

Contract No. HY/2011/09
Hong Kong-Zhuhai-Macao Bridge Hong Kong Link Road – Section
between HKSAR Boundary and Scenic Hill



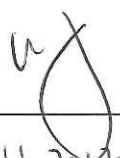

Technical Document

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Document Title:

Acoustic Decoupling Measures Plan

	PREPARED BY:	INTERNAL REVIEW:		INTERNAL APPROVAL
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SIGNATURE				
DATE	28.11.2012	28/11/2012	28.11.2012	28.11.2012

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2.0 DOCUMENT STATUS

2.1 Details of Revision:

Rev.	Rev. Date	Sections	Amendment Source and/or Details
A	8/10/2012	All	For the first submission to the SOR.
B	12/10/2012	All	Incorporated the SOR/IEC/ENPO's comments and amended text where necessary.
C	26/11/2012	Section 4.0	Incorporated the EPD and IEC's comments and amended text where necessary.

3.0 INTRODUCTION

3.1 Purpose

The Acoustic Decoupling Measures Plan (the Plan) has been prepared in accordance with Condition 2.6 of the Environmental Permit (EP-352/2009/A) for the Highways Department Contract namely Contract No. HY/2011/09 – Hong Kong-Zhuhai-Macao Bridge Hong Kong Link Road – Section between HKSAR Boundary and Scenic Hill.

The Plan shall describe the measures to be taken to minimize impacts to marine ecological environment, and mainly for the Chinese White Dolphins (CWD) when carrying out bored piling, dredging and reclamation.

3.2 Project Description

Highways Department commissioned the project “Hong Kong Link Road- Section between HKSAR Boundary and Scenic Hill” (hereinafter called the Contract) with Contract No: HY/2011/09. Dragages -China Harbour-VSL Joint Venture (DCVJV) is awarded the Contract. The scope of the works comprises the following major item:

- (i) a dual 3-lane carriageway in the form of viaduct from the HKSAR boundary (connecting with the HZMB Main Bridge) to the Scenic Hill (connecting with the tunnel under separate Contract No. HY/2011/03), of approximately 9.4km in length with a hard shoulder for each bound of carriageway and a utilities trough on the outer edge of each bound of viaducts;
- (ii) a grade-separated turnaround facility located near San Shek Wan, composed of slip roads in the form of viaduct with single-lane carriageway bifurcated from the HKLR mainline with an elevated junction above the mainline;
- (iii) provision of ancillary facilities including, but not limited to, meteorological enhancement measures including the provisioning of anemometers and modification of the wind profiler station at hillside of Sha Lo Wan, provisioning of a compensatory marine radar, and provisioning of security systems; and
- (iv) associated civil, structural, geotechnical, marine, environmental protection, landscaping, drainage and highways electrical and mechanical (E&M) works, street lightings, traffic aids and sign gantries, marine navigational aids, ship impact protection system, water mains and fire hydrants, lightning protection system, structural health monitoring and maintenance management system (SHM&MMS), supervisory control and data acquisition (SCADA) system, as well as operation and maintenance provisions of viaducts, provisioning of facilities for installation of traffic control and surveillance system (TCSS), provisioning of facilities for installation of telecommunication cables/equipments and re provisioning works of affected existing facilities/utilities.

Cinotech Consultants Limited was commissioned by the DCVJV to undertake the EM&A works for the Contract and was appointed as the Environmental Team (ET).

The location of the Contract is illustrates in Figure 4.1.

