Gammon Construction Limited



Acoustic Decoupling Measures Plan

for

Contract No. HY/2012/07 Tuen Mun Chek Lap Kok Link – Southern Connection Viaduct Section

J3518

Rev. No.: A

Effective Date: 27 Sep 2013

Prepared by:

Rby Leung Environmental Officer Reviewed by

Brian Kam
Environmental Manager

Approved by:

Andrew Veness Project Director

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Tuen Mun Chek Lap Kok Link – Southern Connection Viaduct Section

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REVISION STATUS SHEET

Rev. No.	Effective Date	Summary of Revision	Prepared	Approved
-	23 Sep 2013	First Submission	Roy Leung	Andrew Veness
Α	27 Sep 2013	Table 1, Table 2 & App B	Roy Leung	Andrew Veness



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1 INTRODUCTION

1.1 Project Descriptions

Gammon Construction Limited (GCL) has been commissioned to design and construct the Contract *No. HY/2012/07 – Tuen Mun Chek Lap Kok Link – Southern Connection Viaduct Section* for the Highways Department (HyD) of the Government of the Hong Kong Special Administrative Region (HKSARG). The Works to be executed comprise the construction of a dual 2-lane elevated carriageway between the HZMB HKBCF and North Lantau Highway (NLH) with associated slip roads, as well as modifications and realignment of sections of the NLH and Cheung Tung Road at North Lantau, and associated works.

2 PURPOSE OF THE PLAN

The Acoustic Decoupling Measures Plan (ADMP) has been developed in accordance with Condition 2.5 of the Environmental Permit (EP-354/2009/A) for the Highways Department Contract namely Contract No. HY/2012/07 — Tuen Mun Chek Lap Kok Link — Southern Connection Viaduct Section.

The ADMP shall describe the measures to be taken to minimize impacts to marine ecological environment when carrying out bored piling, dredging and reclamation works.

The location of the Contract is illustrates in **Appendix A**.

3 MARINE CONSTRUCTION NOISE SOURCES

3.1 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.

In order to minimize impacts to Chinese White Dolphin (CWD) by bored piling, dolphin exclusion zone of 250m around the work area will be implemented and monitored by independent dolphin observers. Dolphin observers shall scan the exclusion zone at least 30 minutes before start of bored piling works, to ensure CWD not being disturbed.

3.2 Working Vessels and Platforms

According to Section 8.11.9.29 of the approved EIA Report, the expected acoustic disturbance from large vessels is well below the primary acoustic range for CWD which in general show the increased use of high-frequency sound. As such, main engines of the proposed working vessels are not considered to be a significant source of acoustic disturbance to CWD. However, there is still a small possibility that noise would be transmitted from the onboard equipment (e.g. air compressor) into the sea (Section 8.14.4.13 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.



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 are summarized in Table 1:

Table 1 Summary of Noisy Equipment Identified on Working Vessels

Working Vessel	Noisy Equipment identified on Working Vessel
Derrick Lighter	Generator (Diesel, 35.81kW, 1.5 Tons approx.)
Jack-Up Platform	Generator (Diesel, 44.76kW, 3 Tons approx.)
Jack-Op i lationii	Generator (Diesel, 4.48kW, 1 Ton approx.)
	Generator (Diesel, 4.47kW, 1 Ton approx.)
Flat Top Barge	Generator (Diesel, 80.57kW, 5 Tons approx.)
	Air compressor (Diesel, 7bar, 1 Ton approx.)
Hopper Barge	No noisy equipment will be provided onboard.
Crane Barge	No noisy equipment will be provided onboard.

In order to minimize the noise transmission to the sea, acoustic decoupling measures for the stationary equipment mounted on boards will be adopted. Sample of stationary powered mechanical equipments on working vessels is illustrated in **Appendix B**.

4 ACOUSTIC DECOUPLING MEASURES

4.1 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.

