ANNEX G

Operational Noise Calculations

West Rail

Concept Specification and Noise Evaluation
of the
Multi-Plenum Model
For
Train Noise Attenuation of West Rail

CONTENTS

TABLES

FIGURES

1. INTRODUCTION

This paper presents the analysis undertaken for the Multi-Plenum System in it's first application to West Rail. An identical system is now proposed for the elevated sections of the Ma On Shan Extension to East Rail.

The Multi-plenum System was conceived by an Operational Noise Working Group, established by the Kowloon-Canton Railway Corporation (KCRC) for West Rail in 1997, which included in its membership: Vic McNally, KCRC's West Rail Environmental Manager; John Carlisle, KCRC's West Rail Permanent Way Manager; Jon Pyke and Rob Bullen of ERM; George Wilson and Alan Crockett of Wilson, Ihrig and Associates and Rupert Taylor of Rupert Taylor Ltd.

The evaluation presented in this report focusses on the wayside noise from the train (direct noise) and not that which is radiated from the structure (re-radiated noise). Direct noise mitigation alternatives are put forward and evaluated for the reduction of wayside noise and compliance with the targeted wayside noise level.

Initially, the Operational Noise Working Group examined the issue of structure radiated noise from a viaduct structure with full enclosure. The main issue at that time was to determine the type of trackform that would be needed for adequate reduction of the vibration transmitted from the rail into the structure which would then, in turn, be radiated from the structure as (wayside) noise. It was later decided on account of safety, costs, aesthetics and visual intrusion, ventilation and engineering concerns that the search for solutions to the wayside noise problem be widened to include consideration of an open viaduct utilising noise mitigation measures other than full enclosure. One option was to place tall sound barrier walls on the edge of the viaduct, possibly with sound absorption and cantilevered overhang.

After discussing and establishing the target wayside noise level and the reference (unmitigated) direct train noise level, this report presents an evaluation of the edge wall noise mitigation solution.

Consideration of the noise predictions resulting from the ongoing evaluation led to the Operational Noise Working Group defining a design enhancement based on the creation of cascading noise plena located beneath the train and beneath the safety walkways aimed at reducing source noise levels. This "double plenum", which is supplemented by edge barrier walls, is considered necessary to achieve compliance with the targeted wayside noise levels.

Whilst train lengths and headways for MOS will result in lower noise levels from MOS, the Multi-plenum System will effectively reduce the required height of otherwise conventional noise barriers in isolation of the plena; thus improving the appearance of the MOS viaducts.

1.1 The Target Wayside Noise Level

The reference wayside noise level assumed for the KCRC West Rail Project is 88 dBA at 25 m for a 12-car train passby at 130 km/h. The source term for the highest train speed on

MOS viaducts is 81.7 (80 kph) dBA. ERM-Hong Kong has determined, in discussion with the Environmental Protection Department (EPD) and members of the Operational Noise Working Group, that for the passenger train service (EMU) on the elevated line. The total wayside noise target could be expressed as a maximum level of 64 dBA [or 71 dBA for MOS to meet the same noise control ordinance criterion for ASR "B" - train speed, train length and timetable influence this change] for the same passby conditions. This target refers to the total wayside noise, which is the energetic sum of the direct noise from the train plus the structure radiated noise.

Preliminary indications are that it will not be possible to reduce the structure radiated noise much more than a few dBA below the target. This implies the direct noise component must be of comparable magnitude or less, otherwise the two will sum to more than 64 dBA. If the structure radiated noise and the direct train noise spectra were identical, the maximum overall A-weighted level of either would be 61 dBA.

When considering *only* the direct train noise component of the total wayside noise, it is therefore more realistic to establish the target maximum level below 64 dBA. Given the similarity of the direct (after mitigation) and structure radiated noise projections in the one third octave band levels having significant effect on determining the overall A-weighted levels (300-630 Hz), a level of 61 dBA as opposed to 64 dBA is probably a more appropriate target maximum level for direct noise *only* during passbys.

1.2 Reference Spectrum

Wayside noise measurements were taken on the Rapid Transit (BART) system in San Francisco Bay Area during train passbys on an unmitigated concrete viaduct with a concrete deck (Ref. 1,2). These data were averaged and then corrected to KCRC conditions (Ref. 3); namely, 12-car trains travelling at 130 km/h and 25 m distance. The overall A-weighted level under these conditions comes out to be 88 dBA, the agreed upon reference level for West Rail. This spectrum is therefore taken as reference. A very similar reference spectrum was also assumed for the MTR Tsing Ma Bridge pre-construction noise evaluation study.