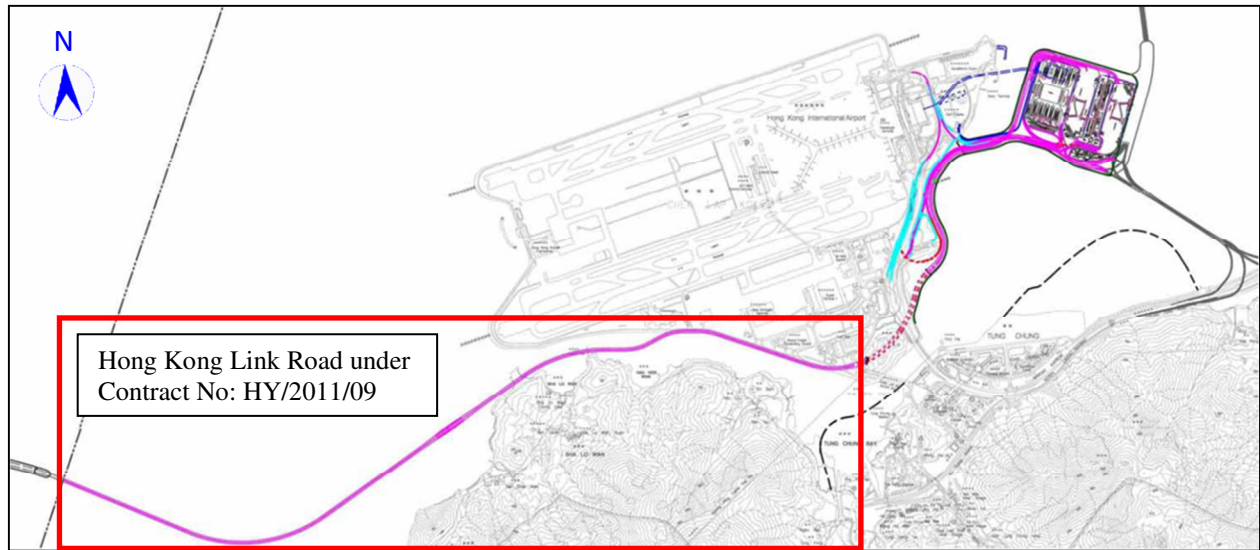


Figure 4.1: The location of the Contract

4.0 MARINE CONSTRUCTION NOISE SOURCES

4.1 Bored Piling Work

Bored piling, instead of percussive piling, will be undertaken with permanent steel casing for construction of the substructures of piers. Low-vibration hammers will be used to install the casings into the seabed following the alignment control guides set on the platform.

4.2 Working Vessels and Platforms

Stationary powered mechanical equipments mounted on boards of working vessels or platforms, when operating, may generate vibration or noise through the hull if they are directly placed on the deck without proper isolation. These common equipments on board include,

- Generators,
- Winch generators,
- Air compressors.



Generator on vessel board



Winch system on vessel board



Air compressors on vessel board

In order to minimize the noise transmission to the sea, acoustic decoupling measures for the stationary equipment mounted on boards will be adopted.

5.0 ACOUSTIC DECOUPLING MEASURES

5.1 Working Vessels and Platforms – Isolation Pad

Noise isolation pad is proposed to separate the stationary equipments from the decks or hulls in order to reduce noise transmission to the sea via the working vessels or platforms. The proposed isolation pad details are given in Appendix A.

Instead of directly mount on decks, noisy equipments will be fixed on noise isolation pad. Prior to installation, DCVJV will ensure the foundation of equipments is flat and level. Adequate clearance all around the noisy equipment will be kept to avoid direct vibration transmission to other materials and machineries.

It is estimated that common generators to be operated on board are about 1m x 2m in plan dimension and they will easily fit to sit on the proposed isolation pads formed by individual units with dimension 1m x 1m. An installation sketch is attached in the Appendix A to show the design scheme.

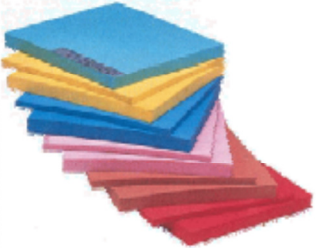
5.2 General Notes to Install the Measures

- To forbid direct vibration transmission, adequate plinth clearance shall be kept all around.
- Close all panels or doors of generators when in use.
- To avoid noise breakout and the undesirable sound paths through gaps, the foundation where the equipment to be placed shall be flat and level.
- To further eliminated the sound generation from noisy parts, flexible bellows silencers, mufflers shall be applied when necessary.

END OF TEXT

Appendix A – Proposed Isolation Pad Details

1. General information of PO-MAT



With forming air layers inside, micro-cellular Polyurethane mat offers good elasticity and is applied in a wide range of dynamic load. In particular, since the load is uniformly distributed in full measure, the thickness of floating slab can be reduced. Noise-insulated active materials whose elasticity is maintained by amt itself, the product does not need Floating slab-ascending work.

