Appendix D9

Noise Mitigation Options Review

D9.1 NOISE MITIGATION OPTIONS REVIEW - DETAILED DISCUSSION

The noise mitigation options reviewed have been categorised into the following hierarchy according to the noise control approach:

- At Source (S) - Reduction of Plant Number, Use of Quiet Plant, Alternative Construction Methods, Reduction of Plant Operating Time.
- Along Propagation Path (P) - Portable Noise Barriers, Fixed or Movable Enclosures, Acoustic Shrouds, Full Decking.
- At Receiver (R) - Indirect Technical Remedies by means of Improved Window Glazing and Air-conditioning.
- Management (M) - Contractual Control, e.g. Use of Specialized Equipment, Particular Contract Specification in Terms of Environmental Noise Limits.

D9.1.1 Reduction of Number of Plant to be Used on Site (S)

The activity sound power levels could be reduced by minimizing the number of plant to be used on site. A reduced plant inventory was derived and reviewed by KCRC and the detailed design consultant in order to verify its practicality in completing the work within the programme. Key constraints in determining this list are that the duration of the construction activities will not be affected such that they cause significant delay of the project implementation programme and also the uncertainty of actual plant type to be used by the Contractors.

D9.1.2 Reduction of Plant Operating Time (S)

The activity sound power levels could be reduced by limiting the plant operating time. For a 30 minute period which is the noise exposure time specified for the noise criteria, reducing the total operating time by half (i.e. 15 minutes) would result in 3dB(A) reduction of the noise exposure.

Given that a reduced plant inventory will be employed for undertaking the construction works while at the same time it is also required to complete the railway construction within the current master implementation programme which is already very tight, this approach of noise control may not be appropriate and practical. (This approach of noise control is not supported by the current TM methodology for assessing construction noise).

D9.1.3 Use of "Quiet" Equipment and Working Methods (S)

It is generally accepted (and supported by field measurement) that newer construction equipment is quieter in operation than old, and that PME is available in Hong Kong with SWLs which are quieter than the levels given in TM1. It is understood that the plant noise specification of TM1 for a specific type of plant is a representation for a range of models.

Quiet PME is defined as PME which has a measured SWL which is less than the value specified in TM1 for the same item of plant. Examples which are known to be available are given below (Reference : BS5228:Part 1:1997 Tables C2 - C7 and TM1):

a) Breaker (Excavator-mounted): 115 dB(A) max;

b) Bored Piling Rig: 110 dB(A) max;

c) Bulldozer: 110 dB(A) max;

d) Breaker (Hand-held): 108 dB(A) max;

e) Poker vibrator: 102 dB(A) max;

f) Excavator: 105 dB(A) max;

g) Mini-excavator: 97 dB(A) max;

h) Concrete Pumps (electric): 96 dB(A) max;

i) Loader: 105 dB(A) max;

j) Lorry: 104 dB(A) max;

k) Mobile Crane: 107 dB(A) max;

l) Compressor: 100 dB(A) max;

m) Generators: 100 dB(A) max; and

n) Water pumps: 88 dB(A) max.

It would be normally considered too restrictive to specify Contractors to use specific models or items of plant as one of the EIA recommendations. It is more reasonable and practical to set plant noise performance specifications for specific PME. This is typically supported contractually by giving the Engineer power to remove plant from site which is considered to be the cause of environmental noise nuisance. A pragmatic approach would be to request that the Contractors verify the noise level of the plant proposed to be used and demonstrate through furnishing of these results, that the plant proposed to be used on the site meets the requirements.

For the construction works of the Middle Road station entrances and the pedestrian interchange subway where specific measures will be required to minimize the noise impacts along Middle Road and Mody Road, KCRC could consider to specify in these works contracts that only PME items with proper noise certification and labels can be used.

On the other hand, it is not practical to require that all PME to be used are noise certified or labelled. It is recommended that the categories of PME requiring the certification or labels are only for PME which are declared to be quiet models and non-standard PME items excluded from the TM1. A management and monitoring system should also be imposed to give each of these PME items a reference number and a readily visible label/marking, and this ensures only approved PME are used.

