路政署
HIGHWAYS DEPARTMENT
港珠澳大橋香港工程管理處
Hong Kong - Zhuhai - Macao Bridge
Hong Kong Project Management Office

Contract No. HY/2011/03

Hong Kong-Zhuhai-Macao Bridge Hong Kong Link Road Section between Scenic Hill and Hong Kong Boundary Crossing Facilities

Acoustic Decoupling Measures Plan

12 September 2012

Main Contractor

中國建築工程(香港)有限公司
CHINA STATE CONSTRUCTION ENGINEERING (HONG KONG) LTD.

Designer

ATKINS

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1 Introduction

1.1 Background

1.1.1 The HZMB Hong Kong Link Road (HKLR) serves to connect the Hong Kong-Zhuhai-Macao Bridge (HZMB) Main Bridge at the Hong Kong Special Administrative Region (HKSAR) Boundary and the HZMB Hong Kong Boundary Crossing Facilities (HKBCF) located at the north eastern waters of the Hong Kong International Airport (HKIA).

1.1.2 China State Construction Engineering (Hong Kong) Ltd. was awarded by Highways Department as the Contractor to undertake the construction works of Contract No. HY/2011/03 Hong Kong-Zhuhai-Macao Bridge Hong Kong Link Road – Section between Scenic Hill and Hong Kong Boundary Facilities ("the Contract") for the Highways Department of HKSAR.

1.1.3 This Acoustic Decoupling Measures Plan is prepared for Contract No. HY/2011/03 detailing the acoustic decoupling measures plan for the works as part of the plan on marine ecological mitigation measures.

1.2 Purpose of the Plan

1.2.1 This Acoustic Decoupling Measures Plan was prepared to fulfill Clause 2.6 of EP-352/2009/A, which states:

"*The Permit Holder shall deposit with the Director, at least one month before the commencement of construction of the Project, three hard copies and one electronic copy of the design and implementation of acoustic decoupling measures applied during bored piling, dredging and reclamation works.*"

2 Acoustic Decoupling Measures Plan

2.1 Marine Construction Noise Sources

2.1.1 According to the reclamation design, dredging and bored piling will not be undertaken for this contract. Non-dredged method for reclamation shall be adopted to avoid dredging and disposal of marine sediments, which will in turn avoid adverse environmental impact to the surrounding. Ground improvement measures including installation of prefabricated vertical band drains and stone columns are proposed to improve the compressibility and shear strength of the underlying soft soils, in order to meet the contract requirements. The reclamation plans are attached as Drawings 4809-RC-2001 and 4809-RC-2002.

2.1.2 The marine construction works of the Contract will mainly comprise of the following activities:

- Marine ground investigation;
- Installation of silt curtain;
- Laying geotextile;
- Filling for stone platform; and
- Sand filling for reclamation.

2.1.3 According to Section 10.6.4.61 of the approved EIA Report, dolphins mainly use high-frequency sounds that are well above the frequencies produced by most large vessels used in shipping and marine construction activities. Based on available experience in Hong Kong SAR, these types of vessels are not considered to be a significant source of acoustic disturbance. Main engines of the proposed working vessels are therefore not considered to be a significant source of acoustic disturbance and will not be considered as source of noise and vibration. However, there is still a small possibility that noise would be transmitted from the onboard equipment (e.g. air compressor) into the sea (Section 10.6.4.62 of the approved

EIA Report). Therefore, acoustic decoupling measures for noisy equipment which are not embedded on vessels are required to minimise the possible noise impact on marine ecology.

2.1.4 There will be eight working vessels for the Contract. They will be used for the construction activities listed in Section 2.1.2. No air compressors will be provided on broad. Noisy equipment to be provided on the working vessels have been identified and listed in **Table 1**. The photos of the working vessels are shown in **Appendix A**.

Table 1 Summary of Noisy Equipment Identified on Working Vessels

Working Vessel	Noisy Equipment identified on Working Vessel
Grab Dredger	• Generator (Diesel, 35.81kW, 1.5 Tons approx.)
Pelican Barge	• Generator (Diesel, 35.81kW, 1.5 Tons approx.)
Derrick Lighter	• Winch Generator (Diesel, 80.57kW, 12 Tons approx.) • Generator (Diesel, 35.81kW, 1.5 Tons approx.)
Jack-Up Platform	• Generator (Diesel, 44.76kW, 3 Tons approx.) • Generator (Diesel, 4.48kW, 1 Ton approx.)
Flat Top Barge	• Generator (Diesel, 4.47kW, 1 Ton approx.) • Generator (Diesel, 80.57kW, 5 Tons approx.)
Crane Barge (Ocean Channel)	No noisy equipment will be provided onboard.
Crane Barge (Chung Kong)	No noisy equipment will be provided onboard.
Flat Top Work Barge	No noisy equipment will be provided onboard.

2.1.5 Noise from these identified generators may be transmitted to the sea through the hull if they are directly placed on the deck without proper isolation. In order to minimize the noise transmission to the sea, acoustic decoupling measures for generators are proposed.

2.2 Proposed Acoustic Decoupling Measures

2.2.1 Noise isolation pad is proposed to separate the generators from the deck or hull in order to reduce noise transmission to the sea via the vessel. The proposed isolation pad details are given in **Appendix B**.

2.3 Implementation of Acoustic Decoupling Measures

2.3.1 The dimensions of the proposed isolation pad for the identified noisy equipments are listed in **Table 2**.

Table 2 Summary of Noisy Equipment Identified on Working Vessel

Proposed Working Vessel	Noisy Equipment identified on Working Vessel	Dimensions of the Proposed Isolation Pad (L x W x H)
Grab Dredger	• Generator (Diesel, 35.81kW, 1.5 Tons approx.)	• 2m x 1m x 30mm approx.
Pelican Barge	• Generator (Diesel, 35.81kW, 1.5 Tons approx.)	• 2m x 1m x 30mm approx.
Derrick Lighter	• Winch Generator (Diesel, 80.57kW, 12 Tons approx.) • Generator (Diesel, 35.81kW, 1.5 Tons approx.)	• 6m x 3m x 30mm approx. • 2m x 1m x 30mm approx.
Jack-Up Platform	• Generator (Diesel, 44.76kW, 3 Tons approx.) • Generator (Diesel, 4.48kW, 1 Ton approx.)	• 2m x 1.3m x 30mm approx. • 1.5m x 1m x 30mm approx.

Flat Top Barge	• Generator (Diesel, 4.47kW, 1 Ton approx.) • Generator (Diesel, 80.57kW, 5 Tons approx.)	• 1.5m x 1m x 30mm approx. • 3m x 1.5m x30mm approx.