The colors can be application to design work

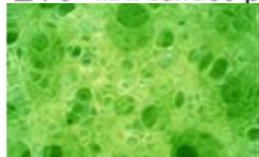
2. PO-MAT Range

MODEL	A12	A25	B12	B25	C12	C25	D12	D25	E12	E25	F12	F25
THICKNESS	12	25	12	25	12	25	12	25	12	25	12	25
COLOR	GREEN		YELLOW		BLUE		PINK		BROWN		RED	
DENSITY (kg/m³)	150 ± 10		220 ± 10		300 ± 10		400 ± 10		500 ± 10		600 ± 10	
RATED LOAD (N/mm²)	0.007		0.024		0.052		0.1		0.2		0.4	
RATED DEF. (mm)	4.0	8.2	3.6	7.5	3.3	6.8	3.0	6.0	2.8	5.8	2.5	5.2
PRODUCTION VOLUME	Owned Manufacturing Facilities: 100~150m³/Day(8Hrs/Day)											
PRODUCTION SIZE	[1,000mm x 1,000(500)mm x THICKNESS]											
MANUFACTURING PROCESS	1. Pouring Polyol and MDI in a tank. 2. Heating ingredients. 3. Mix POLYOL and MDI by SHOOTER. 4. Pouring the mixed ingredients to a mold as suitable density. 5. Forming. 6. Removing mold and scraps. 7. Work condition: 1) regular heating temperature, air pressure and mold temperature, 2) regular forming time											

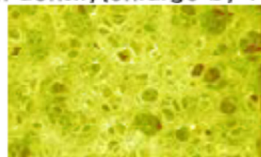
Proposed material for the contract

3. Durobility Test Result

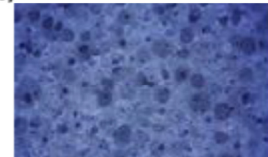
■ PO-MAT surface per each density(enlarge by 100times)



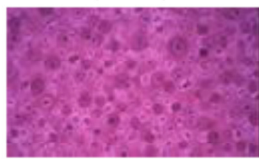
A (GREEN)



B (YELLOW)



C (BLUE)



D (PINK)



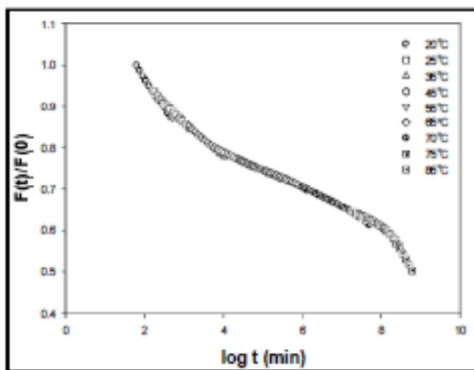
E (BROWN)



F (RED)

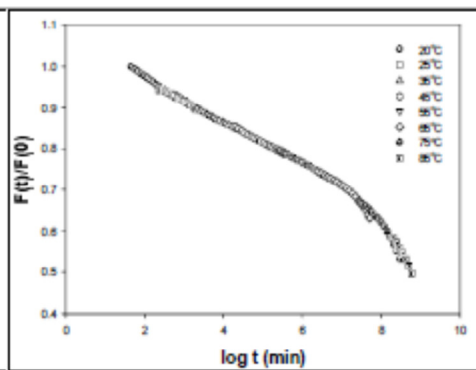
■ Durability tes by TTS(Time-Temperature Superposition)

■ Responsibility: Ph.D Yungwook, Jang, Chemical Engineering, Hanyang Univ.



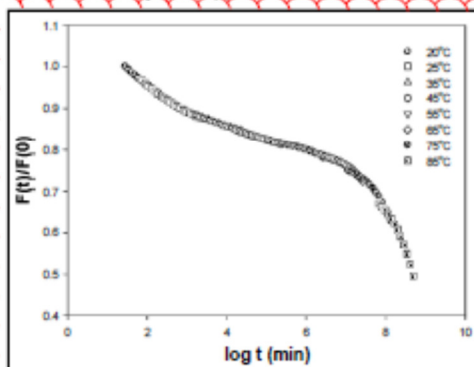
■ Density : 150 kg/m³

■ Durability : Approx. 612Yrs(20°C)