D9.1.4 Use of Alternative Construction Equipment (S)

The use of alternative construction equipment other than those suggested in the quiet equipment list has been explored. For instance, 'Silent Piler' and 'Wirth' are alternative choices of piling equipment. Their sound power levels are in the range of 90-95 dB(A) for the Silent Piler, and in the order of 106dB(A) for the Wirth. These levels are lower than the bore piling by 4 - 20 dB(A). However, the detailed design consultant has confirmed that the use of Silent Piler will be constrained by the presence of hard rocks and boulders (see Appendix D6). The use of Wirth is expected to be limited by the availability of sufficient working spaces. Significant noise exceedances are expected at Mody Road and Middle Road, and effective mitigation is difficult due to the close proximity of the NSRs to the site. Therefore, KCRC will require the Contractor wherever possible to use electrically driven equipment and/or smaller handheld plant, which are usually quieter, and centralized plant such as air compressors, concrete pumps, etc., in locations which are away from the NSRs. KCRC will specify the use of crawler rigs and immersed hammer drills for pipe piling.

The centralized equipment items will be housed inside an acoustically treated containment. It is anticipated that the containment will be constructed of noise insulation panels with a substantial mass of not less than 30kg/m^2 capable of achieving a 20 dB(A) attenuation. All ventilation openings will be adequately equipped with silencers or acoustic louvres in order to achieve an overall 20 dB(A) noise insulation of the containment.

D9.1.5 Use of Alternative Subway Construction Method (S)

The pedestrian interchange subway links the MTR and the ETS concourses, at about 6 and 8m below ground, respectively. There are a number of entrances and ventilation shafts along the length of the subway and the width between entrances etc., varies dependent on the patronage on each section. In order to minimise inconvenience to passengers and minimise space and construction problems at entrances, it is desirable that the subway is as shallow as possible. The use of an almost flat grade between the two stations produces the optimum alignment at minimum depth.

Given the constantly changing shape, substantial entrances and shallow depth, only cut and cover construction techniques are practicable. Locally, micro-tunnelling or pipe jacking techniques may be used to pass under major obstructions or junctions.

External temporary walls and centre supports will be installed using small diameter pipe piles or similar using the smallest and quietest equipment available. The temporary deck will be installed before moving to the opposite side of the road and repeating the operation.

The possibility of a bored tunnel construction technique has been reviewed and a number of factors (engineering, practicality and user convenience) ruled against it as described in Section 2.4.2. In order to compare the noise impacts of the two

methods, the 'product' of noise exceedance (over 75dB(A) and duration (in weeks) were calculated as a measure of the impact. The results are given below and are based on Worksites 7C, 7D and 7E, i.e. the central part of Mody Road and assuming all technical problems could be resolved.

	7C	7D	7E	Total
Planned cut and cover with Mitigation 4	322	282	346	950
Bored Tunnel (where practicable)	402	96	398	896

It is concluded that the bored tunnelling construction method would cause more disruption and similar noise impacts as the cut and cover method. The cause of disruption is that a deeper subway requires larger entrances which take up more road space, and the open cut can only be partially decked.

Other tunnel construction methods have also been considered. Their merits, demerits and practical constraints are provided in Appendix D7.

D9.1.6 Re-routing of the Pedestrian Subway Alignment (S)

A subway alignment via Salisbury Road and Nathan Road has been suggested by EPD as a possible mitigation for evaluation. Although it will be effective in avoiding the construction noise impacts upon the NSRs along Mody Road, the alternative would present similar impacts to other NSRs and is subject to more complicated engineering constraints.

D9.1.7 Portable Noise Barriers (P)

A typical example of a portable noise barrier is provided in Figure 5.5. The actual design and construction will be determined by the Contractor. It is recommended that such a barrier should be constructed of panels or materials with a superficial density of at least 20 kg/m^2. Its maximum practical height should be no more than 3 m above ground, to ensure compliance with wind loading, structural stability and safety issues when in use.

It could provide up to 5 dB(A) attenuation when it is correctly positioned for mobile plant such as an excavator, mobile crane, etc. The recommended distance is about 5m from the mobile plant for effective noise attenuation, subject to the site conditions and safety considerations. For static plant such as air compressors, drilling rigs, water pumps, generators and concrete pumps, it could provide up to 10 dB(A) attenuation.

