

Thilawa Special Economic
Zone (Zone A) Development

Environmental Monitoring Report Phase - 1 (Operation Phase)



Myanmar Japan Thilawa
Development Limited.

April 2016

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1. Executive Summary

The environmental inspection and compliance monitoring program will be implemented under the direction of Ministry of Environmental Conservation and Forestry with oversight by Thilawa SEZ Management Committee.

The monitoring record from October 2015 to March 2016 according to the Environment Monitoring Plan is submitted in conformity with the provision of Chapter 9.1, Table 9.1-3 and 9.2, Table 9.2-3 Content of the EIA Report of Thilawa SEZ Development Project (Zone A).

2. Schedule of Monitoring Activities

- a) **Progress made to date on the implementation of the EMP against the submitted implementation schedule;**

EMP for Phase 1, Operation Phase First Report is submitted this day attached with Operation Phase implementation schedule. Subsequent Operation Phase reports for the Phase 1 will be submitted on bi-annually.

- b) **Difficulties encountered in implementing of the EMP and recommendations for remedying those difficulties and steps proposed to prevent or avoid similar future difficulties;**

None

- c) **Number and type of non-compliance with the EMP and proposed remedial measures and timelines for completion of remediation;**

None

- d) **Accidents or incidents relating to the occupational and community health and safety, and the environment;**

Neither accidents nor incidents happen during this monitoring period at Thilawa SEZ common area. And each tenant will report accidents record directly to Environment Section, One Stop Service Center, Thilawa SEZ Management Committee.

- e) **Monitoring data on environmental parameters and conditions as committed in the EMP or otherwise required.**

Please refer to the attached Environmental Monitoring Form.



3. Construction Progress

Thilawa SEZ Zone A Development Project construction activities is submitted enclosed with monthly progress reports from contractor in Appendix A to E

- A. Monthly Progress Report for October, 2015
- B. Monthly Progress Report for November, 2015
- C. Monthly Progress Report for December, 2015
- D. Monthly Progress Report for January, 2016
- E. Monthly Progress Report for February, 2016
- F. Monthly Progress Report for March, 2016



4. Monitoring Result

Environmental Monitoring plan report for Construction Phase implemented according to the following table, reference on Table 4.2-2, Chapter 4, EIA report.

Monitoring Plan (Operation Phase)

Category	Item	Location	Frequency	Remark
Air Quality	NO ₂ , SO ₂ , CO, TSP, PM ₁₀	Representative point inside this project area (1 point)	1 week each in dry and wet season (First 3 years after operation stage)	Air quality monitoring will start after two year. Locator associated with large scaled emission gas will not cause air pollution in one year.
Water Quality	Water temperature, pH, SS, DO, BOD, COD, coliform count, T-N, T-P, color and odor, HS, HCN, oil and grease, Formaldehyde, Phenols, Cresols, Free chlorine, Zinc, Chromium, Arsenic, Copper, Mercury, Cadmium, Barium, Selenium, Lead and Nickel	Representative points in this project area (6 points) Well in the Monastery (1 point)	Bi-monthly for water temperature, pH, SS, DO, BOD, COD, T-Coli, T-N, T-P, color and odor, Bi-annually for all parameters	MJTD is not discharging to the water body at the time of monitoring period (October 2015 to March 2016).
Waste	Status of non-hazardous waste management Status of hazardous waste management	Each Tenant*	Twice/year	Monthly Progress Reports (July, August, September, October, November, December) 2015, (January, February, March) 2016
Noise and Vibration	Noise level at the monastery and residences to check effect of buffer zone for sound-proofing to	Representative points in this project area (3 points)	One time each in dry and wet season (First 3 years after operation stage)	Noise and Vibration Monitoring Report October 2015
Ground Subsidence	Ground elevation Consumption of ground water amount	Representative (1 point)	Every week	Monthly Progress Reports (July, August, September, October, November, December) 2015, (January, February, March) 2016
Hydrology				
Risk for infectious disease such as AIDS/HIV	Status of measures of infectious disease	Each Tenant*	Once/month	Monthly Progress Reports (July, August, September, October, November, December) 2015, (January, February, March) 2016
Working conditions (including occupational safety)	Prehension of condition of occupational safety and health Prehension of infectious disease	Each Tenant*	Once/ month	
Accident	Existence of accident	Each Tenant*	As occasion arise	

*Remark: Each tenant will report directly to Environment Section, One Stop Service Center, Thilawa SEZ Management Committee.



Thilawa Special Economic Zone (Zone A)
Development Project –Phase 1

Environment Monitoring Form



Environment Monitoring Form

The latest results of the below monitoring items shall be submitted to Authorities on once at Pre-Construction Phase and on quarterly basis at Construction Phase, and on bi-annually base at Operation Phase. The items, standards to be applied, measurement points, and frequency for each monitoring parameter are established based on the EIA Report for Thilawa Special Economic Zone Development Project (Zone A). Should there be any changes to the original plan, such change shall be reviewed and evaluated by environmental expert.