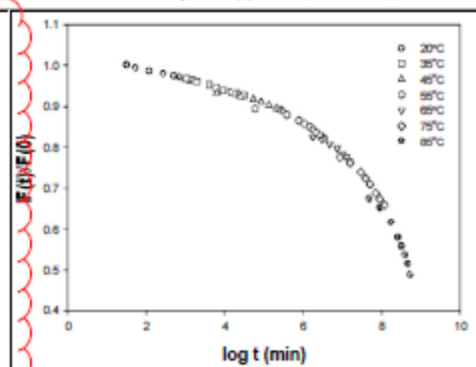
■ Density : 220 kg/m³

■ Durability : Approx. 630Yrs(20°C)



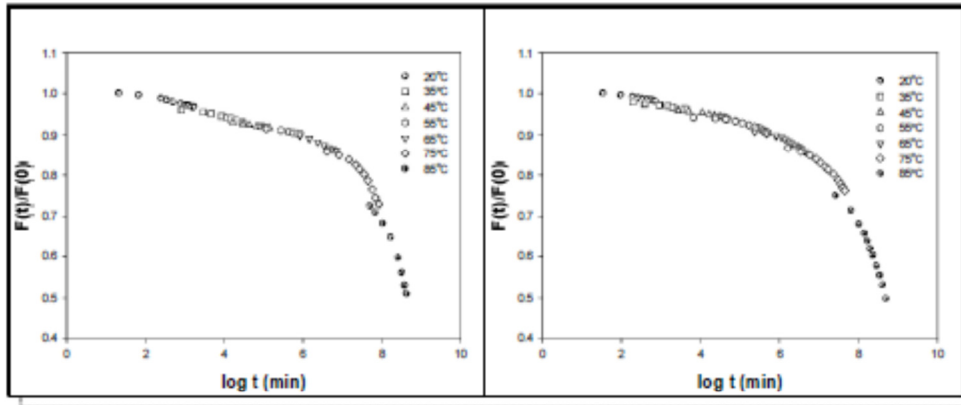
■ Density : 300 kg/m³

■ Durability : Approx. 644Yrs(20°C)



■ Density : 400 kg/m³

■ Durability : Approx. 652Yrs(20°C)



■ Density : 500 kg/m³

■ Durability : Approx. 660Yrs(20°C)

■ Density : 600 kg/m³

■ Durability : Approx. 675Yrs(20°C)

4. Comparison of Technical DATA

■ Consideration : Spring Material, Rubber Material, PU MAT.

■ Material Properties

NO.	ITEM	Material Type			REMARK
		SPRING	RUBBER	POLYURETHANE	
1	Photos				
2	Model	FSL2	NSWP	PU-MAT	
3	Type	COIL	PAD	MAT	
4	Loading Area	POINT	500x500mm	1000x1000mm	

■ Noise and Vibration Properties

NO.	ITEM	Material Type			REMARK
		SPRING	RUBBER	POLYURETHANE	
1	Viscosity	—	■	⊙	
2	Static load(kgf/mm ²)	—	—	0.50	
3	Elastic strain(%)	—	about 20	up to 50	
4	Vertical load ratio	about 4.0	3.3	2.5	
5	Operating load capacity	⊙	◆	⊙	

■ Remark: Excellent★, Very Good⊙, Good◆, Normal▲, Not Good■, Not Applicable▼



Physical Properties

NO.	ITEM	Material Type			REMARK
		SPRING	RUBBER	POLYURETHANE	
1	Ultimate strength	—	200-260	up to 500	
2	Coefficient to expansion	—	630%	260%	
3	Tensile Strength	◆	◆	◎	
4	Creep resistance	■	◆	◎	
5	Abrasion	★	◆	◆	
6	Cracking resistance	■	◎	◎	
7	Tearing Resistance	◎	◆	◎	
	Drying Oil impregnation	◎	■	◎	
8	Heat resistance	★	—	—	
9	Cold resistance	◆	◆	◎	
10	Permanent bend	◆	◆	◆	
11	Manufacturing capacity	▲	◆	◎	
12	Density(kg/m ³)	—	up to 450	up to 1500	
13	Using Temperature	◎		◆	