The use of barriers will have great benefits at ground level or lower floor NSRs. However, it can become ineffective for upper floor NSRs due to unobstructed line of sight. The application of noise barriers is limited by the street canyon conditions in Mody Road and Middle Road where there are high rise buildings located along both sides of the work site. This reduces the noise attenuation effect of the barrier due to multiple noise reflections by building facades opposite to each other.

Similarly, the provision of 3-5 m high site hoarding may reduce impacts by up to 5dB(A) at ground level or lower floor NSRs. The hoarding should contain no openings or gaps (except necessary entrances for site access) and be constructed of panels with a superficial surface density of at least 20 kg/m^2.

The provision of portable barriers or hoardings must not compromise fire safety. Access for vehicles and fire fighters must be maintained at all times, and allow a 1.5m clearance around fire hydrants and ground valves (further details on FSD requirements are provided in Appendix G).

D9.1.8 Fixed or Movable Enclosures (P)

Given the severity of the noise exceedances at the NSRs located along Mody Road and Middle Road, installing a full enclosure has been considered and would normally be expected to provide a solution to the predicted noise impacts. However, there are grave concerns regarding its practical difficulties for this location. Notably accommodating its construction in the construction sequence of the pedestrian subway (see Figure 2.12), which will be similar to that for the cut and cover underground railway tunnel.

A visit to the Mody Road site location(s) provides the best means of understanding the constraints and difficulties associated with installing a full noise enclosure. This is illustrated with an example of a cross section of a full noise enclosure in Figure 5.6 and the main constraints/difficulties include:

- the need to maintain free access for vehicular traffic, pedestrians and emergency vehicles;
- Height and length requirements making the enclosure a very substantial structure;
- interference with emergency help and services (such as fire fighting, ambulance etc.);
- restriction of emergency escape from adjacent buildings;
- noise and disturbance impacts associated with the construction, anchorage and removal of the structure; and
- ventilation, lighting, rain fall drainage and safety considerations.

The need to anchor the structure for safety and other reasons would prevent the structure being readily or quickly movable. A longer discussion of the difficulties is included at the end of this Appendix (Section D9.2).

The use of the enclosure will also constrain the construction works, prolong the construction period and introduce new noise impacts. Therefore for many reasons, its use is not considered practical and it is not proposed.

D9.1.9 Acoustic Shrouds (P)

A typical design being adopted for a local construction site at Swire House indicate that by employing a steel container to act as an acoustic shroud for a concrete lorry mixer to back into and unload concrete, a 5dB(A) to 10dB(A) attenuation could be achieved due to the available screening. It is considered viable to employ similar acoustic housing for off-loading concrete from lorry mixers. To increase the effectiveness of the housing, the internal surfaces (i.e. walls and ceiling) of the housing will be lined with a 100mm thick acoustic absorbent material comprising minimum 60kg/m^3 mineral wool and 1.2mm thick 20% perforated sheet steel facing material. Acoustic shrouds will also be used to mitigate the noise of the crawler rig and the immersed hammer drill which are the electrical equipment proposed by KCRC. It is anticipated that the noise emission source of the crawler rig and the hammer drill is localized, the use of shrouds should be able to provide at least 15dB(A) attenuation given the shrouds are constructed by acoustic panels of superficial surface density of at least 20 kg/m^2.

D9.1.10 Full Decking (P)

A process that may provide a substantial noise screening to the noisy construction activities is the road decking. A full decking constructed of steel plates of not less than 25mm thick will be provided to the worksite for the follow-on excavation and subway box construction. The decking will be specified by KCRC to be noise-insulating and shall not be allowed to have noise leaks such as any sizeable openings. The deck could provide a minimum of 15dB(A) attenuation for the under-deck construction activities for excavation and subway box construction, which use plant items such as excavator, breaker, conveyor, etc.

D9.1.11 Indirect Technical Remedies (R)

The use of indirect technical remedies (ITR) is only considered as the last resort provided that there are still un-mitigatable residual exceedances even after all feasible and available mitigation options are in place.