1.3 Measurement Based Projections Of Edge Wall Noise Reduction

The first estimates of the mitigation provided by the edge barriers were strictly empirical and based on noise measurement data collected on a number of transit viaduct structures with edge walls (Ref. 1-2, 4-7). The wall height of these barriers ranges from 1-1.5 m.

A summary of the observed overall A-weighted noise reductions with indication of the presence of sound absorption is presented in *Table 1.* The best performance observed is the 12 dBA reduction achieved at BART by a wall (approx. vehicle floor height) placed 200 mm from the vehicle, just outside the kinematic envelope, with a 100 mm layer of fibreglass attached for sound absorption. The average noise reduction achieved by sound walls without absorption is 7.5 dBA, whereas with absorption, it is 9.5 dBA.

Table 1 Measured Noise Reduction From Edge Walls Placed On Concrete Viaducts

Railway	Sound Absorption	Noise Reduction (dBA)
BART	No	6
Metropolitan Atlanta (MARTA)	No	9
MARTA	Yes	8
BART	Yes	8
Miami/Dade	Yes	10
Washington Metro (WMATA)	Yes	10
BART	Yes	12

In the initial analysis of the effectiveness of edge wall noise barriers (Ref. 8), it was assumed that a higher wall placed farther from the vehicle could not, in practice, do much better than this, so 12 dBA was chosen as the maximum limit for edge wall effectiveness. Assuming a reference level of 88 dBA at 25 m from track centre for a 12-car train traveling at 130 km/h, this would produce a wayside noise level of 76 dBA. If the train speed were reduced to 100 km/h, the wayside level would become 73 dBA, which is the greatest noise reduction reported in Ref. 8 for any wall height examined including the tall edge wall with cantilevered overhang.

After further consideration, it was decided that the empirical approach to edge wall attenuation based upon low height barriers may have been overly conservative regarding the performance of taller edge walls. A new analysis of the edge barrier sound reduction was performed based on the modified theory of Maekawa as described below, with source height above rail adjusted so that low barrier predictions were consistent with the measured attenuations presented in *Table 1.*

1.4 Maekawa Analysis Of Edge Wall Noise Reduction

1.4.1 Model Description and Theoretical Basis

In this model, sound barrier wall attenuations were calculated with a modified version of the analytic expression provided by Kurze and Anderson (Ref. 11), which closely fits (within +/- 1 dB) the experimental results obtained by Maekawa (Ref. 12). The analytic expression developed by them which determines the excess attenuation of noise from a point source provided by thin barriers with no noise absorption applied is:

$$\Delta L_{barrier} = 5dB + 20\log\left(\frac{(2\pi N)^{1/2}}{\tanh(2\pi N)^{1/2}}\right)dB$$

where N, the Fresnel number, is defined as:

$$N = \frac{2}{\lambda}(P.L.D.)$$

and where P.L.D. is the Path Length Difference between the direct and diffracted sound paths. As the attenuation calculated by this equation is dependent on frequency, all calculations were made in one third octave bands (using the centre frequency of the band) and the A-weighted values were derived from these spectra.

Since in this study the receptor locations are 25 m distance from the track centres, a 12 car long train appears as a line source. The attenuation equation presented above must therefore be modified to correct for the difference (decrease) in attenuation between a point and a line source. By integrating a point source along a line, Beranek (Ref. 13) shows the difference in barrier attenuation between an infinite line source and a point source as a function of the maximum Fresnel Number (Fig. 7.9, pps 178-180 of Ref. 13). This relation or correction, which is utilized in this model, is identified as the function, PL(N).

In *Table 1*, the average attenuation of walls with no absorption is 7.5 dBA, whereas with absorption, it is 9.5 dBA. An increase of 2 dBA is therefore assumed as the increase in barrier attenuation due to the application of sound absorption on the source side of the wall.

Adding 2 dBA for applied sound absorption to, and subtracting the point to line source correction function from the above attenuation equation, yields the resulting equation which is valid for line sources where adequate sound absorption has been placed on the source side of the wall.

$$\Delta L_{barier} = 7dB + 20\log\left(\frac{(2\pi N)^{1/2}}{\tanh(2\pi N)^{1/2}}\right)dB - PL(N)$$

This equation is assumed valid up to the point where the scattering effects on the volume of air above the barrier being insonified by the source limit the performance of a sound barrier wall to approximately 21 dB (Ref. 9).

1.4.1.1 Model Assumptions

In calculating the attenuation due to sound barrier walls only on the edge of the viaduct, the following assumptions were made:

Source height = 7.9 m (0.9 over top of rail), source location = 0.5 m in from the vehicle shell

Attenuation limit = 21 dB

Receiver heights of 1.5, 7, 12, 17 and 22 m from ground level. These correspond to edge wall heights of 1.2, 2.5, 4.2, 5.4 m, respectively, above the safety walk, and 2.9, 4.2, 5.9 and 7.1 m, respectively, above the deck.