Instead of directly mount on decks, noisy equipments will be fixed on noise isolation pad. Prior to installation, GCL 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. 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)
Derrick Lighter	Generator (Diesel, 35.81kW, 1.5 Tons approx.)	2m x 1m x 30mm approx.
Jack-Up	Generator (Diesel, 44.76kW, 3 Tons approx.)	2m x 1.3m x 30mm approx.
Platform	Generator (Diesel, 4.48kW, 1 Ton approx.)	1.5m x 1m x 30mm approx.
	Generator (Diesel, 4.47kW, 1 Ton approx.)	1.5m x 1m x 30mm approx.
Flat Top Barge	Generator (Diesel, 80.57kW, 5 Tons approx.)	3m x 1.5m x30mm approx.
	Air compressor (Diesel, 7bar, 1 Ton approx.)	1.5m x 3m x 30mm approx.

Three type materials of isolation pad are proposed to be used for noisy equipments identified on working vessel, the details are given in **Appendix C**, **Appendix D** and **Appendix E**.



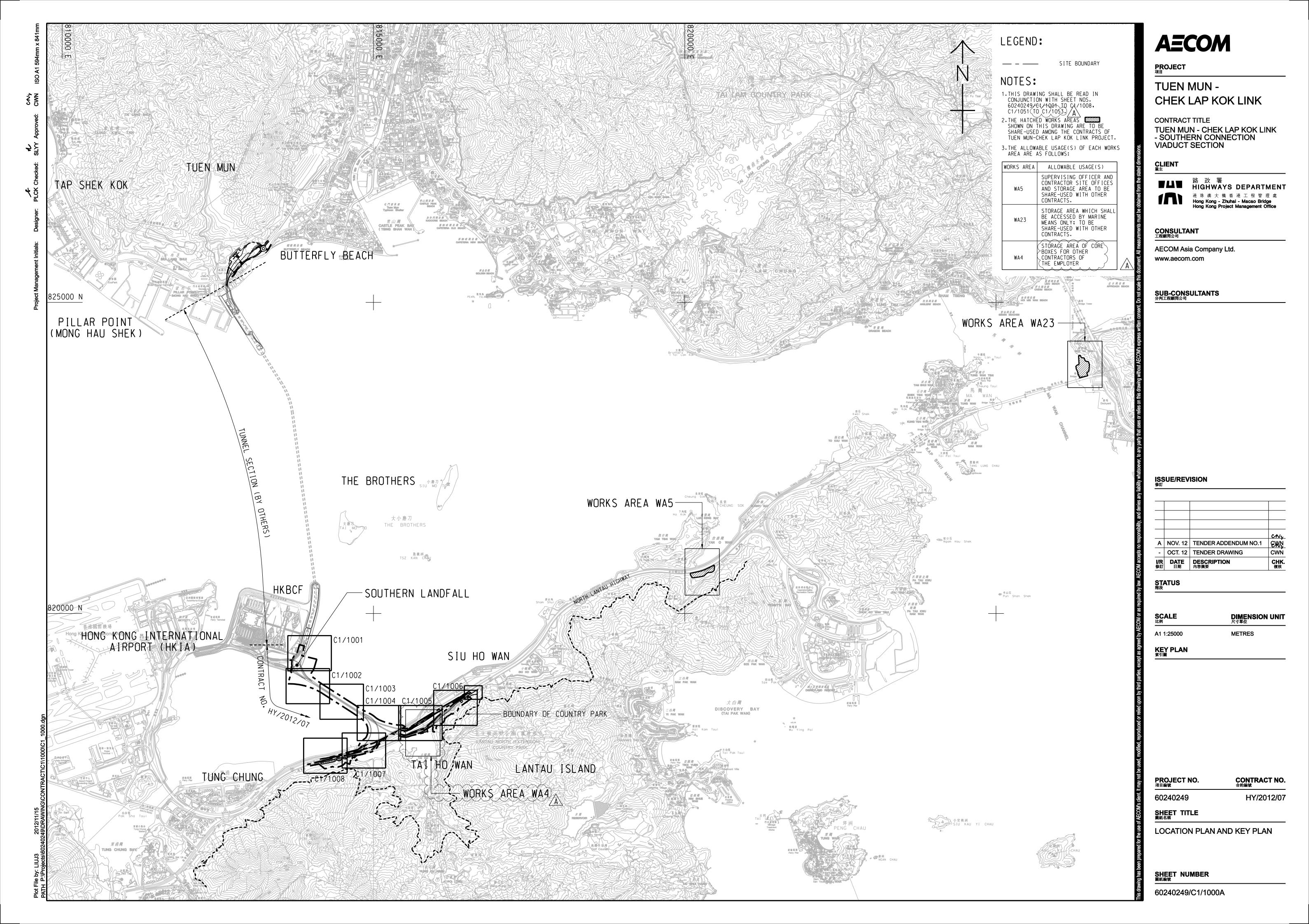
4.2 General Notes to Install the Measures

- 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.