The ITR is only recommended for the noise sensitive parts of the residential flats such as bedrooms, living rooms, dinning rooms, etc. Noise insulation to kitchens and bathrooms is not considered to be necessary.

The extent of ITR for individual households requiring the noise insulation will vary, in terms of the required type of window glazing and the need for air conditioning. It depends on the level of residual noise impacts to be mitigated, the existing window glazing and ventilation arrangement of the household being considered. When ITR is required, it needs to be provided at an early stage, and before the construction phase of the works which cause the un-mitigatable noise exceedances.

D9.1.12 Specific KCRC Mitigation Measures for Pedestrian Interchange Subway and Middle Road Station Entrances (M)

In order to improve the level and duration of the noise exceedances due to the pedestrian interchange subway and Middle Road Station entrances, KCRC will require the Contractors to commit to adopting a number of measures which will be incorporated into the Tender Specifications. These measures include :

- more refined phasing and sequencing of construction activities;
- use of electrically driven plant whenever practicable;
- eliminating mobile generators through the use of temporary mains supply;
- use of containers to accommodate concrete pumping equipment;
- use of alternative construction plant which is quieter;
- use of shrouds to mitigate noise wherever possible; and
- full decking of the worksite during excavation and subway box construction.

For the Mody Road Subway a number of steps will be taken to reduce noise level exceedances.

Worksite 7 will be divided into fifteen areas as shown on Appendix D8. The number of occupied properties in each NSR is shown on the plan. It can be seen that a limited number of NSRs are adjacent to more than one area. This is unavoidable because of the geography of the site.

The initial activities in each area are the preparatory work followed by installation of the temporary pile wall on one side of the street, removing the road surface and installing a temporary traffic deck. After diversion of traffic on to the deck, the activities are repeated on the opposite side of the road. These are the activities most likely to cause noise which will be intermittent but the whole process will not take more than 3 months in most area. As can be seen by reference to the programme in Appendix D8, these activities (shown red) will not occur concurrently in two adjacent areas. The duration of these activities is also shown on Appendix D8.

After installation of the traffic deck, further activities including excavation formwork, reinforcement and concreting will be carried out below the deck. The sequence of construction is planned so that excavated material is removed via completed sections of the subway to access points shielded from the NSRs:

- C, within a hoarded area in Cornwall Street
- K, via the ETS station site in Wing On Plaza Gardens
- Q, via the ETS station site in Middle Road Children's Playground

These under-deck activities will last up to about 26 weeks for the largest area. It will be necessary to lift panels of the deck during the working day for the delivery of large items and for concreting. Most of the concrete will be pumped from locations shielded from the NSRs.

After completion of the subway in each section the deck will be removed, backfill placed, utilities reinstated and the road reconstructed whilst maintaining access to buildings and traffic and pedestrian flows.

For the station entrances in Middle Road (Worksite 6), similar construction techniques and methods to the subway will be used and the worksite divided into six areas. The bulk of the excavated material will be brought out via the subway for removal from the Middle Road Children's Playground area. However, the presence of large numbers of sensitive utilities in Middle Road and the existing MTR tunnels will demand extra care and precautions which do not allow full sequential working within the time available. Nevertheless the majority of this work will be carried out under protective decking.

Table D9.1 Residual Noise Exceedances and Duration with Mitigation Options 1, 2 & 3 (Worksites 2,5 & 5A)