1) General

1) Phase of the Project (TSEZ Zone A, Phase 1)

- Please mark the current phase.

☐ Pre-Construction Phase

☐ Construction Phase

☒ Operation Phase

2) Obtainment of Environmental Permits (Not Applicable)

Name of permits	Expected issuance date	Actual issuance date	Concerned authority	Remarks (Conditions, etc.)
Attached approval letter:				





3) Response/Actions to Comments and Guidance from Government Authorities and the Public

Item	Response from MJTD	Duration of Report Period	Frequency
MOECAP commented in guidance Letter No 3(2)/16 (Ga Gy)(6)/(2196/2015) dated on 01 st September 2015, Remark Statement of Environmental Monitoring Plan Construction Phase, July 2014 Thilawa SEZ Zone A.	1. Comment by MOECAP: Suspended Solid amount is higher than standard of 30mg/l in all locations. The water shall be properly treated. Response by MJTD: Suspended Solid (SS) in the water system around Thilawa has been higher than the target value since the first Environmental Monitoring Report in September 2013 for the EIA for Thilawa Special Economic Zone Class A. Also, MJTD has not been discharging treated sewage water to the water body as of the time of monitoring. Therefore, the high suspended solid level is the result of the natural conditions around Thilawa and not coming from MJTD.		
	2. Comment by MOECAP: Dissolved Oxygen amount is lower than standard in some locations. The water shall be properly treated. Response by MJTD: Less Dissolved Oxygen (DO) occurs as a result of high suspended solid levels around Thilawa. The more suspended solid amount in water, the less oxygen from atmosphere can directly absorb to the water. The amount of suspended solid also has been high since the survey results report of Zone A, EIA report. Also, MJTD has not been discharging treated		





Monitoring Question No. Request

	sewage water to the water body as of the time of monitoring. Therefore, the high suspended solid level is the result of the natural conditions around Thilawa and not coming from MJTD. 3. Comment by MOECAP: To monitor solid waste management. Response by MJTD: We have been monitoring all solid waste disposal since start of Construction Phase in April 2014. We have reported all solid waste disposal which is included in the Monthly Progress Report in the Environmental Monitoring Plan for Construction Phase submitted quarterly to MOECAP during construction phase.	
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(2) Monitoring Results

1) Ambient Air Quality

According to the EIA Report for Operation Phase, Environmental Monitoring Plan(EMP) Schedule, Table 4.2-3, air quality monitoring have to conduct in each dry and wet season for one week for the first three (3) years of Operation Phase. As of the Scheduled date for the monitoring, only three (3) companies are under operations. After consultation with relevant authority, MJTD has decided to start monitoring from the second year and continue for three years afterwards.

NO_x, SO_x, CO, TSP, PM10

Location	Item	Unit	Measured Value (Mean)	Measured Value (Min~Max.)	Country's Standard	Target value to be applied	Referred International Standard*	Frequency	Method	Note (Reason of excess of the standard)
Construction Area	NO _x	ppm			N/A	N/A	0.06	Once in three months	HAZSCANNE REFAS	
	SO _x	ppm			N/A	N/A	0.04	Once in three months	HAZSCANNE REFAS	
	CO	ppm			N/A	N/A	10	Once in three months	HAZSCANNE REFAS	
	TSP	ppm			N/A	N/A	0.33	Once in three months	HAZSCANNE REFAS	
	PM10	ppm			N/A	N/A	0.12	Once in three months	HAZSCANNE REFAS	

*Remark: Referred to the Japan and Thailand Standard (EIA Report, Table 6.4-1).



2) Water Quality

Measurement Point: Effluent of Wastewater- Are there any effluents to water body in this monitoring period? ☐ Yes, ☒ No

If yes, please attach "Analysis Record" and fill in the items not to comply with Referenced International Standard.

"MJTD is not discharging to water body at the time of monitoring period (October 2015 to March 2016)."

Location	Item	Unit	Measured Value	Country's Standard	Target value to be applied	Referred International Standard	Frequency	Method	Note (Reason of excess of the standard)

3) Soil Contamination (only operation phase)

Situations environmental report from tenants- Are there any serious issues regarding soil contamination in this monitoring period? ☐ Yes, ☒ No

If yes, please describe the contents of complains and its countermeasures to fill in below the table.

Contents of Issues on Soil Contamination	Countermeasures





4) Noise -October 2015

Noise Level (Living Environment-Near Monastery, Thilawa SEZ Residential Area)

Location	Item	Unit	Measured Value (Mean)	Measured Value (Min~Max)	Country's Standard	Target value to be applied	*Referred International Standard	Frequency	Method	Note (Reason of excess of the standard)
TNV-1	Leq (day)	dB(A)	58	51-61	N/A	75	Singapore	Once in 3 months	Sound Level Meter	
	Leq(eve)	dB(A)	52	50-54		60				
	Leq(night)	dB(A)	51	47-53		55				
TNV-2	Leq(day)	dB(A)	61	46-66	N/A	75	Singapore	Once in 3 months	Sound level Meter	
	Leq(eve)	dB(A)	52	50-54		60				
	Leq(night)	dB(A)	53	50-54		55				

*Remark: Referred to the Singapore Target Noise Standard (EIA Report), Reference to the Noise and Vibration Report October 2015.