APPENDIX A

Site Location Plan





APPENDIX B

Samples of Stationary PMEs on Working Vessels





Type A – Generator on vessel board



Type B – Air compressors on vessel board

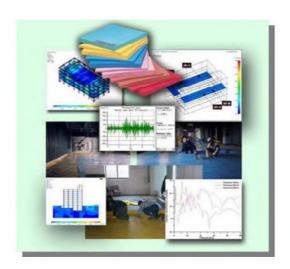


APPENDIX C

Proposed Isolation Pad Details – PO MAT



Technical Data







■ COMENT: ■

- 1. General information of PO-MAT
- 2. Size of PO-MAT
- 3. Durobility Test Result
- 4. Comparison of Technical Data
- 5. Application Data for PO-MAT
- 6. Comparison of Installation/Major Characteristics

for PO-MAT



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

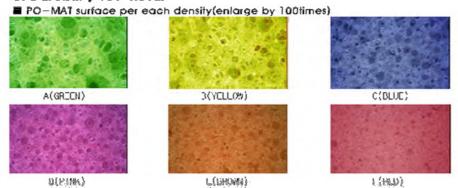
Proposed material for the contract

2	PO	-MAT	Ranc	10
		IVIC	Kulls	•

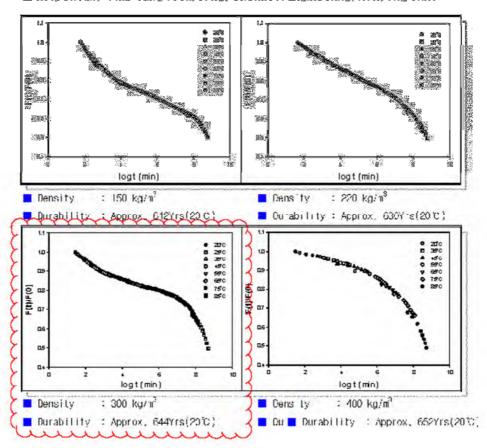
2. PO-MAT N	cang	<u>e</u>			\sim	~						
MODEL	A12	A25	B12	B25	C12	C25	012	D25	E12	E25	F12	F25
THICKNESS	12	25	12	25	12	25	12	25	12	25	12	25
COLOR	GRI	EEN	YEL	LOW }	BL	.UE	PI	NK	BR	NWC	R	ED
DENSITY (kg/m³)	150	± 10	220	± 10	300	± 10	3400	± 10	500	±10	600	± 10
RATED LOAD (N/mm²)	0.0	007	0.	024	0.0	052	3 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		Owner	d Manu	factur	ing F	acilit	ies:10	00~150	m²/Day	(8Hrs	/Day)	
PRODUCTION SIZE			1	1,000m	ım x 1	,000(5	600)mm	x THI	CKNESS	5]		
MANUFACTURING PROCESS	2.Hea 3.Mix 4.Pou 5.For 6.Rem	ting i POLYO ring t ming. oving k cond	ngred L and he mix mold a	and Miants, MDI by MDI	y SHOO gredia raps. ulare	OTER. ants t	o a mo	nperati	ure, a	ir pre		



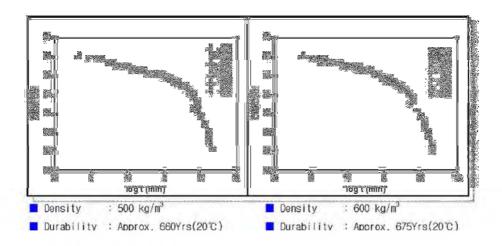
3. Durobility Test Result



- Durability tes by TTS(Time-Temperature Superposition)
- Resposibility: Ph.D Yungwook, Jang, Chemical Engineering, Hanyang Univ.







