm	Calm
24-01-18	2100	20	58	1014	200	2.1
24-01-18	2130	20	60	1014	200	2.1
24-01-18	2200	20	62	1014	180	2.6
24-01-18	2230	19	64	1014	180	2.1
24-01-18	2300	19	64	1014	180	2.1
24-01-18	2330	19	68	1015	Calm	Calm
25-01-18	0000	17	72	1014	270	2.6

**AMBIENT AIR, NOISE AND WATER QUALITY MONITORING ALONG BRT RED LINE CORRIDOR, KARACHI**

25-01-18	0030	17	72	1014	250	2.1
25-01-18	0100	16	77	1014	270	2.1
25-01-18	0130	16	77	1013	270	2.6
25-01-18	0200	15	77	1013	270	2.6
25-01-18	0230	15	77	1013	290	2.1
25-01-18	0300	15	82	1013	Calm	Calm
25-01-18	0330	14	82	1013	Calm	Calm
25-01-18	0400	15	77	1013	270	2.1
25-01-18	0430	14	82	1013	290	1.5
25-01-18	0500	14	82	1013	Calm	Calm
25-01-18	0530	14	82	1012	Calm	Calm
25-01-18	0600	13	82	1012	250	2.1
25-01-18	0630	13	72	1012	Calm	Calm
25-01-18	0700	13	82	1012	270	1.5
25-01-18	0730	13	82	1012	Calm	Calm
25-01-18	0800	13	82	1012	Calm	Calm
25-01-18	0830	13	88	1013	Calm	Calm
25-01-18	0900	13	82	1013	Calm	Calm
25-01-18	0930	14	77	1014	Calm	Calm
25-01-18	1000	14	78	1013	Calm	Calm

**AMBIENT AIR, NOISE AND WATER QUALITY MONITORING ALONG BRT RED LINE CORRIDOR, KARACHI**

25-01-18	1030	14	77	1014	Calm	Calm
25-01-18	1100	16	77	1014	Calm	Calm
25-01-18	1130	18	68	1014	Calm	Calm
25-01-18	1200	21	6	1015	250	1.5
25-01-18	1230	24	36	1015	Calm	Calm
25-01-18	1300	24	29	1014	270	1.5
25-01-18	1330	25	32	1014	270	3.1
25-01-18	1400	25	28	1014	270	4.1
25-01-18	1430	26	26	1013	250	1.5
25-01-18	1500	27	24	1013	270	2.1
25-01-18	1530	26	26	1012	270	2.1
25-01-18	1600	27	24	1012	250	2.6
25-01-18	1630	27	26	1012	225	2.1
25-01-18	1700	27	28	1011	200	4.1
25-01-18	1730	26	34	1011	225	4.1
25-01-18	1800	26	34	1011	225	3.6
25-01-18	1830	26	34	1011	225	4.1
25-01-18	1900	25	34	1011	250	4.1
25-01-18	1930	25	34	1011	225	5.1

### AMBIENT AIR, NOISE AND WATER QUALITY MONITORING ALONG BRT RED LINE CORRIDOR, KARACHI

<b>PROJECT</b>	Ambient Air Quality and Noise Level Monitoring along BRT Red Karachi	<b>CLIENT</b>	MM Pakistan (Pvt.) Ltd.
<b>SITE ID</b>	Jamia Masjid Tayyab	<b>COORDINATES</b>	24° 52' 43.8" N, 67°02' 45.8" E

Date	Time	Meteorological Parameters Measurements				
		Air Temperature (°C)	Humidity (%)	Pressure (hPa)	Wind direction (degree)	Wind speed (m/s)
25-01-18	2100	20	68	1013	250	3.1
25-01-18	2130	20	68	1013	250	3.1
25-01-18	2200	19	73	1013	250	2.6
25-01-18	2230	19	73	1013	250	2.6
25-01-18	2300	19	73	1013	250	3.1
25-01-18	2330	19	76	1013	Calm	Calm
26-01-18	0000	17	77	1013	250	3.1
26-01-18	0030	17	77	1013	225	3.1
26-01-18	0100	16	82	1013	250	2.6