Noise Level (Along the Lower Padagyi Road)

Location	Item	Unit	Measured Value (Mean)	Measured Value (Min~Max)	Country's Standard	Target value to be applied	*Referred International Standard	Frequency	Method	Note (Reason of excess of the standard)
TNV-3	Leq (day)	dB(A)	67	51-76	N/A	N/A	70	Once (peak period)	Sound Level Meter	
	Leq(eve)	dB(A)	60	60			65			
	Leq(night)	dB(A)	59	58-61			60			

*Remark: Referred to the Japan Standard (EIA Report), Reference to the Noise and Vibration Report October 2015.



Complaints from Residents

- Are there any complaints from residents regarding noise in this monitoring period? ☐ Yes, ☒ No

If yes, please describe the contents of complains and its countermeasures to fill in below the table.

Contents of Complaints from Residents	Countermeasures

5) Solid Waste

Measurement Point: Construction Site (Construction Phase), Storage for Sludge (Operation Phase)

- Are there any wastes of sludge in this monitoring period? ☒ Yes, ☐ No

If yes, please report the amount of sludge and fill in the results of solid waste management Activities.

No.	Date	Description	No. of Loads	Remarks
1.	4-Dec-15	Waste Disposal (Sewage from Septic Tank at Temporary site office)	3	YCDC

***Remark:** Reference to the Monthly Progress Report December 2015.

Each locator will submit according to ECCP approval for the waste disposal record directly to the Environmental Section, One Stop Service Center, Thilawa SEZ Management Committee.



6) (a) Ground Subsidence and Hydrology- October 2015

Duration (Week)	Water Consumption		Ground Level		Frequency	Note
	Quantity	Unit	Quantity	Unit		
1-Oct-15	200	m ³ /week	+6.995	m	Once a week	
8-Oct-15	240	m ³ /week	+6.989	m		
15-Oct-15	130	m ³ /week	+6.992	m		
22-Oct-15	250	m ³ /week	+6.989	m		

*Reference to the Monthly Progress Report October 2015.

6) (b) Ground Subsidence and Hydrology- November 2015

Duration (Week)	Water Consumption		Ground Level		Frequency	Note
	Quantity	Unit	Quantity	Unit		
5-Nov-15	175	m ³ /week	-	m	Once a week	Heavy Raining Day
12-Nov-15	240	m ³ /week	+6.988	m		
19-Nov-15	168	m ³ /week	+6.986	m		
26-Nov-15	255	m ³ /week	-	m		Public Holiday

*Reference to the Monthly Progress Report November 2015.

6) (c) Ground Subsidence and Hydrology- December 2015

Duration (Week)	Water Consumption		Ground Level		Frequency	Note
	Quantity	Unit	Quantity	Unit		
3-Dec-15	212	m ³ /week	+6.990	m	Once a week	
10-Dec-15	312	m ³ /week	+6.991	m		
7-Dec-15	276	m ³ /week	+6.992	m		



MYANMAR JAPAN THILAWA DEVELOPMENT LIMITED

Date: 09th June 2016

Client: Myanmar Power Co., Ltd.

15	211	m ³ /week	+6.992	m	
31-Dec-15	191	m ³ /week	+6.994	m	

*Reference to the Monthly Progress Report December 2015.

(d) Ground Subsidence and Hydrology-January 2016

Duration (Week)	Water Consumption		Ground Level		Frequency	Note
	Quantity	Unit	Quantity	Unit		
7-Jan-16	211	m ³ /week	+6.989	m	Once a week	
14-Jan-16	221	m ³ /week	+6.99	m		
21-Jan-16	141	m ³ /week	+6.993	m		
28-Jan-16	207	m ³ /week	+6.998	m		

*Reference to the Monthly Progress Report January 2016.

(e) Ground Subsidence and Hydrology-February 2016

Duration (Week)	Water Consumption		Ground Level		Frequency	Note
	Quantity	Unit	Quantity	Unit		
4-Feb-16	140	m ³ /week	+6.998	m	Once a week	
11-Feb-16	176	m ³ /week	+6.995	m		
18-Feb-16	252	m ³ /week	+6.989	m		
25-Feb-16	215	m ³ /week	+6.992	m		

*Reference to the Monthly Progress Report February 2016.





(f) Ground Subsidence and Hydrology-March 2016

Duration (Week)	Water Consumption		Ground Level		Frequency	Note
	Quantity	Unit	Quantity	Unit		
3-Mar-16	107	m ³ /week	+6.997	m	Once a week	
10-Mar-16	220	m ³ /week	+6.999	m		
17-Mar-16	108	m ³ /week	+6.992	m		
24-Mar-16	111	m ³ /week	+6.993	m		
31-Mar-16	203	m ³ /week	+6.991	m		

*Reference to the Monthly Progress Report March 2016.