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

APPENDIX A

Photos of the Proposed Working Vessels

Appendix A – Photo of Proposed Working Vessels

Proposed Working Vessel	Photo
Grab Dredger	
Pelican Barge	
Derrick Lighter	

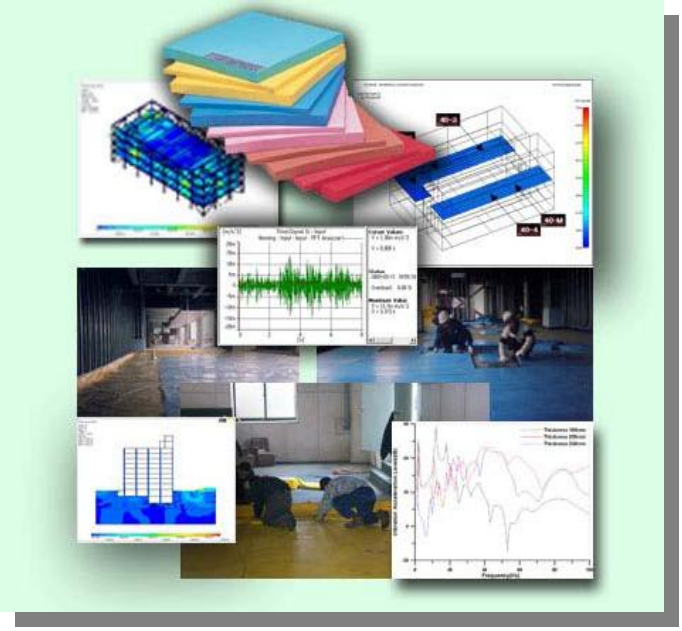
Proposed Working Vessel	Photo
Jack-Up Platform	
Flat Top Barge	
Crane Barge (Ocean Channel)	

Proposed Working Vessel	Photo
Crane Barge (Chung Kong)	
Flat Top Work Barge	

APPENDIX B

Proposed Isolation Pad Details

Technical Data
(PO-MAT)



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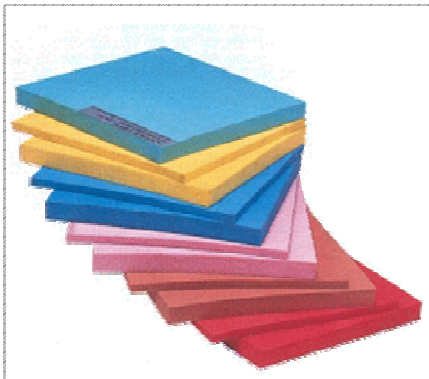
1. General information of PO-MAT



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 uniformity 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

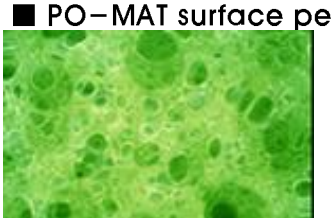
2. PO-MAT Range

Proposed material for the contract

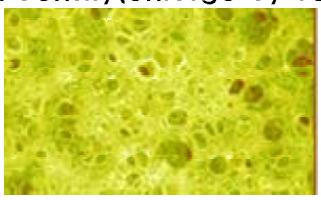
MODEL	A12	A25	B12	B25	C12	C25	D12	D25	E12	E25	F12	F25
THICKNESS	12	25	12	25	12	25	12	25	12	25	12	25
COLOR	GREEN		YELLOW		BLUE		PINK		BROWN		RED	
DENSITY (kg/m^3)	150±10		220±10		300±10		400±10		500±10		600±10	
RATED LOAD (N/mm^2)	0.007		0.024		0.052		0.1		0.2		0.4	
RATED DEF.(mm)	4.0	8.2	3.6	7.5	3.3	6.8	3.0	6.0	2.8	5.8	2.5	5.2
PRODUCTION VOLUME	Owned Manufacturing Facilities:100~150㎡/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 ingrediants. 3.Mix POLYOL and MDI by SHOOTER. 4.Pouring the mixed ingrediants to a mold as suitable density. 5.Forming. 6.Removing mold and scraps. 7.Work condition:1)regulare heating temperature, air pressure and mold temperature, 2)regular forming time											

3. Durobility Test Result

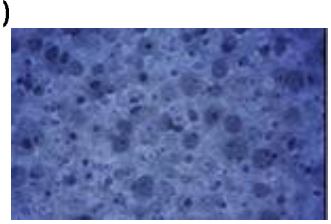
■ PO-MAT surface per each density(enlarge by 100times)



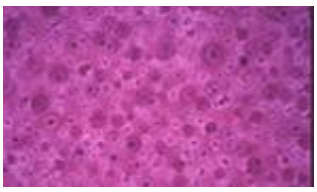
A(GREEN)



B(YELLOW)

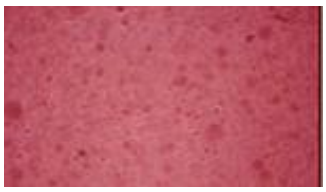


C(BLUE)



D(PINK)

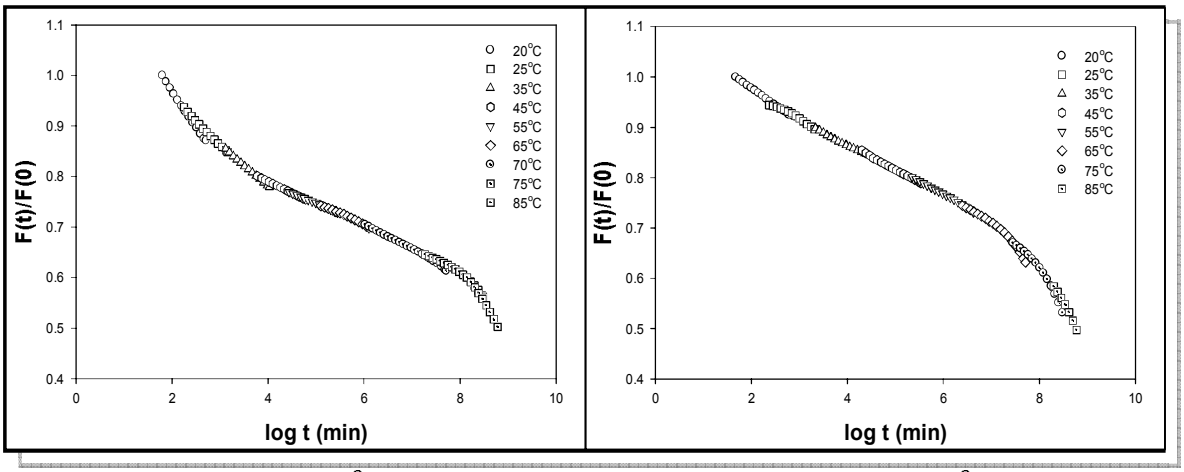
E(BROWN)



F(RED)

■ Durability tes by TTS(Time-Temperature Superposition)