### AMBIENT AIR, NOISE AND WATER QUALITY MONITORING ALONG BRT RED LINE CORRIDOR, KARACHI

26-01-18	0130	16	82	1013	250	2.6
26-01-18	0200	16	82	1012	Calm	Calm
26-01-18	0230	15	82	1012	Calm	Calm
26-01-18	0300	15	78	1012	Calm	Calm
26-01-18	0330	15	82	1012	Calm	Calm
26-01-18	0400	14	82	1012	Calm	Calm
26-01-18	0430	13	88	1012	Calm	Calm
26-01-18	0500	13	88	1012	Calm	Calm
26-01-18	0530	13	88	1012	Calm	Calm
26-01-18	0600	13	86	1012	Calm	Calm
26-01-18	0630	13	82	1012	Calm	Calm
26-01-18	0700	13	82	1012	Calm	Calm
26-01-18	0730	13	82	1013	Calm	Calm
26-01-18	0800	13	82	1013	Calm	Calm
26-01-18	0830	13	78	1013	Calm	Calm
26-01-18	0900	14	88	1014	Calm	Calm
26-01-18	0930	16	82	1014	Calm	Calm
26-01-18	1000	18	77	1015	Calm	Calm
26-01-18	1030	20	64	1015	Calm	Calm
26-01-18	1100	22	57	1015	Calm	Calm

### AMBIENT AIR, NOISE AND WATER QUALITY MONITORING ALONG BRT RED LINE CORRIDOR, KARACHI

26-01-18	1130	23	57	1015	Calm	Calm
26-01-18	1200	23	47	1016	Calm	Calm
26-01-18	1230	24	47	1015	Calm	Calm
26-01-18	1300	24	47	1015	Calm	Calm
26-01-18	1330	27	38	1014	Calm	Calm
26-01-18	1400	27	32	1013	Calm	Calm
26-01-18	1430	27	26	1013	200	2.1
26-01-18	1500	27	22	1013	180	Calm
26-01-18	1530	27	24	1012	200	2.1
26-01-18	1600	28	25	1012	225	3.1
26-01-18	1630	28	21	1011	250	2.1
26-01-18	1700	27	37	1011	250	3.1
26-01-18	1730	26	44	1011	225	4.1
26-01-18	1800	25	47	1011	225	4.1
26-01-18	1830	25	45	1012	225	Calm
26-01-18	1900	24	47	1011	200	4.6
26-01-18	1930	24	50	1012	225	4.1
26-01-18	2000	22	57	1012	250	4.1
26-01-18	2030	23	44	1012	Calm	Calm
26-01-18	2100	21	55	1013	250	3.6

### AMBIENT AIR, NOISE AND WATER QUALITY MONITORING ALONG BRT RED LINE CORRIDOR, KARACHI

<b>PROJECT</b>	Ambient Air Quality and Noise Level Monitoring along BRT Red Karachi	<b>CLIENT</b>	MM Pakistan (Pvt.) Ltd.
<b>SITE ID</b>	Gulistan-e-Jauhar Bus Depot	<b>COORDINATES</b>	24° 56' 2.23"N, 67° 08' 33.64"E

Date	Time	Meteorological Parameters Measurements				
		Air Temperature (°C)	Humidity (%)	Pressure (hPa)	Wind direction (degree)	Wind speed (m/s)
14-02-18	1100	24	34	1025	25	6.2
14-02-18	1130	24	32	1025	315	6.2
14-02-18	1200	25	32	1024	25	6.2
14-02-18	1230	26	32	1024	90	5.1
14-02-18	1300	26	3	1023	45	6.2
14-02-18	1330	27	26	1023	25	5.1
14-02-18	1400	27	26	1022	45	5.1
14-02-18	1430	28	23	1021	45	3.1
14-02-18	1500	28	21	1021	70	3.1