Sound absorption 45 mm thick placed on the interior side of the walls - Pyrok at a minimum.

The (line) source location from a modelling standpoint is not well defined because a number of car and track components radiate noise, namely, the rail, the wheels and the trucks. The location of 0.9 m above the rail was determined by matching the model prediction with the average taken from *Table 1* (9.5 dBA) of the low barrier wall measurement data with absorption (See third entry in *Table 3).*

1.4.2 Wayside Noise Level Predictions for the Edge Wall Model

The wayside noise levels (L_{max}) shown in *Table 2* are predicted at ten receptor locations adjacent to the open viaduct with edge barriers and sound absorption applied. The top of rail is assumed to be 7 m above the ground. Five receptors are located at 25 m distance from the track centerline on each side of the viaduct, totaling ten receptors. The outboard side is defined as that adjacent to the track carrying the train, whereas the inboard side is defined as that opposite. The receptors are located 1.5, 7, 12, 17, and 22 m, respectively, above the ground on each side. Edge barriers of heights of 1.2, 2.5, 4.2 and 5.4 m above the safety walkway are considered. Measured from the deck, these barrier heights would be 2.9, 4.2, 5.9 and 7.1 m, respectively.

Table 2 Noise Levels (L_{max}) Predicted At The Ten Noise Receptors For Edge Barriers Only With Absorption Located 25 M From The Track Centerline And With Line Of Site (Los) Indicated At Various Heights Above Ground - Re: 130 Km/H, 12 Car

RECEPTOR LOCATION (Height Above Ground)	NO NOISE MITIGATION (dBA)	1.2 m (2.9 m) EDGE BARRIER (dBA)	2.5 m (4.2 m) EDGE BARRIER (dBA)	4.2 m (5.9 m) EDGE BARRIER (dBA)	5.4 m (7.1 m) EDGE BARRIER (dBA)
OUTBOARD					
1. 1.5 m	88	71.3	68.5	67.6	67.5
2. 7 m (tor)	88	73.4	69.5	67.8	67.6
3. 12 m	88	76.1	71.1	68.4	67.8
4. 17 m	88	79.3	73.1	69.5	68.3
5. 22 m	88	83.5	75.6	71.2	69.4
INBOARD					
6. 1.5 m	88	71.7	69.3	67.9	67.6
7. 7 m (tor)	88	75.7	71.8	68.9	68.0
8. 12 m	88	81.5	75.4	70.9	69.2
9. 17 m	88	88.4 los	81.1	74.4	71.4
10. 22 m	88	88.5 los	88.3 los	78.8	75.0

Cantilevering the tops of the sound walls is not considered as either a practical or effective means of enhancing the attenuation performance of the sound walls because:

1) cantilevering is only possible for very tall walls because of the catenary system spatial requirements;
2) the attenuation of sound barriers is limited to about 21 dBA maximum and walls high enough to rise above the catenary system have reached this performance limit; and
3) the cantilevering makes no difference for receptors located on the inboard side of the rail.

For 130 km/h train passbys, no barrier of any height considered provides sufficient attenuation to reduce the wayside noise to either the target level of 64 dBA for the total wayside noise or of 61 dBA for the direct train noise only. At the top of rail receptor height, the 5.4 m wall provides the best performance of 68 dBA. Among the more constructable and aesthetically palatable alternatives, the noise level for the 2.5 m wall is about 72 dBA. If the train speed is reduced to 100 km/h, these levels become 65 and 69 dBA, respectively, which is still significantly higher than the target 61-64 dBA levels.

1.5 Multi-Plenum Noise Reduction System

Since the performance of edge noise barriers by themselves appears inadequate, even if constructed to be very tall with cantilevering and utilizing sound absorption, it was decided to evaluate the effectiveness of combining edge wall noise barriers with added source reduction achieved by constructing noise plena in the space beneath and adjacent to the transit car.

The proposed noise reduction system, termed the "Multi-plenum System", consists of three components: an undercar sound absorbing plenum; under walkway sound absorbing plena on either side of the vehicle; and edge walls with sound absorption applied. A representative cross section of the two (tangent) track viaduct is shown in *Figure 2*, and is dimensioned in *Figure 3*. A superelevated depiction is shown in *Figure 4*, whereas the single (tangent) track viaduct is shown in *Figure 5*.