4. Comparison of Technical DATA

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

	1774		Material Type	}	REMARK
NO.	ITEM	SPRING	RUBBER	POLYURETHANE	
1	Photos				3
2	Model	FSL2	NSWP	PO-MAT	}
2	Туре	COIL	PAD	MAT	5
3					-

Noise and Vibration Prope	Hine

NO	LTCH.	Material Type				
NO.	ITEM	SPRING	RUBBER	POLYURETHANE	REMARK	
1	Viscosity	-		0	2	
2	Static load(kgf/mm²)	-	-	0.50	}	
3	Elastic strain(%)		about 20	up to 50	(
4	Virtical load ratio	about 4.0	3.3	2.5	{	
5	Operating load	0	•	0)	



■ Physical Properties

NO	LTCH		Material Type		DEMAN
NO.	ITEM	SPRING	RUBBER	POLYURETHANE	REMARK
1	Ultimate strength		200~260	up to 500	3
2	Coefficient fo expansion	Ψ.	630%	260%	3
3	Tensile Strength	+	•	0	3
4	Creep resistance		•	0	2
5	Abrasion	*	•		3
6	Cracking resistance		0	0	5
7	Tearing Drying	0	•	0	2
1	Resista 011 nce impregration	0		- ©	3
8	Heat resistance	*	-	-	2
9	Cold resistance	•	•	0	}
10	Permanent bend	+	•		5
11	Manufacturing capacity	A	•	0	2
12	Density(kg/m³)	iù l	up to 450	up to 1500	3
13	Using Temperature	0)

■ Chmical Properties

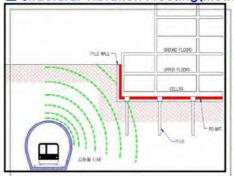
NO.	ITEM	Material Type				
NU.		SPRING	AUBBER	POLYURETHANE	REMARK	
1	Adhesion capacity	-	0	*	3	
2	Oil resistance	•	•	O	2	
3	O zone resistance	*	•	0	3	
4	Ageing resistance	•	+	*	3	
5	Biological Besistance	*	0	*	2	
6	Water & Aqueous Solution	★(Corrosion)	0	*	3	
7	Formic acid	◎(Corrosion)			2	
8	Acetic acid	@(Corrosion)		0	3	
9	Phosphoric acid	⊚(Corrosion)	A	*	3	
10	Oils & Greases	◎(Corrosion)	0	*	3	
11	Glycerol	⊚(Corrosion)	0	*	3	
12	Glycol	0	0	* *	2	
13	Hexane	0	٥	*	ζ	

■Remark:Excellent★, Very Good②, Good◆, Normal▲, Not Good■, Not Applicable▼



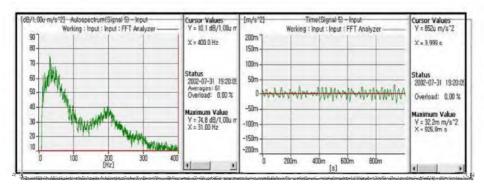
5. Application Data for PO-MAT

Structural Vibration Proofing(Metro)

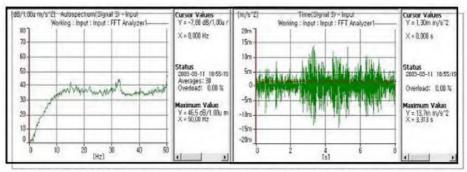




■Outline of PO-MAT installation once subway train passes



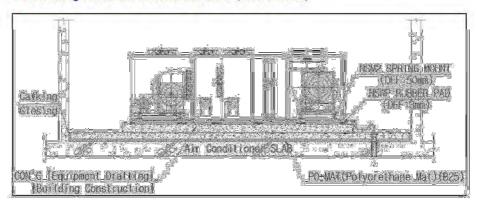
■Piblickion apelvalo DATA taco-educar/ train beserve batora PO-MAT thetal for for

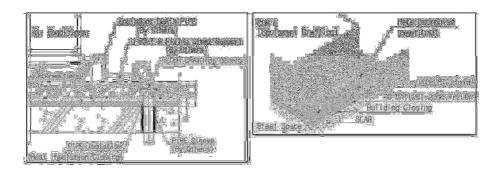


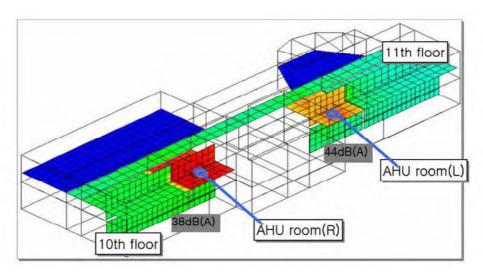
■Vibration analysis DATA once subway train passes after PO-MAT installation