### AMBIENT AIR, NOISE AND WATER QUALITY MONITORING ALONG BRT RED LINE CORRIDOR, KARACHI

14-02-18	1530	29	19	1020	90	3.6
14-02-18	1600	29	18	1020	70	2.6
14-02-18	1630	28	19	1020	70	2.6
14-02-18	1700	28	17	1020	90	4.1
14-02-18	1730	28	19	1020	90	4.1
14-02-18	1800	28	19	1021	90	3.1
14-02-18	1830	26	21	1021	Calm	
14-02-18	1900	25	24	1022	Calm	
14-02-18	1930	25	27	1022	225	2.5
14-02-18	2000	24	29	1022	90	2.6
14-02-18	2030	23	31	1023	Calm	
14-02-18	2100	22	33	1023	25	2.1
14-02-18	2130	21	35	1023	70	2.6
14-02-18	2200	20	4	1022	45	2.6
14-02-18	2230	22	35	1022	Calm	
14-02-18	2300	19	43	1022	259	2.6
14-02-18	2330	19	46	1022	259	2.6
15-02-18	0000	15	59	1022	259	2.1

### AMBIENT AIR, NOISE AND WATER QUALITY MONITORING ALONG BRT RED LINE CORRIDOR, KARACHI

15-02-18	0030	15	59	1022	259	2.6
15-02-18	0100	19	44	1021	Calm	
15-02-18	0130	17	48	1021	Calm	
15-02-18	0200	16	55	1021	25	2.6
15-02-18	0230	16	55	1021	25	2.6
15-02-18	0300	16	55	1021	70	2.1
15-02-18	0330	16	55	1021	45	2.1
15-02-18	0400	16	55	1021	Calm	
15-02-18	0430	16	49	1020	Calm	
15-02-18	0500	16	55	1021	Calm	
15-02-18	0530	15	59	1021	45	1.5
15-02-18	0600	15	59	1021	70	2.1
15-02-18	0630	14	63	1021	70	2.1
15-02-18	0700	14	67	1021	70	2.1
15-02-18	0730	14	63	1021	70	2.6
15-02-18	0800	17	6	1022	Calm	
15-02-18	0830	14	63	1021	70	2.6
15-02-18	0900	17	55	1022	45	2.1

**AMBIENT AIR, NOISE AND WATER QUALITY MONITORING ALONG BRT RED LINE CORRIDOR, KARACHI**

15-02-18	0930	19	49	1023	70	2.6
15-02-18	1000	21	43	1023	70	2.6
15-02-18	1030	24	36	1023	70	2.1

### AMBIENT AIR, NOISE AND WATER QUALITY MONITORING ALONG BRT RED LINE CORRIDOR, KARACHI

<b>PROJECT</b>	Ambient Air Quality and Noise Level Monitoring along BRT Red Karachi	<b>CLIENT</b>	MM Pakistan (Pvt.) Ltd.
<b>SITE ID</b>	- Malir Bus Depot Terminal KBRT	<b>COORDINATES</b>	24° 53' 8.21"N, 67° 10' 23.8"E

Date	Time	Meteorological Parameters Measurements				
		Air Temperature (°C)	Humidity (%)	Pressure (hPa)	Wind direction (degree)	Wind speed (m/s)
14-02-18	1100	24	34	1025	25	6.2
14-02-18	1130	24	32	1025	315	6.2
14-02-18	1200	25	32	1024	25	6.2
14-02-18	1230	26	32	1024	90	5.1
14-02-18	1300	26	3	1023	45	6.2
14-02-18	1330	27	26	1023	25	5.1
14-02-18	1400	27	26	1022	45	5.1
14-02-18	1430	28	23	1021	45	3.1
14-02-18	1500	28	21	1021	70	3.1

### AMBIENT AIR, NOISE AND WATER QUALITY MONITORING ALONG BRT RED LINE CORRIDOR, KARACHI

14-02-18	1530	29	19	1020	90	3.6
14-02-18	1600	29	18	1020	70	2.6
14-02-18	1630	28	19	1020	70	2.6
14-02-18	1700	28	17	1020	90	4.1
14-02-18	1730	28	19	1020	90	4.1
14-02-18	1800	28	19	1021	90	3.1
14-02-18	1830	26	21	1021	Calm	
14-02-18	1900	25	24	1022	Calm	
14-02-18	1930	25	27	1022	225	2.5
14-02-18	2000	24	29	1022	90	2.6
14-02-18	2030	23	31	1023	Calm	
14-02-18	2100	22	33	1023	25	2.1
14-02-18	2130	21	35	1023	70	2.6
14-02-18	2200	20	4	1022	45	2.6
14-02-18	2230	22	35	1022	Calm	
14-02-18	2300	19	43	1022	259	2.6
14-02-18	2330	19	46	1022	259	2.6
15-02-18	0000	15	59	1022	259	2.1