NSRs	N1	N2	N3	N4
Work Site Activity	2	5	5A	5A
Site Preparation	3 / - / - (18)	3 / - / - (28)	-	7 / 7 / 6 (5.6)
Regrading/Formation	-	N/A	N/A	N/A
Demolition	-	N/A	N/A	N/A
Excavation (Drill and Blast)	N/A	N/A	-	10 / 8 / 8 (14)
Station Construction	-	4 / - / - (28)	-	9 / 9 / 9 (11)
Grouting	N/A	5 / 4 / 4 (28)	N/A	N/A
Concreting	3 / - / - (18)	N/A	-	2 / - / - (11)
Sheet Piling - Oscillating	N/A	2 / 2 / 2 (28)	N/A	N/A
Bored Piling				
- Excavation	N/A	N/A	N/A	N/A
-Concreting	N/A	N/A	N/A	N/A
Diaphragm Walling				
- Walling	N/A	-	N/A	N/A
- Concreting	N/A	-	N/A	N/A
- Breaking	N/A	9 / 2 / - (28)	N/A	N/A
Road Decking	N/A	3 / 2 / - (28)	N/A	N/A
Excavation (at surface)	N/A	1 / - / - (28)	N/A	N/A
Subway/Tunnel Box Construction				
- Formation	N/A	1 / - / - (28)	N/A	N/A
- Concreting	N/A	2 / 1 / - (28)	N/A	N/A
Backfilling	N/A	3 / - / - (28)	-	-
Road Reinstatement	N/A	4 / 3 / 3 (28)	N/A	N/A

Notes: *# / ## /###, where* *#: residual exceedances with mitigation 1 (using reduced quantity of plant)*
##: residual exceedances with mitigation 2 (using reduced quantity of plant & quiet PME)
###: residual exceedances with mitigation 3 (using reduced quantity of plant, quiet PME & barrier)

-: indicate no exceedance above the 75dB(A) noise criterion

( ): exceedance duration in months

N/A: Not applicable

Example: Site preparation, N4, Work Site 5A, # = 7, ## = 7, ### = 6 and ( )= 5.6

Table D9.2 Residual Noise Exceedances and Duration with Mitigation Options 1, 2, 3 & 4 (Worksites 6 & 7)

NSRs	N4	N5	N6 /N16	N7/N8
Work Site Activity	6 / 6S†	7 / 7B†	7 / 7N† / 7M†	7 / 7E† / 7D†
Site Preparation	15 / 11 / 8 / 4† (3.3)	4 / -/ - / -† (3.3)	24 / 19 / 16 / 11† (2.8)	24 / 19 / 16 / 8† (3.1)
Regrading/Formation	N/A	N/A	N/A	N/A
Demolition	N/A	N/A	N/A	N/A
Excavation (Drill and Blast)	N/A	N/A	N/A	N/A
Station Construction	N/A	N/A	N/A	N/A
Grouting	17 / 16 / 16 / † (3.3)	-	N/A	N/A
Concreting	N/A	N/A	N/A	N/A
Pipe Pile Wall	4† (3.3)	-†	11† (2.8)	8† (3.1)
Sheet Piling - Oscillating	N/A	N/A	N/A	N/A
Bored Piling				
- Excavation	N/A	1 / 1 / - / † (3.3)	21 / 21 / 11 / † (2.8)	18 / 18 / 8 / † (3.1)
-Concreting	N/A	5 / 2 / - / † (3.3)	25 / 22 / 20 / † (2.8)	22 / 19 / 17 / † (3.1)
Road Decking	15 / 14 / 5 / 4† (3.3)	2 / 1 / - / -† (3.3)	22 / 21 / 12 / 11† (2.8)	19 / 18 / 9 / 8† (3.1)
Excavation (at surface)	13 / 9 / 5 / † (3.3)	-	19 / 16 / 12 / † (4.9)	16 / 13 / 9 / † (5.4)
Excavation & Shoring	1† (6.8)	-†	8† (4.9)	5† (5.4)
Subway Construction	-†	-†	7† (4.9)	4† (5.4)
Subway/Tunnel Box Construction				
- Formation	13 / 10 / 2 / † (6.8)	-	20 / 17 / 9 / † (4.9)	17 / 14 / 6 / † (5.4)
- Concreting	12 / 11 / 8 / † (6.8)	1 / - / - / † (2.8)	21 / 20 / 18 / † (4.9)	18 / 17 / 15 / † (5.4)
Backfilling	15 / 10 / 9 / 4† (3.7)	2 / - / - / -† (2.8)	22 / 17 / 16 / 11† (2.3)	19 / 14 / 13 / 8† (2.8)
Road Reinstatement	16 / 15 / 15 / 3† (3.7)	3 / 2 / 2 / -† (2.8)	23 / 22 / 22 / 10† (2.3)	20 / 19 / 19 / 7† (2.8)