■ Floating Floor on Machine Room(AHU Room)

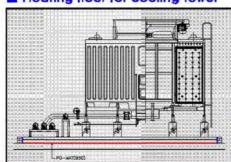


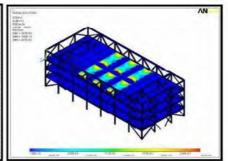




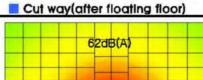


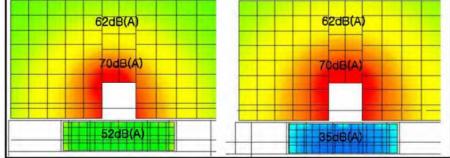
Floating floor for cooling tower





Cut way(before floating floor)





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

Lo	cation	Point	B.G.	CT	Δ	Remar
A t Sucti t on c		1		70.5	+17.6	+
	2	52.9	75.4	+22.5		
		3	00	74.6	+21.7	_
	Disch	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



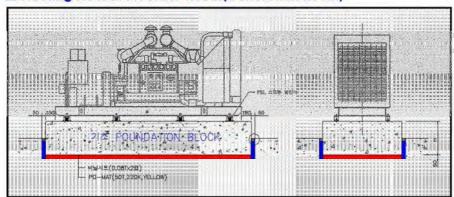




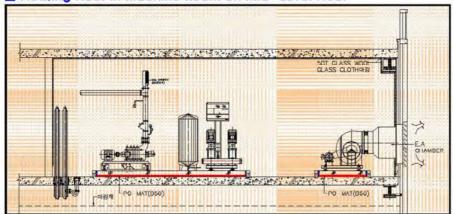




■ Floating Floor in Machine Room(Generation Room)



■ Floating Floor in Machine Room on Mid-Level Floor



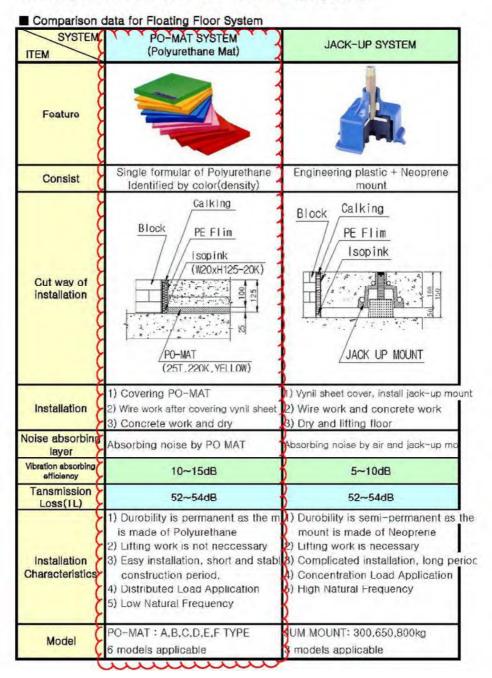
Other Special Structural Vibration Proofing



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



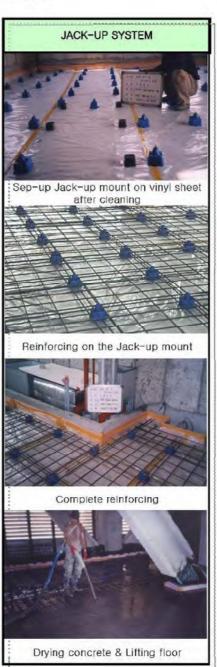
Comparison Data (PO-MAT vs Jack-Up System)