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

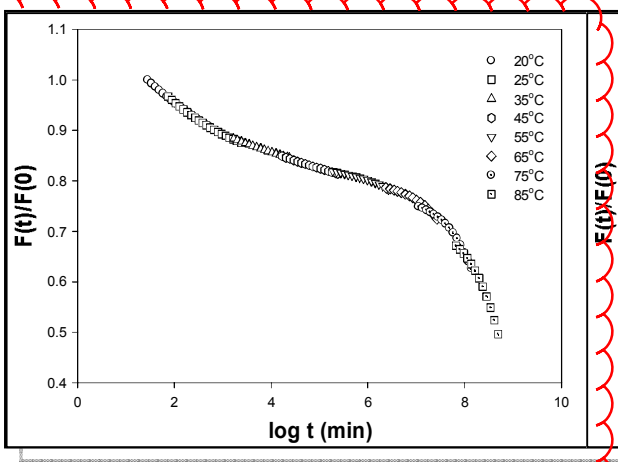


■ Density : 150 kg/m^3

■ Durability : Approx. 612Yrs(20℃)

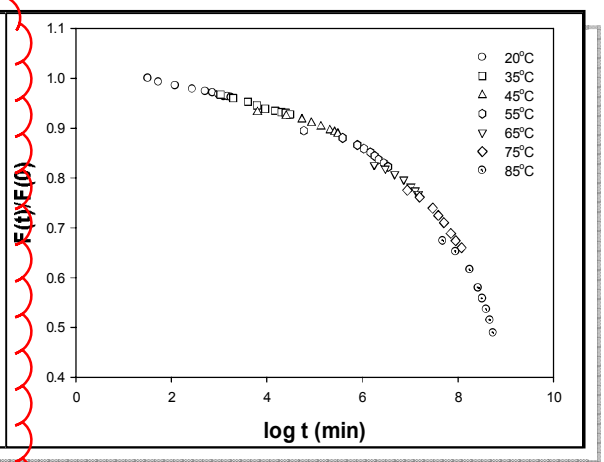
■ Density : 220 kg/m^3

■ Durability : Approx. 630Yrs(20℃)



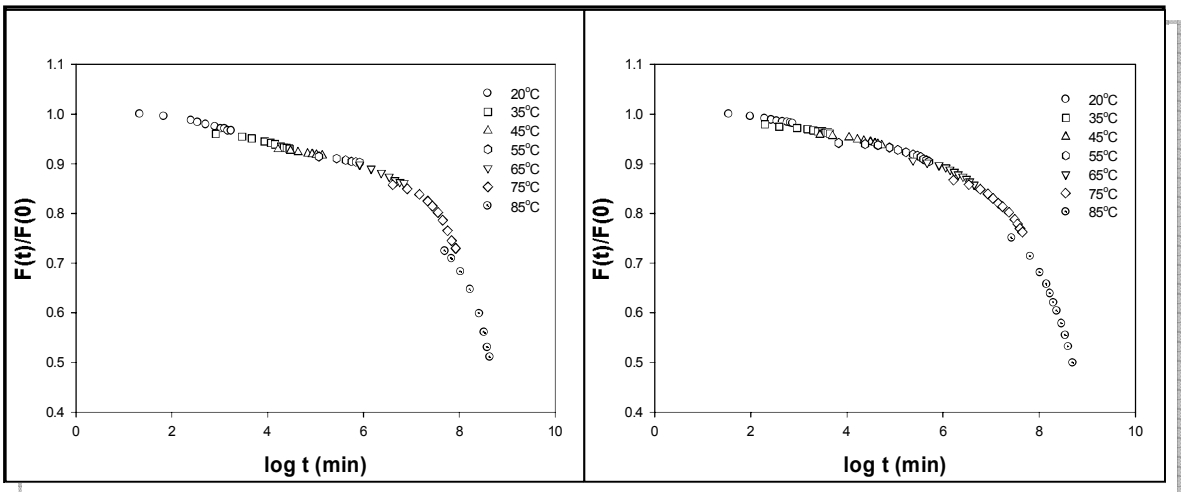
■ Density : 300 kg/m^3

■ Durability : Approx. 644Yrs(20℃)



■ Density : 400 kg/m^3

■ Du ■ Durability : Approx. 652Yrs(20℃)



■ Density : 500 kg/m^3
■ Durability : Approx. 660Yrs(20℃)

■ Density : 600 kg/m^3
■ Durability : Approx. 675Yrs(20℃)

4. Comparison of Technical DATA

■ Candidates : Spring Mounts, Rubber Mounts, PO MAT.

■ Material Properties

NO.	ITEM	Material Type			REMARK
		SPRING	RUBBER	POLYURETHANE	
1	Photos				
2	Model	FSL2	NSWP	PO-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	Virtical 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 fo expansion		–	630%	260%	
3	Tensile Strength		◆	◆	◎	
4	Creep resistance		■	◆	◎	
5	Abrasion		★	◆	◆	
6	Cracking resistance		■	◎	◎	
7	Tearing Resistance	Drying	◎	◆	◎	
		Oil impregration	◎	■	◎	
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▼