Remark: Excellent★, Very Good◎, Good◆, Normal▲, Not Good■, Not Applicable▼

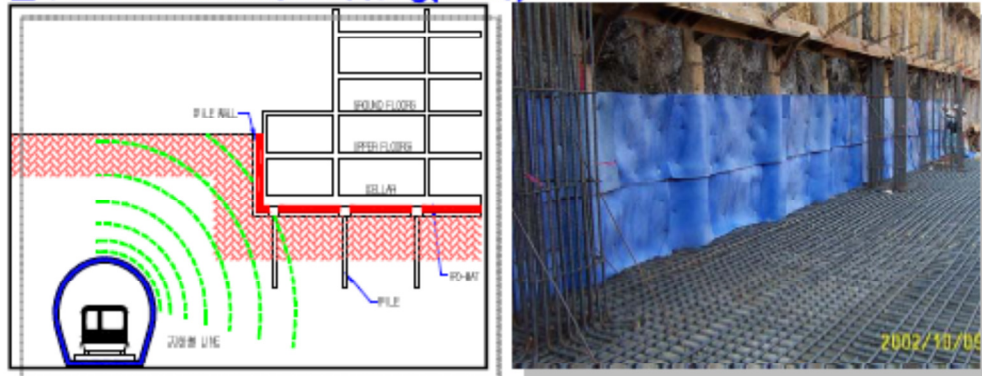
Chemical Properties

NO.	ITEM	Material Type			REMARK
		SPRING	RUBBER	POLYURETHANE	
1	Adhesion capacity	—	◎	★	
2	Oil resistance	◆	◆	◎	
3	O zone resistance	★	◆	◎	
4	Ageing resistance	◆	◆	★	
5	Biological Resistance	★	◎	★	
6	Water & Aqueous Solution	★(Corrosion)	◎	★	
7	Formic acid	◎(Corrosion)	■	▲	
8	Acetic acid	◎(Corrosion)	■	◎	
9	Phosphoric acid	◎(Corrosion)	▲	★	
10	Oils & Greases	◎(Corrosion)	◎	★	
11	Glycerol	◎(Corrosion)	◎	★	
12	Glycol	◎	◎	★	
13	Hexane	◎	◎	★	

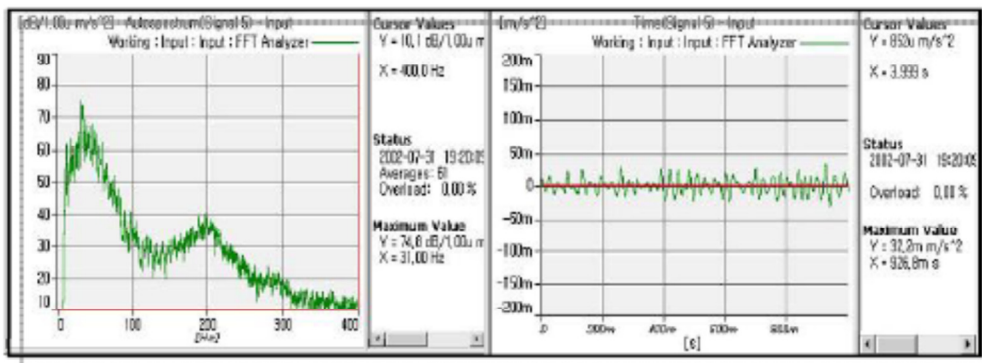
Remark: Excellent★, Very Good◎, Good◆, Normal▲, Not Good■, Not Applicable▼

5. Application Data for PO-MAT

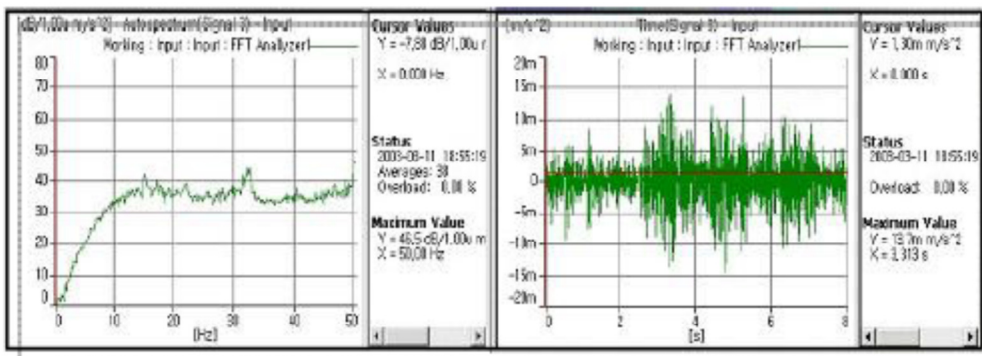
■ Structural Vibration Proofing(Metro)