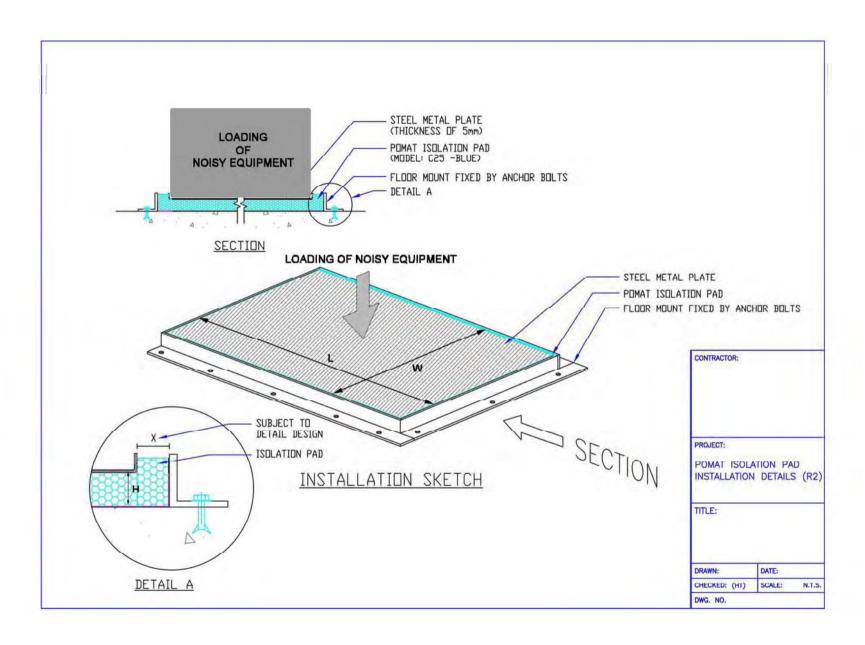


■ Comparison of installation(PO-MAT vs JACK-UP)









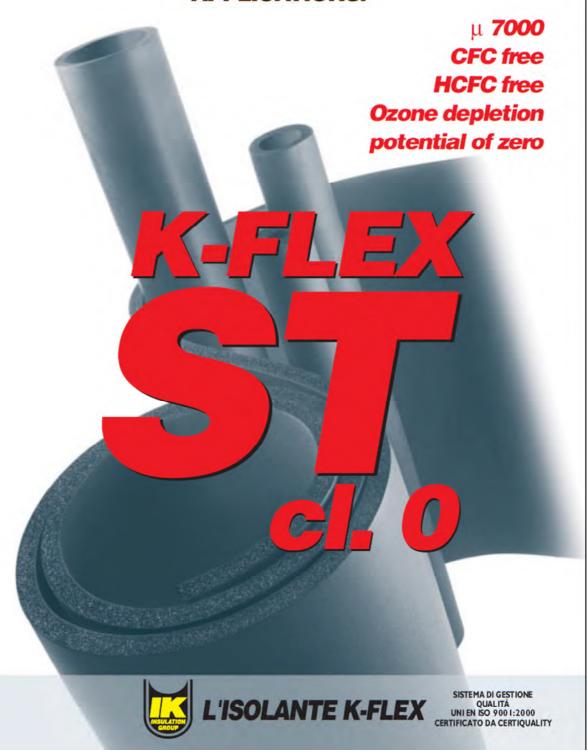


APPENDIX D

Proposed Isolation Pad Details – K-FLEX ST



QUALITY INSULATION FOR REFRIGERATION, AIR CONDITIONING, HEATING AND PLUMBING APPLICATIONS.





K-FLEX ST

K-FLEX ST offers all the technical characteristics required to insulate chilled water and refrigerated pipework, hot and cold water services, heating systems and air ducts in commercial, industrial and public buildings where cost/quality are of paramount importance.

Sheet rolls

40

50

1	Self adhesive sheets	1,5 metre wide	1 metre vride	Thickness mm	
-	6	30 x 1,5	30 x 1	6	
	10	20 x 1,5	20 x 1	10	
-	13	14 x 1,5	14 x 1	13	4
	16	12 x 1,5	12 x 1	16	ľ
	19	10 x 1,5	10 x 1	19	
6	25	8 x 1,5	8 x 1	25	á
400 lb	32	6 v 1 5	6 v 1	32	•

4 x 1,5

4 x 1,5



Tube size range: lenght 2 metres

thickness

6 . 1/4"

9 . 3/8"

13 . 1/2"

19 . 3/4" 25 . 1"

32 . 11/4"