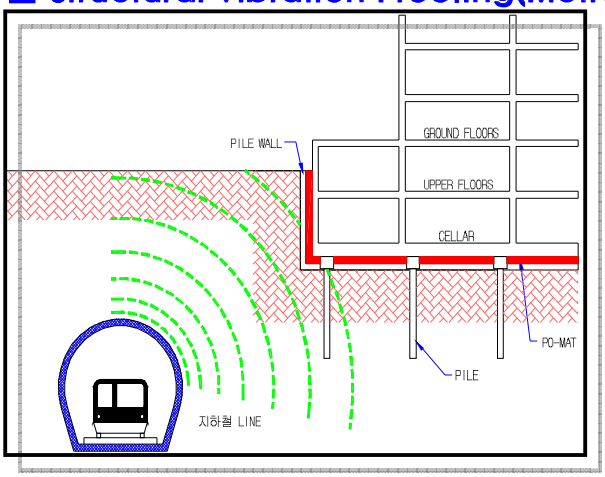
■ Chmical Properties

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	◎	◎	★	

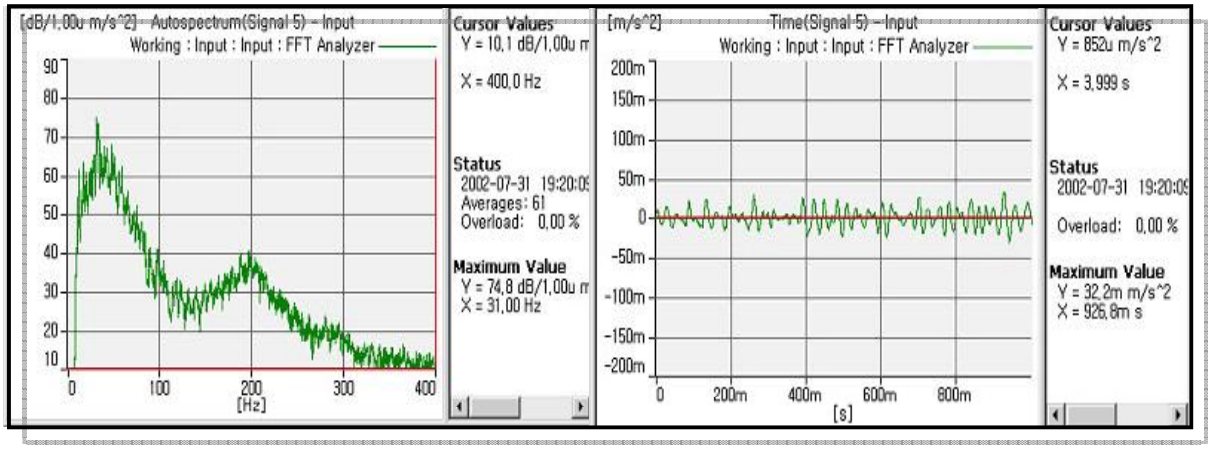
■Remark:Excellent★, Very Good◎, Good◆, Normal▲, Not Good■, Not Applicable▼

5. Application Data for PO-MAT

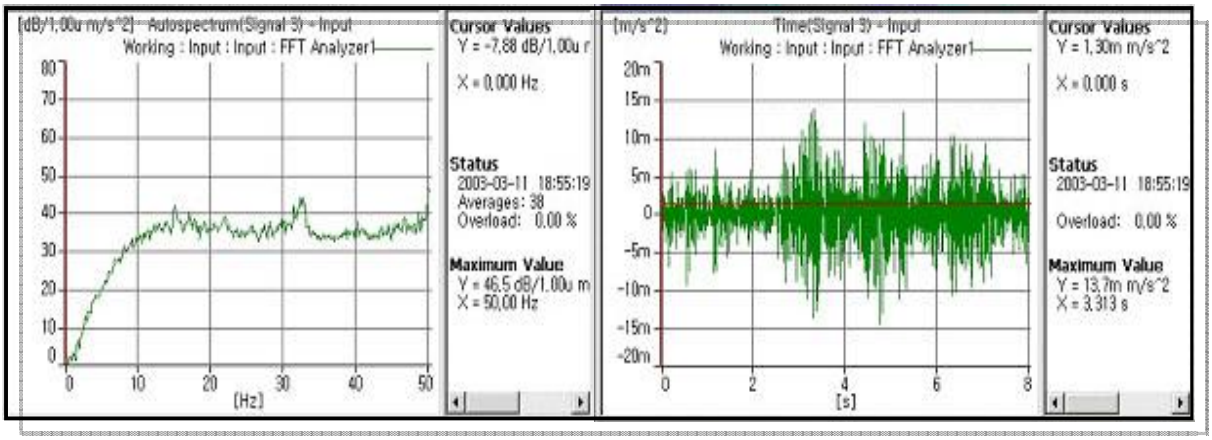
■ Structural Vibration Proofing(Metro)



■Outline of PO-MAT installation once subway train passes

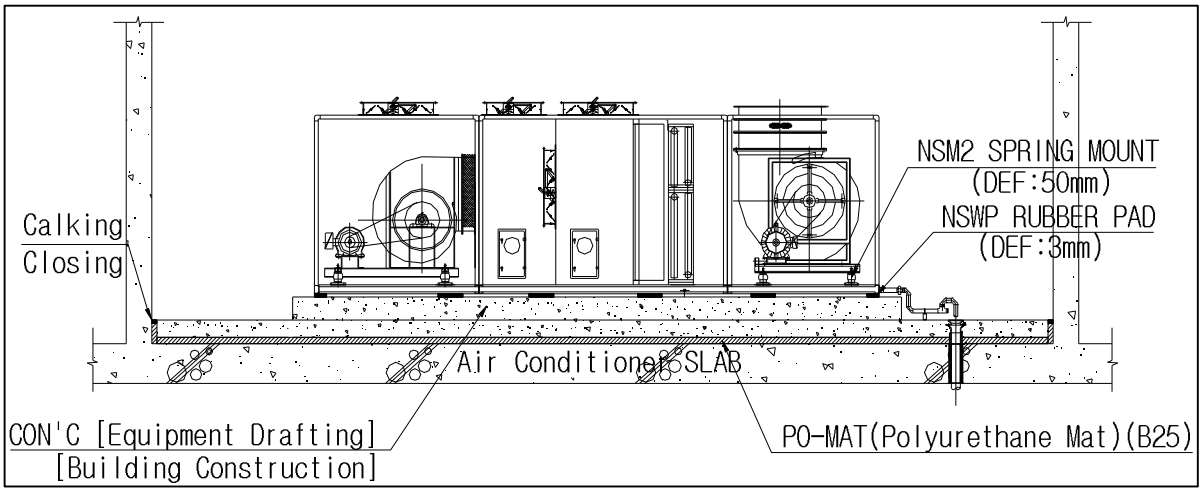


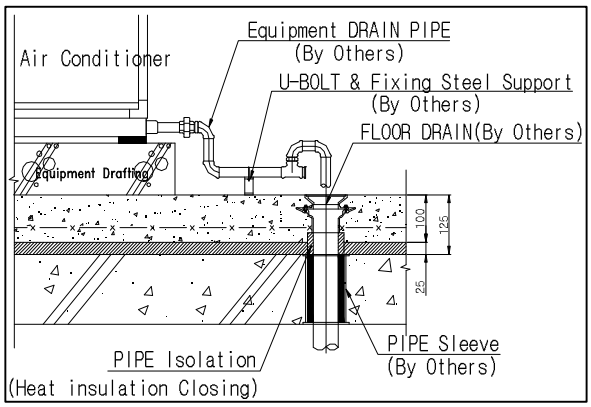
■Vibration analysis DATA once subway train passes before PO-MAT installation