■ Outline of PO-MAT installation once subway train passes

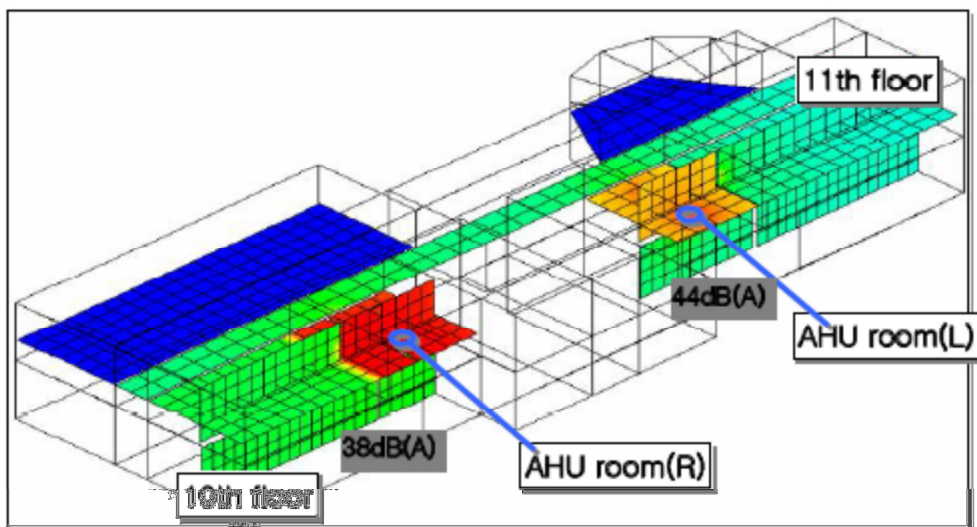
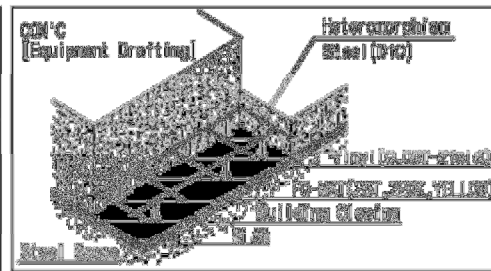
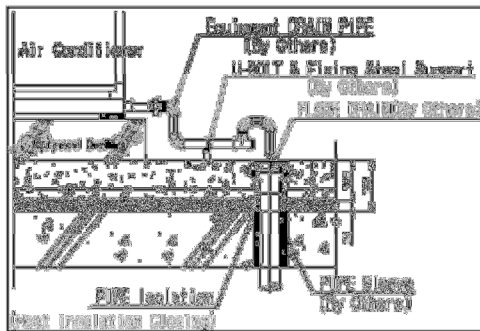
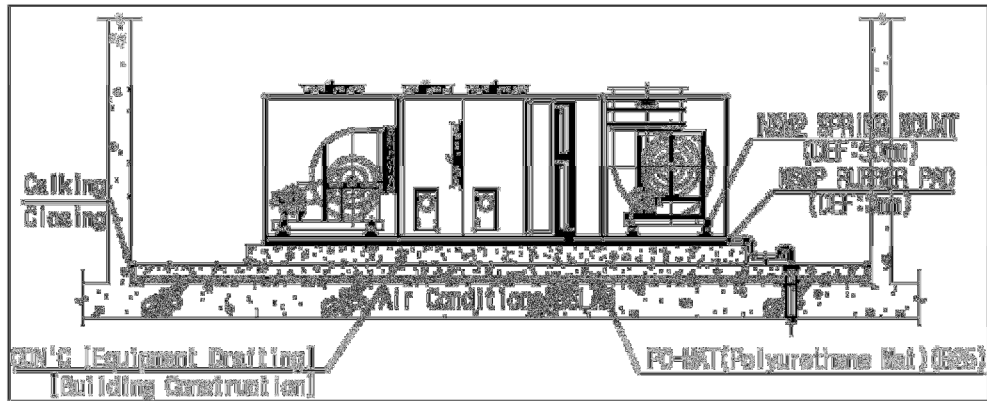