Diameters from

6 to 160 mm

K-FLEX ST 08/02 - UK





Sheet flat

4 x 1

4 x 1

Thickness mm	2m-x-1m m-Zhox	2m x Q5m m=/box
6	48	24
10	32	16
13	24	12
16	20	10
19	16	8
25	12	6
32	10	5
40	8	4
50	6	3

Data sheet

Temperature range	-200 °C max +116 °C **	Corrosion risk	DIN 1988/7"; pH neutra
Thermal conductivity \(\lambda\) W/(mk) EN 12667 (DIN 52612) EN ISO 8497 (DIN 52613)	-20 °C = 0,034 0 °C = 0,036* +20 °C = 0,038	Data ecolo gical	No Diphenyloxyde HFCKW - FCKW free No Formaldehyde - Cd
Water vapour diffusion		Closed cell	>95%
resistance factor (µ) EN 12086 (DIN 52615)	> 7000	Ozone resistancy	Good
		Resistancy to oil and greases	Good
Water vapour permeability (23 °C)	δ 1-10*	Resistancy to fungus and perassite	Good
(DIN 52615, BS 4370) EN ISO 12572		Resistancy, to agent atmospheric	Good
LITTO 1807 E		Noise reduction	Max 35 dB (A)
	Q.1(I)*	Odor	Negligible
Fire	Brandkenreitter 5-2 (CH) B1 DIN 4102 (D)* (ABP-P3346-1021-MPA BS) DIN 4102 Tell 11 (Wand- und	Schallab sorption nach EN ISO 11654	Absorberklasse D
	Dechendurchführung) MI-NF (F)* PII NIT 036 (SK)* BI 0NORM B38000 (A.) BS 476 Part 6 1999 CLD (UK)	* Supervised ** In case of product application un	ider - 150 °C please

L'ISOLANTE K-FLEX reserves the possibility to vary data and technical requirements without notice.



via Don Locatelli, 35 20040 Roncello (MI) Italy tel.: +39.039.68241 (r.a.) fax: +39.039.6824560 http://www.lisolantek-flex.com

e-mail: international@isolante.com italysales@isolante.com



APPENDIX E

Proposed Isolation Pad Details – Kinetics ISOlayment QT-B



Recycled Rubber Noise Control Floor Underlayments

ISOLayment QT*



Features

- Low-cost, recycled rubber noise control underlayment
- Extensively tested at the top labs in the USA
- Two (2) Styles: Flat (F) and Bumpy (B) in full rolls
- Available in eight (8) standard thicknesses; other thicknesses available
- Easily installed over sheathing, planking, concrete, and gypsum concrete
- Accepts a wide range of finished floor materials including vinyl sheet, stone, wood, and gypsum concrete
- Combine with KINETICS' WAVE Hanger, IsoMax, and ICW to maximize performance in wood-framed construction

It's like this: You want a low-cost, easy-to-install floor underlayment to ensure you at least meet current building code in your multi-family high rise, dormitory, or mixed-use development. Yet, you want a product manufactured in the USA that has been extensively tested, meets all established indoor air quality standards, outperform similar low-cost underlayments such as cork or foam plastic, and can help contribute LEED points for your project.

KINETICS offers the solution: /SOLayment QT. KINETICS /SOLayment QT rubber noise control underlayment

features patented QT Impact Sound Isolation Technology. North America's largest manufacturer of recycled rubber products supports KINETICS' efforts to offer our customers the broadest range of isolation products for ceilings, floors, and walls. You can have a single-source for all your project's isolation requirements. By partnering with the folks who created QT Impact Sound Isolation Technology, KINETICS has ready access to a large test report database as well as a trove of information covering installation of a wide range of finished floor products over top of recycled rubber underlayments.

Available in Two Styles

KINETICS ISOLayment QT is available in two styles: Flat (F) and Bumpy (B). All rolls are 48-inches wide. Flat (F) rolled products are available in standard thicknesses of 2mm, 5mm, 10mm, and 15mm. Bumpy (B) rolled products are available in standard thicknesses of 6mm, 10mm, 17mm, and 25mm. Let us know if you need thicknesses other than standard. Special requests are not a problem.

Installation Guidelines

KINETICS ISOLayment QT can be installed over plywood sheathing, concrete floors, heavy timber planks, and gypsum concrete. Finished flooring products including concrete, ceramic tile, vinyl sheet and LVT, stone, wood, and gypsum concrete can be applied directly to KINETICS ISOLayment QT.