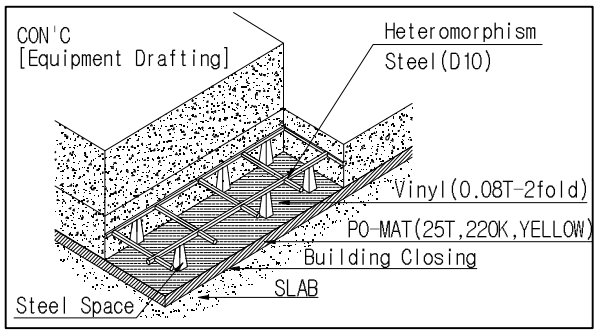


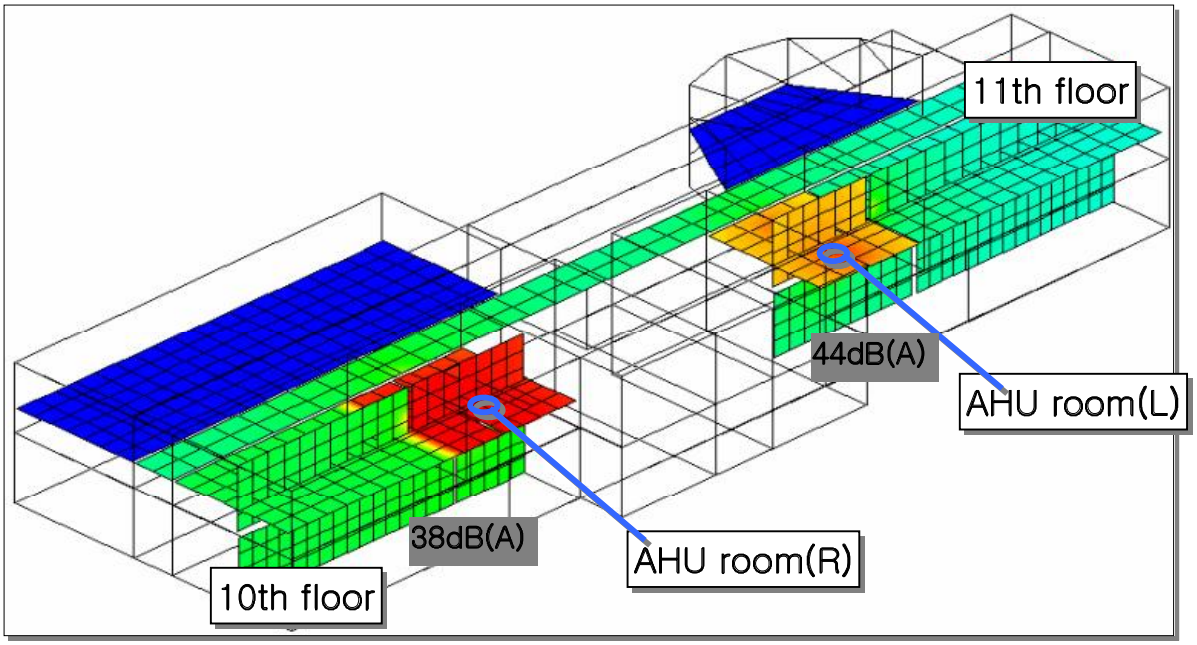
■Vibration analysis DATA once subway train passes after PO-MAT installation

■ Floating Floor on Machine Room(AHU Room)

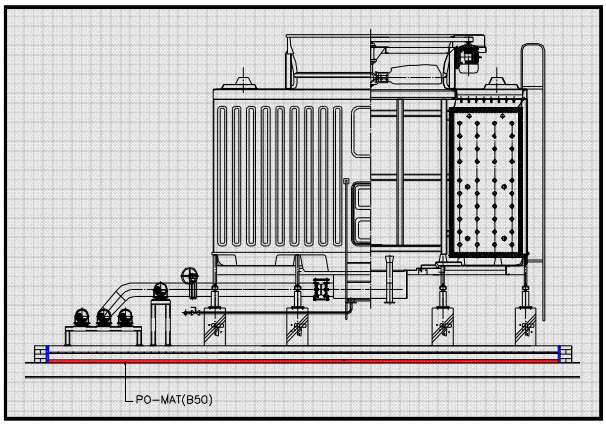


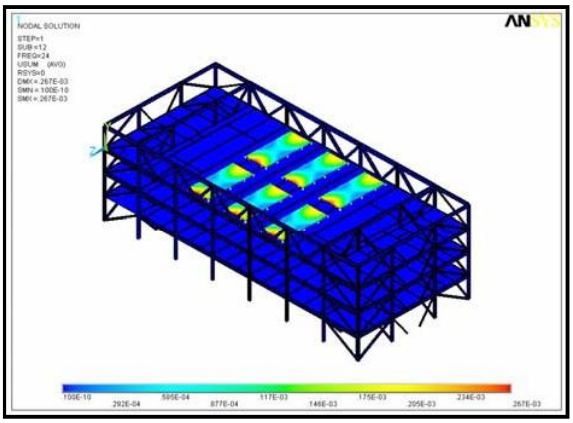




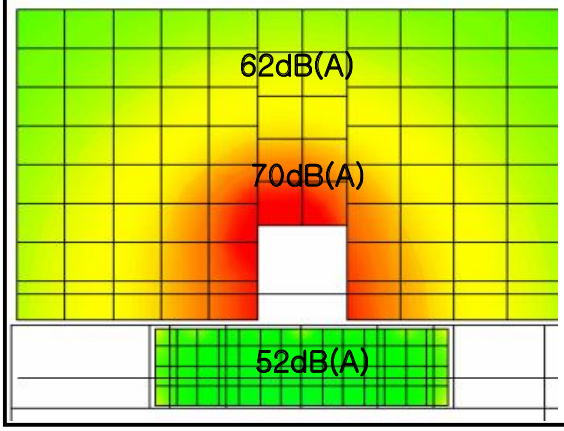


■ Floating floor for cooling tower

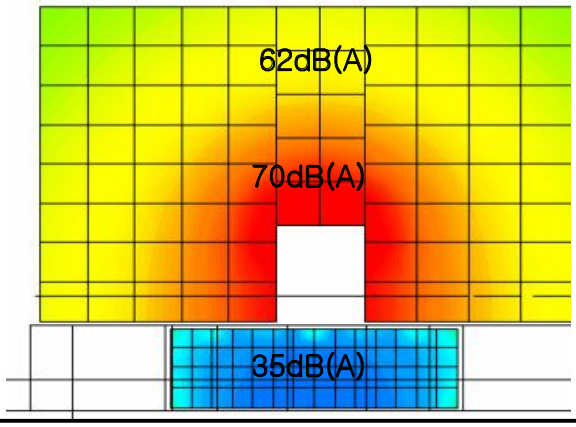




■ Cut way(before floating floor)

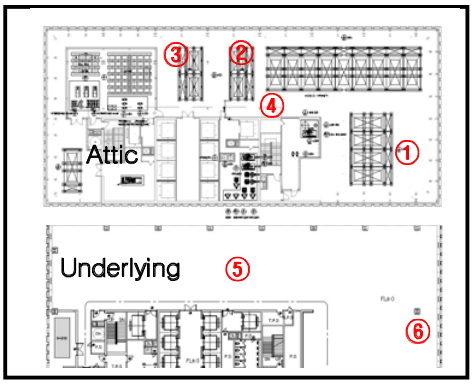


■ Cut way(after floating floor)