■ Vibration analysis DATA once subway train passes before PO-MAT installation

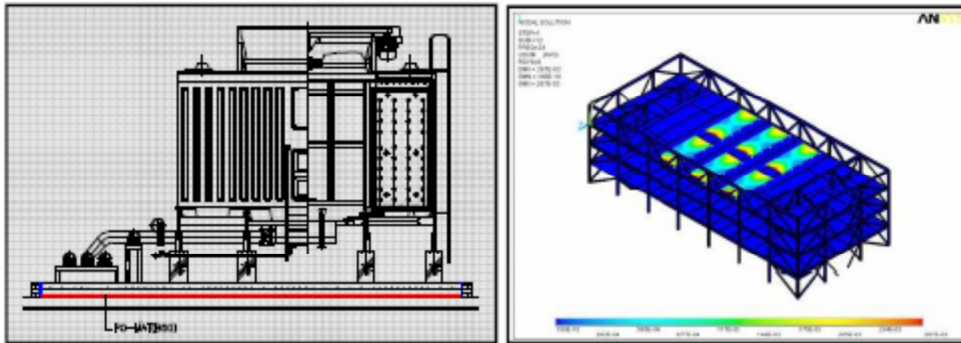


■ Vibration analysis DATA once subway train passes after PO-MAT installation

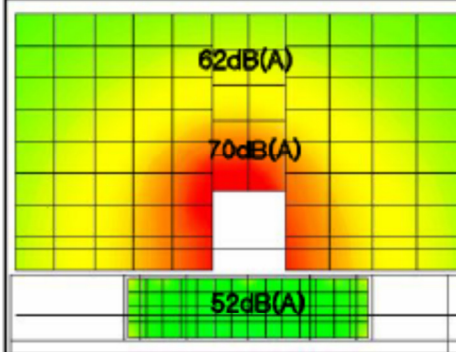
■ Floating Floor on Machine Room(AHU Room)



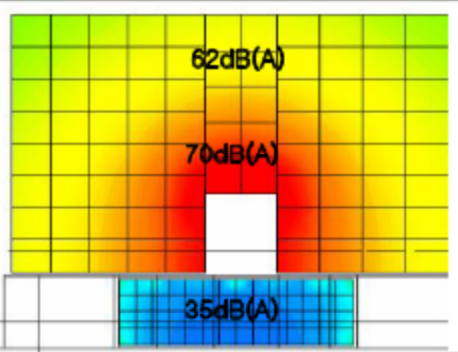
■ Floating floor for cooling tower



■ Cut way(before floating floor)

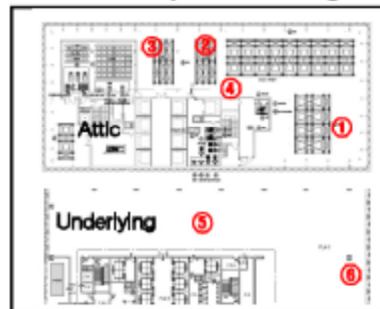


■ Cut way(after floating floor)



■ Noise measurement result for cooling tower on the roof(after floating floor)

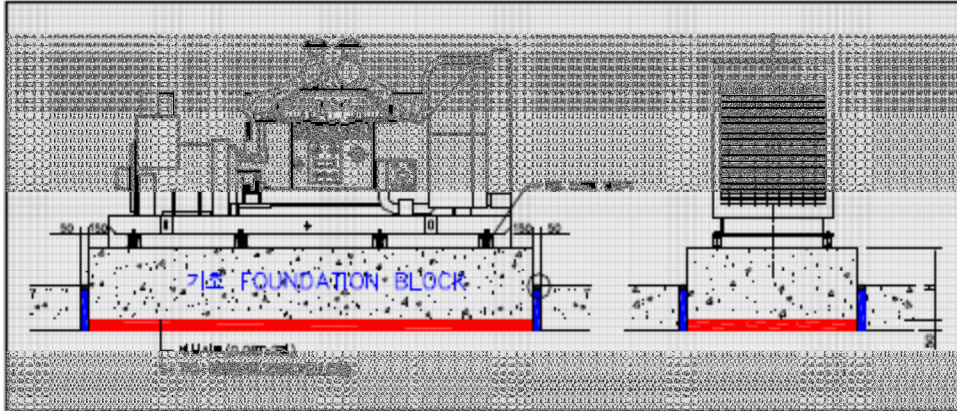
Location	Point	B.G.	CT	Δ	Remark
Attic	1	52.9	70.5	+17.6	—
	2		75.4	+22.5	—
	3		74.6	+21.7	—
	4		77.5	+24.6	—
Underlying Layer	5	32.8	34.0	+1.2	—
	6	38.5	39.2	+0.7	—