Notes: *# / ## /###/####, where #: residual exceedances with mitigation 1 (using reduced quantity of plant)*
##: residual exceedances with mitigation 2 (using reduced quantity of plant & quiet PME)
###: residual exceedances with mitigation 3 (using reduced quantity of plant, quiet PME & barrier)
####: Residual exceedances with mitigation 4 (KCRC specific measures)

-: indicate no exceedance above the 75dB(A) noise criterion
( ): exceedance duration in months
N/A: Not applicable
†: Nearest refined worksite with Mitigation 4
- No process of Grouting in Mitigation 4, or
- process of Bored Piling replaced by Pipe Pile Wall activity in Mitigation 4, or
- process of Excavation (at surface) replaced by Excavation & Shoring activity in Mitigation 4, or
- process of Subway Box Construction replaced by Subway Construction activity in Mitigation 4 or

Example: Site preparation, N4, Work Site 6, # = 15, ## = 11, ### = 8, #### = 4 and ( ) = 3.3; and Excavation (at surface) for the same work site and NSRs, † means it is replaced by excavation and shoring with Mitigation 4.

Table D9.3 Residual Noise Exceedances and Duration with Mitigation Options 1, 2, 3 & 4 (Worksites 6 & 7) (Con't)

NSRs	N9	N10	N13	N14
Work Site Activity	7 / 7C†	7 / 7A†	7 / 7G†	7 / 7H†
Site Preparation	23 / 18 / 15 / 10† (2.6)	22 / 17 / 14 / 9† (3.3)	23 / 18 / 15 / 10† (2.8)	23 / 18 / 15 / 10† (2.6)
Regrading/Formation	N/A	N/A	N/A	N/A
Demolition	N/A	N/A	N/A	N/A
Excavation (Drill and Blast)	N/A	N/A	N/A	N/A
Station Construction	N/A	N/A	N/A	N/A
Grouting	N/A	N/A	N/A	N/A
Concreting	N/A	N/A	N/A	N/A
Pipe Pile Wall	10† (2.6)	9† (3.3)	10† (2.8)	10† (2.6)
Sheet Piling - Oscillating	N/A	N/A	N/A	N/A
Bored Piling - Excavation -Concreting	 20 / 20 / 10 / † (2.6) 24 / 21 / 19 / † (2.6)	 19 / 19 / 9 / † (3.3) 23 / 20 / 18 / † (3.3)	 20 / 20 / 10 / † (2.8) 24 / 21 / 19 / † (2.8)	 20 / 20 / 10 / † (2.6) 24 / 21 / 19 / † (2.6)
Road Decking	21 / 20 / 11 / 10† (2.6)	20 / 19 / 10 / 9† (3.3)	21 / 20 / 11 / 10† (2.8)	21 / 20 / 11 / 10† (2.6)
Excavation (at surface)	18 / 15 / 11 / † (4.7)	17 / 14 / 10 / † (4.9)	18 / 15 / 11 / † (5.1)	18 / 15 / 11 / † (4.9)
Excavation & Shoring	7† (4.7)	6† (4.9)	7† (5.1)	7† (4.9)
Subway Construction	6† (4.7)	5† (4.9)	6† (5.1)	6† (4.9)
Subway/Tunnel Box Construction - Formation - Concreting	 19 / 16 / 8 / † (4.7) 20 / 19 / 17 / † (4.7)	 18 / 15 / 7 / † (4.9) 19 / 18 / 16 / † (4.9)	 19 / 16 / 8 / † (5.1) 20 / 19 / 17 / † (5.1)	 19 / 16 / 8 / † (4.9) 20 / 19 / 17 / † (4.9)
Backfilling	21 / 16 / 15 / 10† (2.3)	20 / 15 / 14 / 9† (2.8)	21 / 16 / 15 / 10† (2.8)	21 / 16 / 15 / 10† (2.3)
Road Reinstatement	22 / 21 / 21 / 9† (2.3)	21 / 20 / 20 / 8† (2.8)	22 / 21 / 21 / 9† (2.8)	22 / 21 / 21 / 9† (2.3)