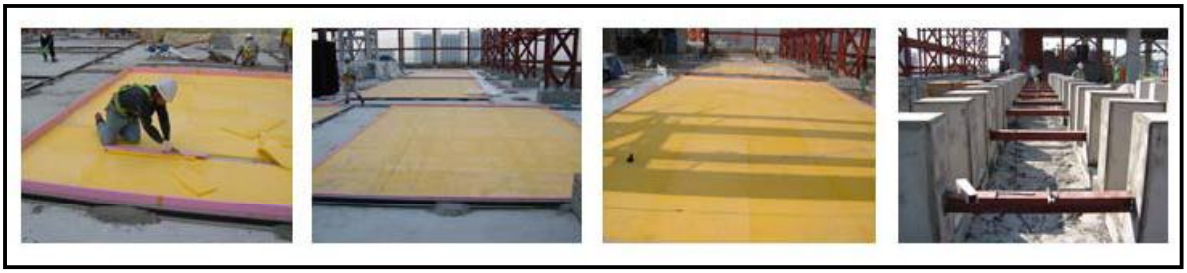


■ Noise measurement result for cooling tower on the roof(after floating floor)

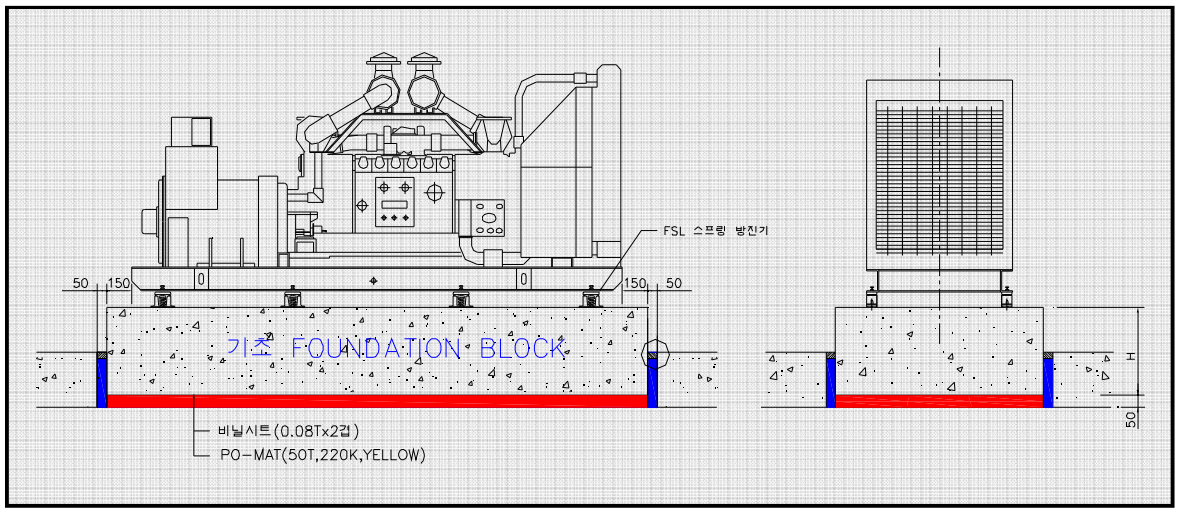
Location		Point	B.G.	CT	Δ	Remar
Attic	Suction	1	52.9	70.5	+17.6	-
		2		75.4	+22.5	-
		3		74.6	+21.7	
	Discharge	4		77.5	+24.6	
Underlying Layer		5	32.8	34.0	+1.2	-
		6	38.5	39.2	+0.7	-



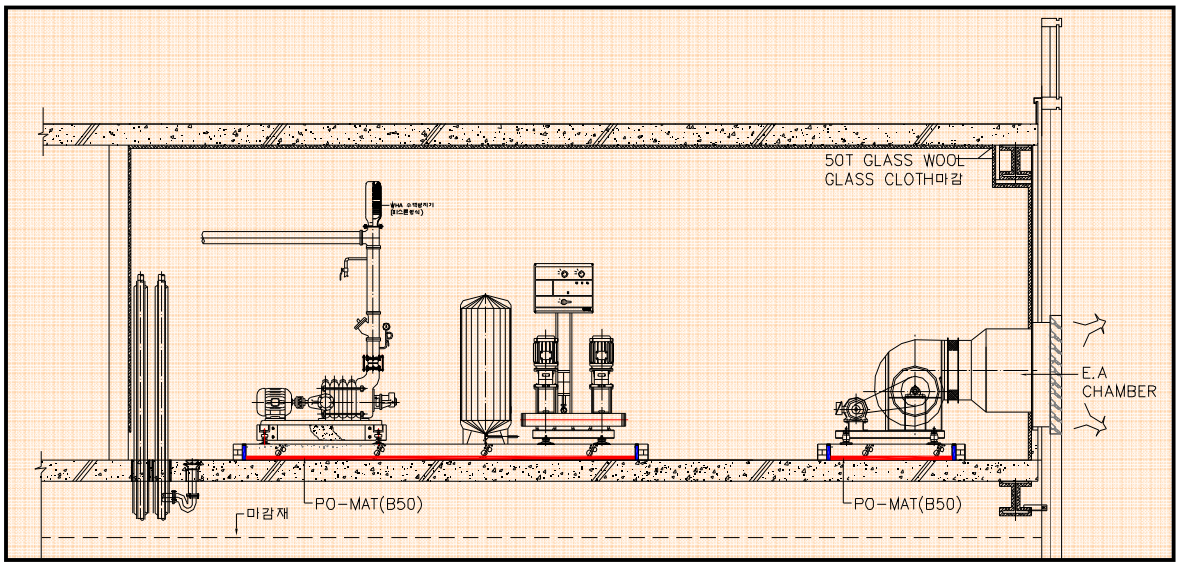
■ Floating Floor on Roof of Building for Cooling Tower



■ Floating Floor in Machine Room(Generation Room)



■ Floating Floor in Machine Room on Mid-Level Floor

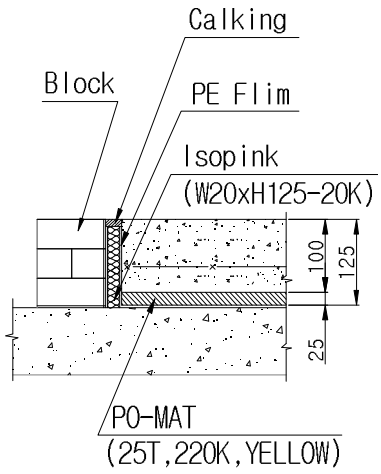
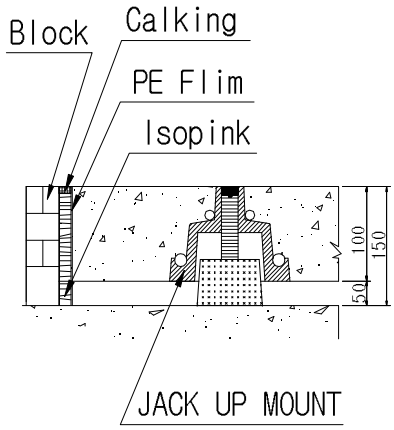