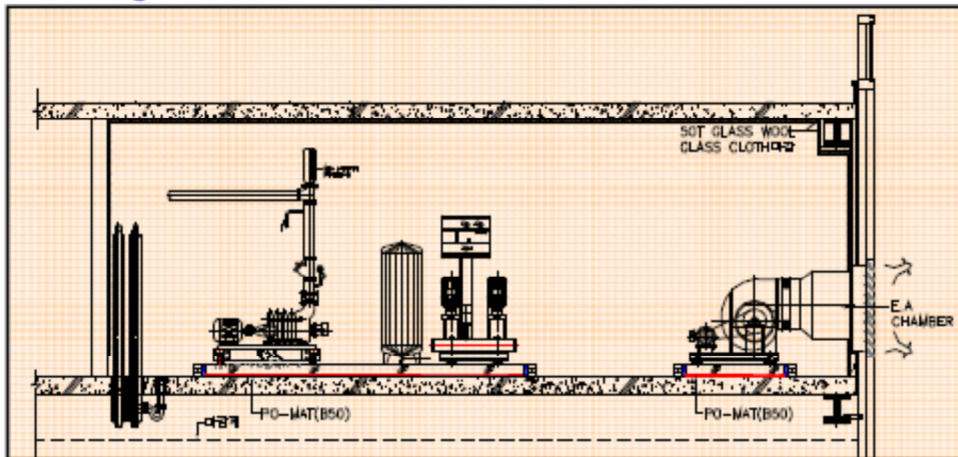
■ Floating Floor on Roof of Building for Cooling Tower



■ Floating Floor In Machine Room(Generation Room)



■ Floating Floor In Machine Room on Mid-Level Floor





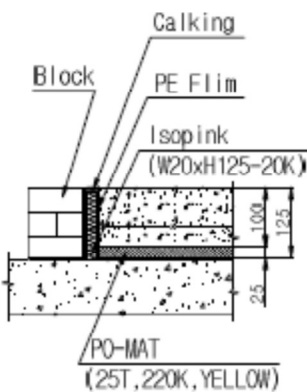
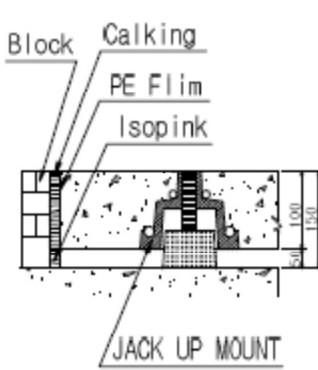
■ Other Special Structural Vibration Proofing



Amusement Park / Bumper(ship) / Metro Office / special application

6. Comparison Data (PO-MAT vs Jack-Up System)

■ Comparison data for Floating Floor System

SYSTEM ITEM	PO-MAT SYSTEM (Polyurethane Mat)	JACK-UP SYSTEM
Feature		
Consist	Single formular of Polyurethane Identified by color(density)	Engineering plastic + Neoprene mount
Cut way of Installation		
Installation	1) Covering PO-MAT 2) Wire work after covering vinyl sheet 3) Concrete work and dry	1) Vinyl sheet cover, install jack-up mount 2) Wire work and concrete work 3) Dry and lifting floor
Noise absorbing layer	Absorbing noise by PO MAT	Absorbing noise by air and jack-up mo
Vibration absorbing efficiency	10~15dB	5~10dB
Transmission Loss(TL)	52~54dB	52~54dB
Installation Characteristics	1) Durobility is permanent as the m is made of Polyurethane 2) Lifting work is not neccessary 3) Easy installation, short and stabl construction period. 4) Distributed Load Application 5) Low Natural Frequency	1) Durobility is semi-permanent as the mount is made of Neoprene 2) Lifting work is necessary 3) Complicated installation, long perio 4) Concentration Load Application 5) High Natural Frequency
Model	PO-MAT : A,B,C,D,E,F TYPE 6 models applicable	JUM MOUNT: 300,650,800kg 3 models applicable

■ Comparison of installation(PO-MAT vs JACK-UP)