**AMBIENT AIR, NOISE AND WATER QUALITY MONITORING ALONG BRT RED LINE CORRIDOR, KARACHI**

15-02-18	0030	15	59	1022	259	2.6
15-02-18	0100	19	44	1021	Calm	
15-02-18	0130	17	48	1021	Calm	
15-02-18	0200	16	55	1021	25	2.6
15-02-18	0230	16	55	1021	25	2.6
15-02-18	0300	16	55	1021	70	2.1
15-02-18	0330	16	55	1021	45	2.1
15-02-18	0400	16	55	1021	Calm	
15-02-18	0430	16	49	1020	Calm	
15-02-18	0500	16	55	1021	Calm	
15-02-18	0530	15	59	1021	45	1.5
15-02-18	0600	15	59	1021	70	2.1
15-02-18	0630	14	63	1021	70	2.1
15-02-18	0700	14	67	1021	70	2.1
15-02-18	0730	14	63	1021	70	2.6
15-02-18	0800	17	6	1022	Calm	
15-02-18	0830	14	63	1021	70	2.6
15-02-18	0900	17	55	1022	45	2.1

**AMBIENT AIR, NOISE AND WATER QUALITY MONITORING ALONG BRT RED LINE CORRIDOR, KARACHI**

15-02-18	0930	19	49	1023	70	2.6
15-02-18	1000	21	43	1023	70	2.6
15-02-18	1030	24	36	1023	70	2.1

**AMBIENT AIR, NOISE AND WATER QUALITY MONITORING ALONG BRT RED LINE CORRIDOR, KARACHI**

# **Annexure-B**

## **(Vibration Measurements)**

**AMBIENT AIR, NOISE AND WATER QUALITY MONITORING ALONG BRT RED LINE CORRIDOR, KARACHI**

Time	Tank Chowrangi	Karachi University	Nipa	Hasan Square	Ashfaq Hospital	Tayyab Masjid	Islamia College	Quaid e Azam Tomb
	Vibration (mm)	Vibration (mm)	Vibration (mm)	Vibration (mm)	Vibration (mm)	Vibration (mm)	Vibration (mm)	Vibration (mm)
	22, 23 (Jan-18)	23, 24 (Jan-18)	23, 24 (Jan-18)	23, 24 (Jan-18)	24, 25 (Jan-18)	25, 26 (Jan-18)	25, 26 (Jan-18)	25, 26 (Jan-18)
0000	0.018	0.023	0.028	0.032	0.021	0.03	0.024	0.029
0200	0.01	0.015	0.026	0.029	0.018	0.021	0.025	0.023
0400	0.01	0.018	0.022	0.024	0.022	0.018	0.028	0.032
0600	0.035	0.029	0.031	0.035	0.039	0.034	0.027	0.036
0800	0.052	0.044	0.048	0.061	0.076	0.065	0.052	0.06
1000	0.07	0.043	0.047	0.032	0.038	0.045	0.03	0.051
1200	0.058	0.029	0.036	0.034	0.038	0.047	0.028	0.046
1400	0.061	0.021	0.027	0.026	0.049	0.057	0.021	0.034
1600	0.054	0.042	0.033	0.047	0.066	0.076	0.039	0.062
1800	0.076	0.034	0.052	0.066	0.058	0.087	0.054	0.071
2000	0.019	0.018	0.063	0.058	0.069	0.076	0.062	0.058
2200	0.011	0.034	0.058	0.067	0.056	0.045	0.051	0.065

**AMBIENT AIR, NOISE AND WATER QUALITY MONITORING ALONG BRT RED LINE CORRIDOR, KARACHI**

**Annexure-C**  
**(Survey Photographs)**

**AMBIENT AIR, NOISE AND WATER QUALITY MONITORING ALONG BRT RED LINE CORRIDOR, KARACHI**



**AMBIENT AIR, NOISE AND WATER QUALITY MONITORING ALONG BRT RED LINE CORRIDOR, KARACHI**