7) Offensive Odor (only operation phase)

Complaints from Residents

- Are there any complaints from residents regarding offensive odor in this monitoring period? ☐ Yes, ☒ No

If yes, please describe the contents of complains and its countermeasures to fill in below the table.

Contents of Complaints from Residents	Countermeasures





Situations environmental report from tenants Not Applicable at Construction Phase Report

- Are there any serious issues regarding offensive odor in this monitoring period? ☐ Yes, ☒ No

If yes, please describe the contents of complains and its countermeasures to fill in below the table.

Contents of Issues on Soil Contamination	Countermeasures

*Remark: Each tenant will be submitted monitoring report directly to Environmental Section, One Stop Service Center, Thilawa SEZ Management Committee.

8) Infectious disease, Working Environment, Accident Information from contractor (construction phase) or tenants (operation phase)

- Are there any incidents regarding Infectious disease, Working Environment, Accident in this monitoring period? ☐ Yes, ☒ No

If yes, please describe the contents of complains and its countermeasures to fill in below the table.

Contents of Incidents	Countermeasures

Note: If emergency incidents are occurred, the information shall be reported to the relevant organizations and authorities immediately.

*Remark: Each tenant will be submitted monitoring report directly to Environmental Section, One Stop Service Center, Thilawa SEZ Management Committee.



End of Document

**Thilawa Special Economic Zone (Zone A)
Development Project –Phase 1**

Appendix

Noise and Vibration Monitoring Report

October, 2015



MJTD MYANMAR JAPAN THILAWA DEVELOPMENT LIMITED

NOISE AND VIBRATION MONITORING IN THILAWA SEZ (PHASE 1, OPERATION STAGE)

October 2015



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1. INTRODUCTION

The monitoring points are sited in the Thilawa SEZ area, which is located in the Thanlyin and Kyauktan townships, about 20 km southeast of Yangon city (Figure 1). Thilawa SEZ is surrounded by ring road and accompanied with the container ports along the Yangon River.

There are two ways to access to Thilawa SEZ from Yangon city, which are the route passing through Thanlyin Bridge and also through Dagon River.



Figure 1. Location map of Thilawa SEZ area and monitoring locations.

2. ENVIRONMENTAL STANDARD

(A) Noise

Construction Phase

There is no noise standard of construction activities to receptors in Myanmar and International Organization's standards such as WHO and Environmental, Health, and Safety (EHS) Guidelines prepared by International Finance Cooperation (IFC) in a group member of World Bank, therefore the target noise level at construction stage is set based on the standard in the other foreign countries.

In the south-east Asia countries, only Singapore has the noise standard of construction activities to receptors categorized area to be quiet, residential area, and the other areas. On the basis of the above information, target noise level is set as following concept,

- Residential houses and monastery located less than 150m from the construction site comply with the middle range of the Singapore standard (categorized as "Residential buildings located less than 150m"), or



- Residential houses and monastery located more than 150m from the construction site, office, commercial facilities, and factories shall comply with the moderate range of standard Singapore standard (categorized as "Other buildings").

This target noise level is shown in Table 1 and is not so much difference comparing with noise standard at construction stage in the other countries as shown in Table 2.

Table 1. Target noise level in construction phase

Category	Day time (Leq) (7am-7pm)	Evening Time (Leq) (7pm-10pm)	Night time (Leq) (10pm-7am)
Residential houses and monastery located less than 150m	75 dB	60 dB	55 dB
Residential houses and monastery located more than 150m from the construction site, office, commercial facilities, and factories	75 dB	65 dB	65 dB

Note) Evaluation point is at boundary of building

Table 2. Noise standard at construction stage in various countries

Items		Day time (Leq)	Night time (Leq)
Japan	Using heavy equipments with high noise level (piling, excavating etc.)	85 dB (Maximum)	-
Singapore	Hospitals, schools, institutions of higher learning, homes for the aged sick, etc.	60 dB (7am - 7pm, 12hrs)	50 dB (7pm - 7am, 12hrs)
	Residential buildings located less than 150m from the construction site where the noise is being emitted	75 dB (7am - 7pm, 12hrs)	60 dB (7pm - 10pm, 3hr) 55 dB (10pm - 7am, 9hr)
	Other Buildings	75 dB (7am - 7pm, 12hrs)	65 dB (7pm - 7am, 12hrs)
UK	In rural, suburban and urban areas away from main road traffic and industrial noise.	70 dB (8:00-18:00)	-
	Urban areas near main roads	72 dB (8:00-18:00)	-
USA	Residential	80 dB (8hrs)	70 dB (8hrs)
	Commercial	85 dB (8hrs)	85 dB (8hrs)
	Urban Area with high ambient noise level (>65 dB)	Ambient Noise Level +10dB	