Notes: *# / ## /###/####, where #: residual exceedances with mitigation 1 (using reduced quantity of plant)*
##: residual exceedances with mitigation 2 (using reduced quantity of plant & quiet PME)
###: residual exceedances with mitigation 3 (using reduced quantity of plant, quiet PME & barrier)
####: Residual exceedances with mitigation 4 (KCRC specific measures)

-: indicate no exceedance above the 75dB(A) noise criterion
( ): exceedance duration in months
N/A: Not applicable
†: Nearest refined worksite with Mitigation 4
- No process of Grouting in Mitigation 4, or
- process of Bored Piling replaced by Pipe Pile Wall activity in Mitigation 4, or
- process of Excavation (at surface) replaced by Excavation & Shoring activity in Mitigation 4, or
- process of Subway Box Construction replaced by Subway Construction activity in Mitigation 4 or

Example: Site preparation, N4, Work Site 6, # = 15, ## = 11, ### = 8, #### = 4 and ( ) = 3.3; and Excavation (at surface) for the same work site and NSRs, † means it is replaced by excavation and shoring with Mitigation 4.

D9.2 USE OF FULL ENCLOSURE AT MODY ROAD - FURTHER DISCUSSION

The provision of a full noise enclosure over Mody Road to mitigate construction noise has been investigated. A typical cross section of a possible structure is shown in Figure 5.6.

D9.2.1 Enclosure Dimensions and Structure

In order to allow working space and clearance for the piling rigs to install temporary pipe piles for the support of the Subway excavation the enclosure would need to have internal dimensions of 12m wide by 19m high. The length of the enclosure would need to be at least 20m longer than the length of the section being constructed i.e. a 10m overlap at each end to ensure effective acoustic performance. The length of the construction Sections is about 50m making the enclosure about 70m long.

In order to provide support for the enclosure and to tie down the structure to cater for strong winds up to typhoon conditions and for safety reasons, large piles (800 to 1000 mm diameter) would be needed at about 3m centres along each side of the road. These would be less than 1 metre clear of the building line. In order to construct these piles significant utility diversions would be required. The whole exercise of utilities diversions, piling and enclosure erection would take not less than 8 weeks for each section depending on the complexity of utilities, canopies and signs. In many cases, it may be much longer. A further period of about 4 weeks would be needed to remove the enclosure.

D9.2.2 Requirements and Constraints

The enclosure would need to permit normal vehicular traffic to pass through on the opposite side of the road to that where piles were being installed. Normal traffic signs and lighting would need to be provided within the enclosure.

The enclosure could not continue past road junctions without interruption, thus reducing its effectiveness.

The supporting structure would be located about 1m from the building line on each side of the road, thus severely restricting pedestrian traffic, access, and means of escape from the buildings in the event of an emergency arising.

The structure would effectively block emergency access to the whole building frontage over a 60 – 70 metre length. The slender nature of the structure would effectively preclude the provision of quick emergency access through it. The structure would also block light and severely limit air flow to the building up to 4th floor level.

Access must be maintained to fire hydrants so that their efficient use is not restricted. A full enclosure might also prevent the use of fire fighting water hoses as there would be insufficient room outside of the enclosure and the water path would be blocked inside the enclosure. It is understood that the minimum

practical length of 70m for the enclosure would significantly exceed the maximum length of 20m (see Appendix G) advisable for fire fighting / emergency purposes.

All protruding canopies and advertising signs would need to be removed. The enclosure may need to be tied to the buildings for stability.

The total duration of these activities is as long, if not longer than the time needed to install the pipe piles and road deck in the preferred scheme, i.e. about 3 months. During this period, it would be almost impossible to implement any effective mitigation measures.

D9.2.3 Conclusion

Thus, a full noise enclosure would need to be a substantial structure, which could not be quickly or readily moved. It would greatly complicate the construction works and would increase the overall construction period and create new noise impacts associated with its own construction. At the same time it would be likely to compromise safety and comfort of the residents and cause a major obstruction to pedestrians and businesses. A full noise enclosure (fixed or movable) is therefore not considered appropriate for these locations.