LEED Certification

Made from 92% recycled rubber content, KINETICS /SOLayment QT provides an environmentally responsible solution for quality sound control. It is designed to meet the stringent criteria required to earn points in multiple categories for LEED certification. Additionally, KINETICS /SOLayment QT passed the strictest indoor air quality tests and assurance methods for low emissions of total volatile organic compounds (VOCs).



CREATE QUIET



ISOLayment QT* Test Reports Summary

Concrete Slab and Composite Deck - Acoustical Lab Test Reports

Floor Description	Celling	Finish	ISOLayment	IIC.	AllC	STC
6" Concrete Slab	No	Bare	No	27		
6" Concrete Slab	No	Vinyl Sheet	QT-F05	53	23	
8" Concrete Slab	No	Bare	No	32		
8" Concrete Slab	No	Engineered Wood	QT-F02W	54		
8" Concrete Slab	No	Quarry Tile	QT-F05	50		
8" Concrete Slab	No	Quarry Tile	QT-F10	53		53
8" Concrete Slab	No	Quarry Tile	QT-F12	55		55
4" Concrete Hambro D500 System	one (1) layer 1/2" GWB on furring	Engineered Wood	QT-F10W	51		54

Wood-Framed with Fiber Glass - Acoustical Lab Test Reports

Floor Description	Ceiling	Finish	/SOLayment	IIC	STC
3/4" gypsum concrete over 3/4" OSB on 18" open web wood joists	one (1) layer 5/8" GWB on RC Deluxe channel ceiling	Ceramic Tile	QT-F06 directly under tile	53	55
1" gypsum concrete over plywood on 2x10 wood joists	two (2) layers 5/8" GWB on RC Deluxe	Bare	QT-B06/3 directly under gypsum concrete	53	
1" gypsum concrete over plywood on 2x10 wood joists	one (1) layer 5/8" GWB on RC Deluxe	Vinyl Sheet	QT-B06/3 directly under gypsum concrete	53	
1" gypsum concrete over plywood on 2x10 wood joists	one (1) layer 5/8" GWB on RC Deluxe	Stone Tile	QT-B06/3 directly under gypsum concrete	51	
1" gypsum concrete over plywood on 2x10 wood l-joists	two (2) layers 5/8" GWB on RC Deluxe	Vinyl Sheet	QT-F05 directly under gypsum concrete	53	
3/4" plywood on 12" wood I-joists	two (2) layers 5/8" GWB on WAVE Hanger suspended furring channels	Engineered Wood	QT-F03 directly under wood floor	57	60
5/8" plywood over 3/4" plywood on 12" wood I-joists	two (2) layers 5/8" GWB on WAVE Hanger suspended furring channels	Ceramic Tile	QT-F03 directly under tile	56	61

Post-Tensioned Concrete - Field Test Reports

Floor Description	Ceiling	Finish	/SOLayment	FIIC
Eight-inch (8") PT Slab	No	Ceramic Tile	QT-F05 directly under tile	59
Eight-inch (8") PT Slab	No	Ceramic Tile	QT-F10 directly under tile	60
Eight-inch (8") PT Slab	No	Bare	No	35
Seven-inch (7") PT Slab	No	Ceramic Tile	QT-F05 directly under tile	51
Seven-inch (7") PT Slab	No	Wood Plank	QT-F05 directly under tile	56
Seven-inch (7") PT Slab	No	Bare	No	33

*KINETICS /SOLayment QT is available exclusively from Kinetics Noise Control, Inc. and its representatives. The product is fully supported by the USA manufacturer of QT Impact Sound Isolation Technology which means our product is made to the exact same standards as QT Sound Insulation. Test reports, technical information, installation guidelines, and other data for QT Sound Insulation apply equally to /SOLayment QT.



kinetics noise.com/arch/isolayment_qt.html sales@kineticsnoise.com 1-800-959-1229

Ohio, USA

Nevada, USA

Ontario, Canada

Hong Kong, China

Kinetics Noise Control, Inc. is continually upgrading the quality of our products. We reserve the right to make changes to this and all products without notice.

/SOLayment QT 3/13