Source: Noise Regulation Act, Japan (Law No.98, 1968, Amended No.33, 2006)

Environmental Protection and Management Act in Singapore (Chap.94A, Section 77, revised in 2008)

British Standard 5228: 1997 "Noise and vibration control on open and construction sites"

Transit Noise and Vibration Impact Assessment, U.S. Department of Transportation in USA, 1995



Operation Phase

There is no ambient noise standard to receptors in Myanmar. However, most of the countries in south-east Asia have the ambient noise standard to receptors categorized land use or requirement of quiet as well as in Japan. International standard is also available in the EHS Guidelines prepared by IFC. On the basis of the above information, target noise level is set as following concept and target ambient noise level.

- Ambient noise standard for sensitive areas of Japan and International Organization, relatively high in comparison with the results of baseline survey especially during night time.
- Thus, the target ambient noise level for sensitive and residential area is set in accordance with the noise standard in Singapore which is similar to the ambient noise level of the baseline survey.

The target noise level is shown in Table 3 and the target noise level is not so much difference comparing with ambient noise standard as shown in Table 4.

Table 3. Target noise level in operation phase

Category	Day Time (Leq) (7am-7pm)	Evening Time (Leq) (7pm-10pm)	Night Time (Leq) (10pm-7am)
Sensitive area such as Monastery	60 dB	55 dB	50 dB
Residential houses	65 dB	60 dB	55 dB
Commercial and Industrial Areas	70 dB	65 dB	60 dB

Note) Evaluation point is at boundary of building

Table 4. Noise standard at operation stage in South-East Asia Countries

Items		Day time (Leq)	Night time (Leq)
Indonesia	Noise standard for sensitive areas such as residences, hospitals, schools, places of religious worships	55 dB	
	Noise standard for office and commercial	65 dB	
	Noise standard for commercial and service	70 dB	
Malaysia	Sensitive Areas/ Low Density Residential Areas	55 dB (7am - 10pm, 15hrs)	50 dB (10pm - 7am, 9hrs)
	Sub Urban Residential	60 dB (7am - 10pm, 15hrs)	55 dB (10pm - 7am, 9hrs)
	Urban Residential	65 dB (7am - 10pm, 15hrs)	60 dB (10pm - 7am, 9hrs)
	Commercial and Business	70 dB (7am - 10pm, 15hrs)	60 dB (10pm - 7am, 9hrs)
Singapore	Sensitive Areas	60 dB (7am - 7pm, 12hrs)	55 dB (7pm - 10pm, 3hr)



Items		Day time (Leq)	Night time (Leq)
			50 dB (10pm – 7am, 9hr)
	Residential Areas	65 dB (7am – 7pm, 12hrs)	60 dB (7pm – 10pm, 3hr) 55 dB (10pm – 7am, 9hr)
	Commercial Areas	70 dB (7am – 7pm, 12hrs)	65 dB (7pm – 10pm, 3hr) 60 dB (10pm – 7am, 9hr)
Thailand	Noise standard	70 dB (24hrs)	
Japan	Sensitive Area (Class AA)	50 dB (6am – 10pm, 16hrs)	40 dB (10pm – 6pm, 8hrs)
	Residential Area (Class A and Class B)	55 dB (6am – 10pm, 16hrs)	45 dB (10pm – 6pm, 8hrs)
	Commercial and Industrial Area (Class C)	60 dB (6am – 10pm, 16hrs)	50 dB (10pm – 6pm, 8hrs)
IFC	Residential; institutional, educational	55 dB (7am – 10pm, 15hrs)	45 dB (10pm – 7am, 9hrs)
	Industrial; commercial	70 dB (7am – 10pm, 15hrs)	70 dB (10pm – 7am, 9hrs)

Source: Noise Standard in Indonesia (KEP-48/MENLH/11/1996)

Effect of Traffic Noise on Sleep: A Case Study in Serdang Raya, Selangor, Malaysia, Environment Asia, 2010

Environmental Protection and Management Act in Singapore (Chap.94A, Section 77, revised in 2008)

Notification of Environmental Board No. 15 B.E.2540(1997) under the Conservation and Enhancement of National

Environmental Quality Act B.E.2535 (1992) dated March 12, B.E.2540 (1997) and Notification of Pollution Control

Department : Subject: Calculation of Noise Level Dated August 11, B.E. 2540 (1997) in Thailand

(B) Vibration

As there is no vibration standard to receptors in Myanmar, the target vibration level at construction phase shall be set based on the standards in some foreign countries. Accordingly the target level of vibration is set based on the following policies.

- Monastery and residential house where are necessary to keep quiet and sleep shall comply with the Japanese standard for residential area,
- Office, commercial facilities, and factories areas shall comply with the Japanese standard for mixed areas including residential and commercial and industrial areas, and
- The category of times divided into three types in a manner consistency with target noise level for construction.