■ Other Special Structural Vibration Proofing

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 vynil sheet 3) Concrete work and dry	1) Vynil 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 effioiency	10~15dB	5~10dB
Tansmission 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 perioc 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)

PO-MAT SYSTEM

Spread PO-MAT on floor after cleaning

read 2 layers of vinyl sheet in the PO-MA

Wiremash & Concrete

Drying concrete

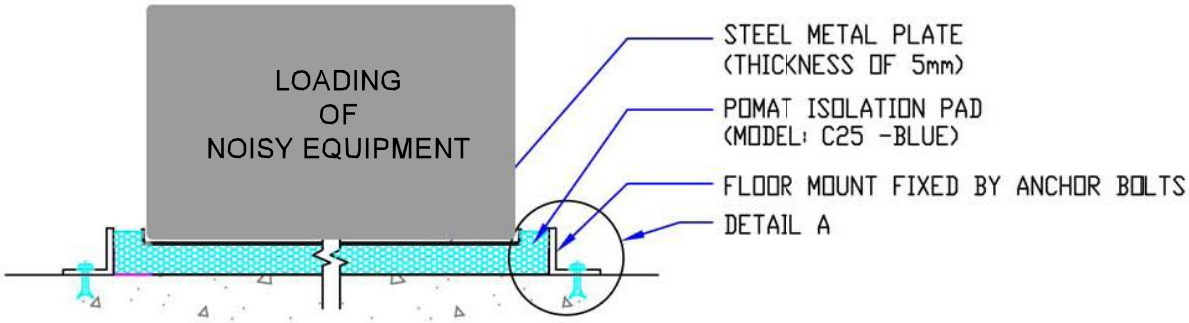
JACK-UP SYSTEM

Sep-up Jack-up mount on vinyl sheet after cleaning

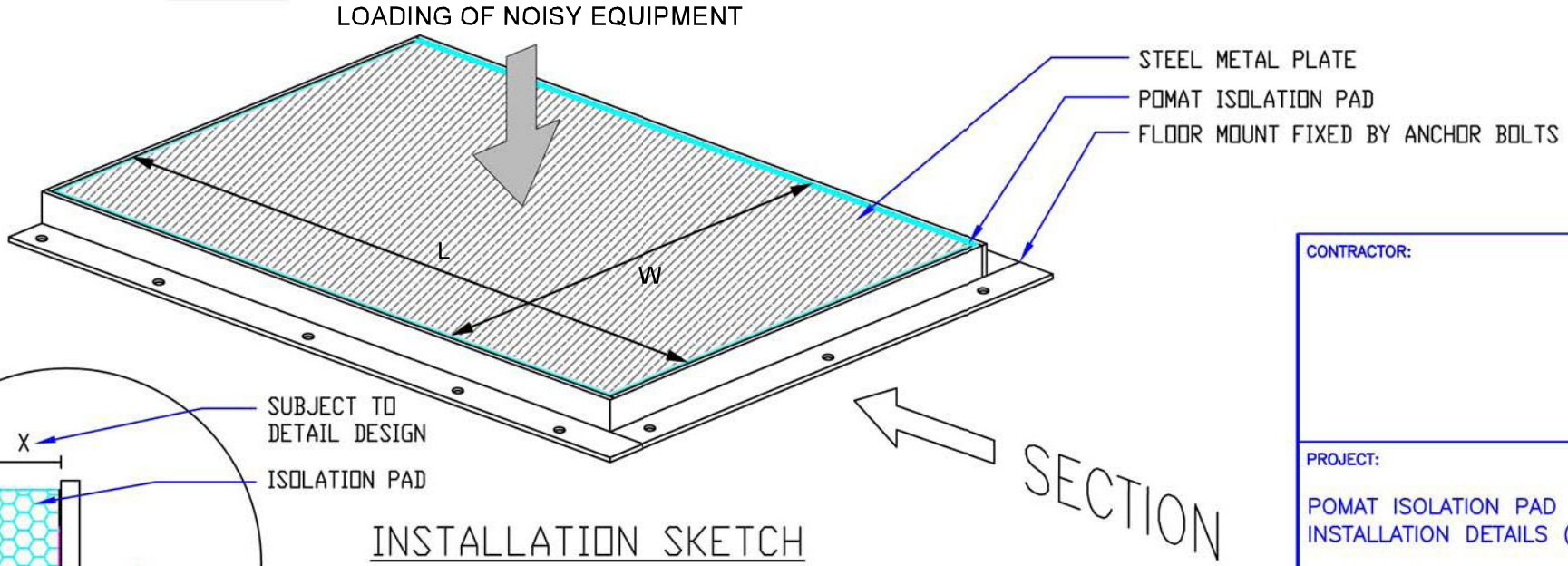
Reinforcing on the Jack-up mount

Complete reinforcing

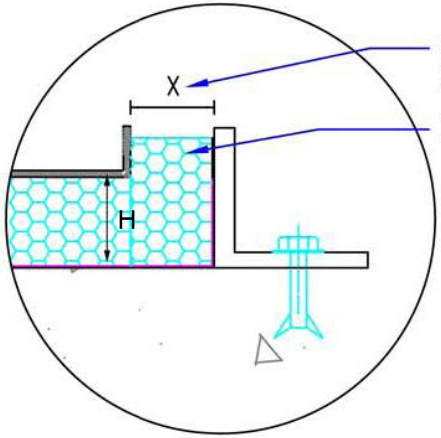
Drying concrete & Lifting floor



SECTION



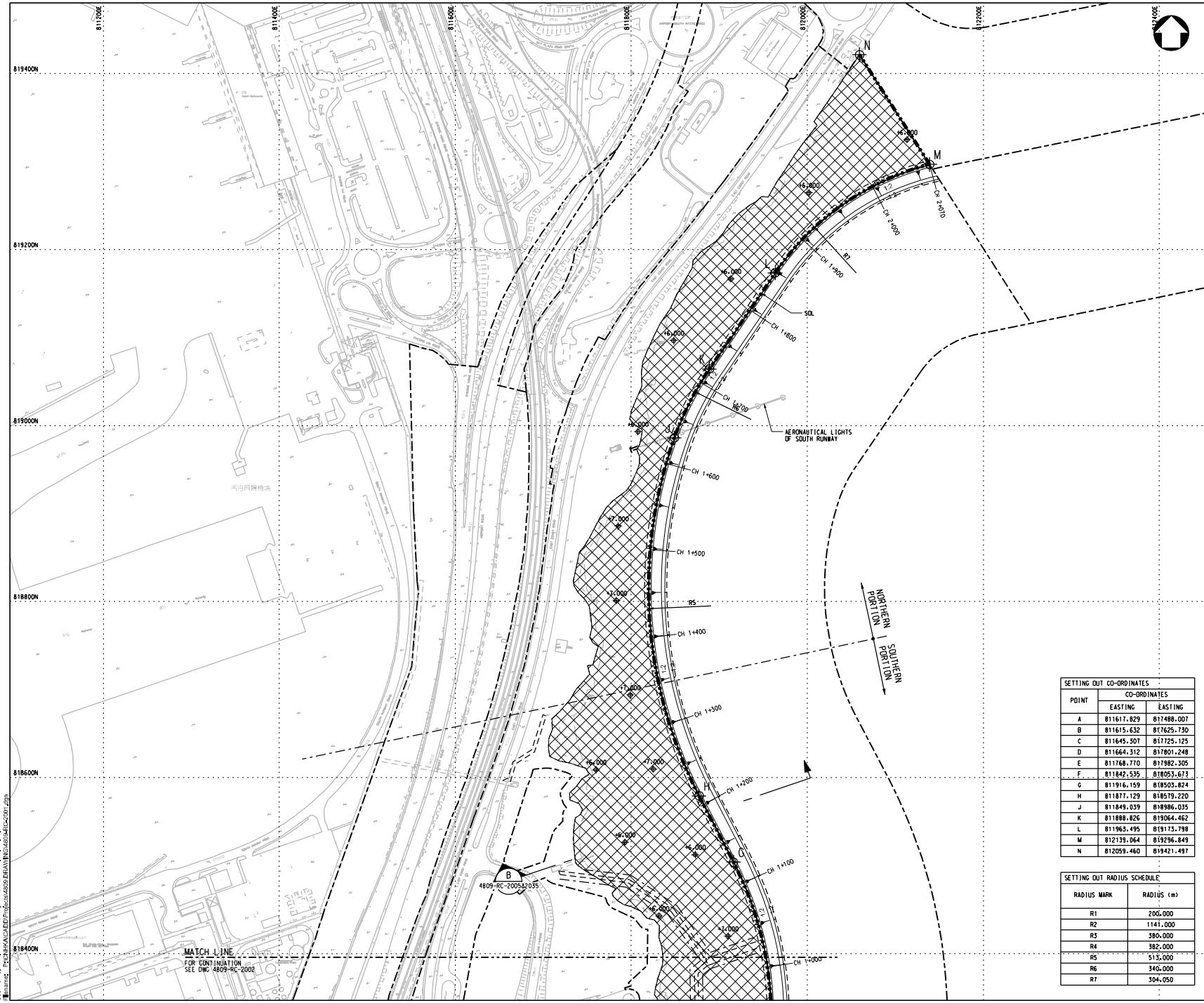
INSTALLATION SKETCH

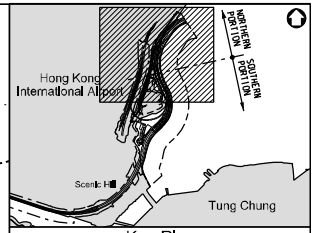


DETAIL A

CONTRACTOR:	
PROJECT: POMAT ISOLATION PAD INSTALLATION DETAILS (R2)	
TITLE:	
DRAWN:	DATE:
CHECKED: (HT)	SCALE: N.T.S.
DWG. NO.	

DRAWINGS

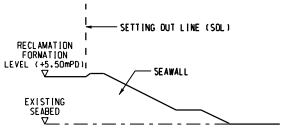




Key Plan

LEGEND:

- SITE BOUNDARY
- SETTING OUT LINE (SOL)
- SLOPING SEAWALL / BERM
- PROPOSED RECLAMATION AREA
- SETTING OUT POINT



DEFINITION SECTION
SCALE N.T.S.

Rev	Description	By	Date

Supervising Officer
ARUP 奧雅納工程顧問 Ove Arup & Partners Hong Kong Limited

Contractor
中國建築工程(香港)有限公司 CHINA STATE CONSTRUCTION ENGINEERING (HONG KONG) LTD.

Contractor's Designer
ATKINS 阿特金斯

Contract No. and Title:
Contract No. HY/2011/03
Hong Kong-Zhuhai-Macao Bridge
Hong Kong Link Road -
Section Between Scenic Hill and
Hong Kong Boundary Crossing Facilities

Drawing title
SEAWALL AND RECLAMATION
RECLAMATION PLAN
(SHEET 1 OF 2)

Drawing no.	Rev.
4809-RC-2001	A

Drawn	Date	Checked	Approved
CAD	VAR	VAR	VAR

Scale @ A1: 1 : 2000 | Status: CONSTRUCTION