3. FIELD SURVEY

The survey included noise and vibration monitoring for three locations in Thilawa SEZ area.



Survey Item

(A) Noise

Parameter for noise level survey was determined by referring the environmental quality standards in Japan and other countries for operation stage as shown in Table 5.

Table 5. Survey parameters for noise level

No.	Parameter	Category	Day Time (Leq) (7am-7pm)	Evening Time (Leq) (7pm-10pm)	Night Time (Leq) (10pm-7am)
1	A-weighted loudness equivalent (LAeq)	Commercial and Industrial Areas	70 dB	65 dB	60 dB

(B) Vibration

Vibration can be defined as regularly repeated movement of a physical object about a fixed point. The parameter normally used to assess the ground vibration is the Peak Particle Velocity (PPV) expressed in millimeters per second (mm/s).

Vibration can cause varying degrees of damage in buildings and affect vibration-sensitive machinery or equipment. Its effect on people may be to cause disturbance or annoyance or, at higher levels, to affect a person's ability to work.

Typical levels measured during construction activities are shown below:

Construction Activity	Typical Ground Vibration Level
Vibratory roller	Up to 1.5mm/s @ 25m
Hydraulic rock breakers	4.5 mm/s @ 5m, 0.4 @ 20m, 0.1 @ 50m
Compactor	20mm/s @ 5m, <0.3mm/s @30m
Pile driving	1-3mm/s @ 50m depending on soil conditions and piling technique
Bulldozer	1-2mm/s @ 5m, 0.1 @ 50m
Truck traffic (smooth surface)	<0.2mm/s @ 20m
Truck traffic (rough surface)	<2mm/s @ 20m

Summary of sampling points

The detail of the locations of monitoring points are shown below.



Table 6. Locations of noise and vibration monitoring stations

Sampling Point	Coordinates	Description of Sampling Point
NV-1	16° 40' 13.1" N 96° 16' 32.0" E	Near Mogyoswan Monastery compound
NV-2	16° 40' 58.0" N 96° 16' 48.6" E	North of Gate 2 in Thilawa SEZ, Zone A
NV-3	16° 40' 46.3" N 96° 15' 31.2" E	In the western part of Thilawa SEZ, Zone A



Figure 2. Location map of noise and vibration monitoring locations

NV-1

The NV-1 was an open area located west of Mogyoswan Monastery compound. This location is far about 100 m away from the Dagon-Thilawa road which was paved with moderately traffic volume and moderate speed. Dominant source of noise was vehicular traffic and construction activity nearby the site. Noise and vibration monitoring at NV-1 is shown in Figure 3.



Figure 3. Noise and vibration monitoring at NV-1.

NV-2

NV-2 was sited at the northern part of Class A in Thilawa SEZ. The location was an open area and distanced about 50m from the car road. The road was paved with moderately traffic volume while the day time. Dominant sources of noise were vehicle traffic and construction activity from the worksite during the day time. Noise and vibration monitoring at NV-2 is shown in Figure 4.



Figure 4. Noise and vibration monitoring at NV-2.

NV-3

NV-3 was sited at DOWA worksite into the Thilawa SEZ class A. The location was an open area beside the road which is distanced about 50 m away. The road was paved with low traffic. Dominant source of noise was vehicular traffic and construction activity nearby the site. Noise and vibration monitoring at NV-3 is shown in Figure 5.



Figure 5. Noise and vibration monitoring at NV-3.

Survey Period

Sampling and monitoring of surrounding sound and vibration level at NV-1, NV-2 and NV-3 were conducted during 19th - 22nd October 2015.

Sampling Point	Survey Period
NV-1	21 st - 22 nd October, 2015 (24 hours)
NV-2	20 th - 21 st October, 2015 (24 hours)
NV-3	19 th - 20 th October, 2015 (24 hours)

Survey Method

Sampling and monitoring of surrounding sound and vibration level were conducted by using following instrument for 24 hours/1 day measurement.

Instrument	Brand	Model	Measurement unit
Sound Level Meter	Lutron	SL-0423SD	dB
Vibration Meter	Lutron	VB-8206SD	mm/s, cm/s

Survey Result

(A) Noise

Noise levels (L_{Aeq}) of the monitoring points were presented in Table 7. One day L_{Aeq} was calculated by using the following array formula in the excel sheet. This formula is firstly used for hourly L_{Aeq} and then for the 24 hours L_{Aeq} .

$$10 * \text{LOG10}(\text{AVERAGE}(10^{((\text{RANGE})/10)}))$$



By means of the calculated results, all noise levels found lower than the environmental standard (1-day) of the target value. Noise level (L_{Aeq}) in present monitoring period was presented in Table 7 and Table 8.

Table 7. Hourly L_{Aeq} value in noise monitoring stations.

Unit: dBA

Time	NV-1	NV-2	NV-3
	21 st - 22 nd October	20 th - 21 st October	19 th - 20 th October
7:00-8:00	53	54	53
8:00-9:00	61	62	59
9:00-10:00	56	59	52
10:00-11:00	55	59	57
11:00-12:00	55	57	57
12:00-13:00	62	46	70
13:00-14:00	51	59	76
14:00-15:00	51	65	64
15:00-16:00	61	66	51
16:00-17:00	53	66	58
17:00-18:00	61	50	59
18:00-19:00	51	51	60
Day L_{Aeq}	58	61	67
19:00-20:00	53	54	60
20:00-21:00	50	50	60
21:00-22:00	54	52	60
Evening L_{Aeq}	52	52	60
22:00-23:00	52	53	60
23:00-24:00	50	50	58
24:00-1:00	50	50	60
1:00-2:00	52	52	59
2:00-3:00	47	52	60
3:00-4:00	45	54	59
4:00-5:00	53	52	58
5:00-6:00	52	54	61
6:00-7:00	52	54	58
Night L_{Aeq}	51	53	59



Table 8. A-weighted Loudness Equivalent (L_{Aeq}) Level

Unit: dB(A)

Date	NV-1 21 st - 22 nd October 2015			NV-2 20 th - 21 st October 2015			NV-3 19 th - 20 th October 2015		
	Day Time	Evening Time	Night Time	Day Time	Evening Time	Night Time	Day Time	Evening Time	Night Time
	58	52	51	61	52	53	67	60	59
Target Noise Level	70	65	60	70	65	60	70	65	60

(8) Vibration

Vibration results were presented in Figure 6 to 8. Table of observed vibration level is presented in Appendix.

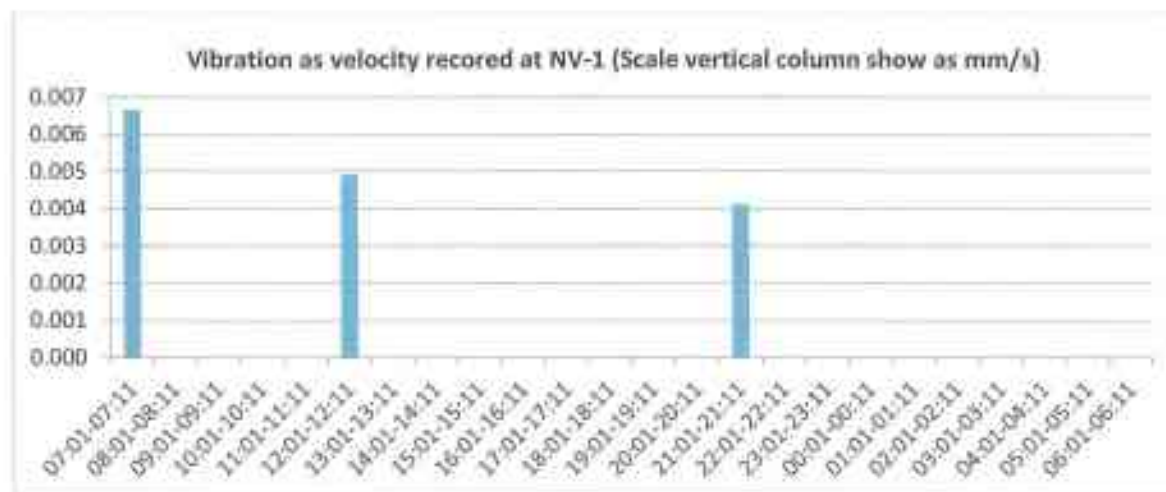


Figure 6. Vibration result of NV-1.

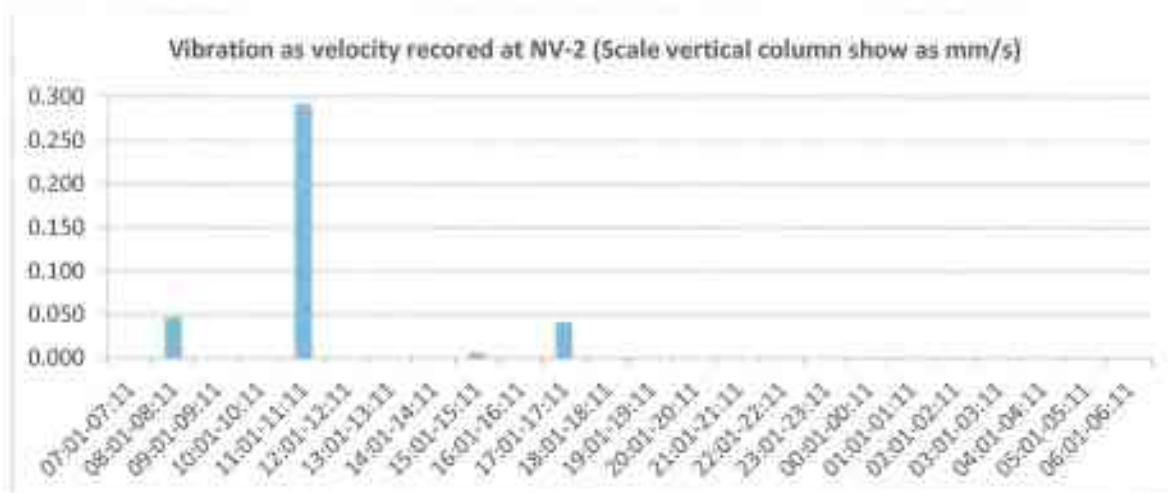


Figure 7. Vibration result of NV-2.