路政署 HIGHWAYS DEPARTMENT
港珠澳大橋香港工程管理處 Hong Kong - Zhuhai - Macao Bridge Hong Kong Project Management Office

SETTING OUT CO-ORDINATES

POINT	CO-ORDINATES	
	EASTING	EASTING
A	811617.829	817488.007
B	811615.632	817625.730
C	811645.307	817725.125
D	811664.312	817801.248
E	811768.770	817982.305
F	811842.535	818053.673
G	811916.159	818503.824
H	811877.129	818579.220
J	811849.039	818986.035
K	811888.826	819064.462
L	811963.495	819173.798
M	812139.064	819296.849
N	812059.460	819421.497

SETTING OUT RADIUS SCHEDULE

RADIUS MARK	RADIUS (m)
R1	200.000
R2	1141.000
R3	380.000
R4	382.000
R5	513.000
R6	340.000
R7	304.050

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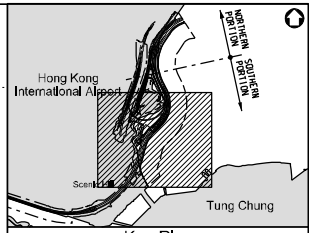
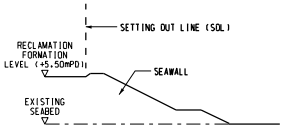


Key Plan

LEGEND:

- SITE BOUNDARY
- SETTING OUT LINE (SOL)
- SLOPING SEAWALL / BERM
- PROPOSED RECLAMATION AREA
- SETTING OUT POINT



DEFINITION SECTION
SCALE N.T.S.

SETTING OUT CO-ORDINATES		
POINT	CO-ORDINATES	
	EASTING	EASTING
A	811617.829	817488.007
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Rev	Description	By	Date

Supervising Officer
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Contractor
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Contractor's Designer
ATKINS 阿特金斯

Contract No. and Title:
Contract No. HY/2011/03
Hong Kong-Zhuhai-Macao Bridge
Hong Kong Link Road -
Section Between Scenic Hill and
Hong Kong Boundary Crossing Facilities

Drawing title
SEAWALL AND RECLAMATION
RECLAMATION PLAN
(SHEET 2 OF 2)

Drawing no.		Rev.
4809-RC-2002		A
Drawn: CAD	Date: VAR	Checked: VAR	Approved: VAR
Scale @ A1: 1 : 2000	Status: CONSTRUCTION		

路政署 HIGHWAYS DEPARTMENT
港珠澳大橋香港工程管理處
Hong Kong - Zhuhai - Macao Bridge
Hong Kong Project Management Office

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