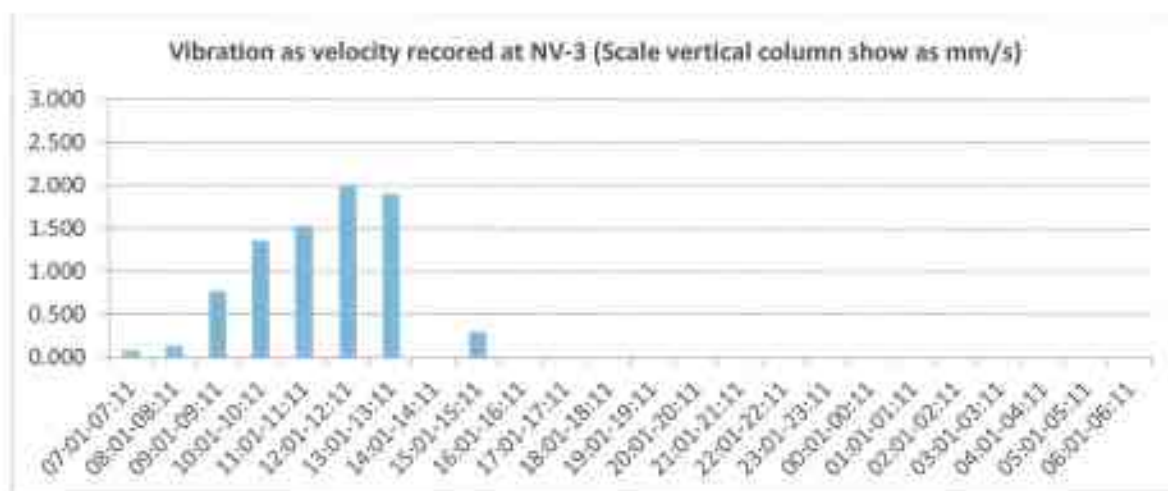


Figure 8. Vibration result of NV-3.

4. CONCLUSION

The noise level monitoring results are compared with target noise level proposed in this report (See Table 3). Three noise receptors were designated in operation phase based on the baseline noise data.

The noise level monitoring at three sites in and near the project site are lower than the target noise level (See Table 8).

There is no standard relating to vibration during construction activities. Common practice in Myanmar has been to use guidance from internationally recognized standards. Vibration standards come in two varieties: those dealing with human comfort and those dealing with cosmetic or structural damage to buildings. In both instances, the magnitude of vibration is expressed in terms of Peak Particle Velocity (PPV) in millimeters per second (mm/s).



In the case of nominally continuous sources of vibration such as traffic, vibration is perceptible at around 0.5mm/s and may become disturbing or annoying at higher magnitudes. However, higher levels of vibration are typically tolerated for single events or events of short duration.

During the monitoring time, there are some construction activities inside the Class A compound and only the loading and unloading raw materials by small vehicles. The main noise and vibration source are largely road traffic noise and vibration. The observed noise and vibration in all monitoring points are lower than the target level.



APPENDIX

Observed vibration level in 3 monitoring stations

Vibration as Velocity (mm/s)

Time	NV-1 (21-22 October)	TNV-2 (20-21 October)	TNV-3 (19-20 October)
7:00-7:10	0.007	0.000	0.085
8:00-8:10	0.000	0.048	0.136
9:00-9:10	0.000	0.000	0.778
10:00-10:10	0.000	0.000	1.362
11:00-11:10	0.000	0.293	1.536
12:00-12:10	0.005	0.000	1.997
13:00-13:10	0.000	0.000	1.907
14:00-14:10	0.000	0.000	0.002
15:00-15:10	0.000	0.007	0.298
16:00-16:10	0.000	0.000	0.000
17:00-17:10	0.000	0.041	0.000
18:00-18:10	0.000	0.000	0.000
19:00-19:10	0.000	0.000	0.000
20:00-20:10	0.000	0.000	0.000
21:00-21:10	0.004	0.000	0.000
22:00-22:10	0.000	0.000	0.000
23:00-23:10	0.000	0.000	0.000
00:00-00:10	0.000	0.000	0.000
1:00-1:10	0.000	0.000	0.000
2:00-2:10	0.000	0.000	0.000
3:00-3:10	0.000	0.000	0.000
4:00-4:10	0.000	0.000	0.000
5:00-5:10	0.000	0.000	0.000
6:00-6:10	0.000	0.000	0.000



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