The undercar plenum is created by installing vehicle skirts on the sides of the cars, particularly over the trucks and by installation of noise absorption on the bottom side of the floor within two metres of the bolsters and on the interior facing of the skirts. The plenum outlet is formed between the bottom of the skirts and the top of the derailment constraint. The noise reduction effectiveness of this undercar plenum is in part determined by the size of the outlet gap, with smaller being better. It is probable that this gap can be limited to a maximum size of 250 mm.

The under walkway plenum on the outside of the viaduct is bounded by the edge wall, the deck, the safety walkway and the vehicle. Sound absorption is to be placed on the edge wall and the underside of the safety walkway. The outlet of the plenum is the gap between the safety walkway and the vehicle required by the kinematic and curvature envelopes, again with smaller being better. It is probable that this gap can be limited to a maximum of

250 mm on tangent track and 350-400 mm on curves. Approximately 60% of the proposed West Rail is tangent track and 40% is curved. Derailment safety requires that the vehicle can move laterally by 600 mm during derailment implying that part of the walkway be frangible.

The under walkway plenum at the centre of the viaduct is bounded by the median wall, the deck, the safety walk and the vehicle. As a requirement of geometric considerations, the volume of this plenum is not as large as that beneath the edge walkway and therefore will not be as effective attenuating noise. The median wall must also be constructed strong enough so that a contained derailment will not send pieces of it onto the other track.

The use of any of these noise attenuation systems by themselves is not unprecedented: (low) edge noise barriers are commonly installed on viaducts; the under walkway plenum (or under station platform) with median noise barrier between tracks has been installed in stations; and vehicle skirts with undercar sound absorption has been tested on transit vehicles and is in service on some "people movers". What is unprecedented is the use of all three components together in a fully integrated direct noise attenuation system. Such a system can always outperform the edge wall only noise attenuation solution because this system can accommodate any edge wall design, supplemented by the at-source attenuation by the Multi-plenum System.

1.5.1 Model Description and Theoretical Basis

The model for the edge wall noise attenuation is the same as that described above, except the source is relocated to a position on the car body just above the under walkway plenum outlet (8.1 m above the ground or 0.1 m higher than the platform).

The plenum attenuation achieved by this system was estimated by means of the Plenum Chamber Transmission Loss equations as described by Beranek (Ref. 13) and ASHRAE (Ref. 14):

$$\mathrm{TL} = -10\log\left\{S_{out}\left[\left(\frac{Q\cos\theta}{2\pi r^2}\right)+\left(\frac{1-\alpha_A}{S\alpha_A}\right)\right]\right\}$$

where

S_{out} = area created by the gap between the bottom of the skirt and the derailment constraint for the undercar plenum or that between the vehicle and the platform for the under walkway plena

r = distance between inlet and outlet of plenum = 0.9 m for undercar plenum; 2 m for under platform plenum

Q = directivity factor = 2

α_A = average absorption coefficient for the lining

θ = angle between the source and outlet = 0 for undercar plenum;
= 80 for under platform plenum

The levels predicted by this equation are conservative by about 5 dB at low frequencies due to the fact that the size of the plena is comparable with the wavelength of the sound at those frequencies. To determine the surface area of the gap under the vehicle skirts and between the vehicle and the walkway, a characteristic length of 4 m was assumed.

The sound absorption coefficients versus frequency for each of the candidate materials recommended is shown in *Figure 6.*

1.5.2 Airborne Noise Attenuation Created by the Plena

Figure 7 shows the attenuation calculated for the undercar (primary) plenum system in one third octave bands.

Figure 8 shows the attenuation calculated for the wayside (secondary) plena in one third octave bands. The higher attenuation predicted for the under platform plenum is due to the larger interior lined surface area (and therefore higher net sound energy absorbed). However, the attenuation introduced by this plenum is significantly limited by the close proximity of the gap under the skirt and that between the vehicle and the walkway.

Figure 9 shows the total attenuation introduced by the combination of the primary and secondary plena.

1.5.3 Calibration of Model Components with Measurement Data

The basic components of the model were calibrated by comparing predicted results with actual measurement data obtained at BART and other systems and the results are shown in *Table 3.*

Table 3 Comparison Of The Multi-Plenum Attenuation Model Predictions And Measurement Data

	MEASUREMENT DATA (dBA)	MODEL PREDICTION (dBA)
Vehicle Skirts and Undercar Absorption (BART)	3.0	2.9
4 ft Close-in Barrier With 8 in Gap and 4 in Fiberglass Absorption (BART)	12	11.2
Low Edge Barrier With Absorption	9.5	9.5

The effects of undercar absorption and vehicle skirts were calibrated by adjusting the distance (r) in the plenum equation so that a noise reduction of approximately 3 dBA was predicted by the model when the gap under the skirt was 600 mm. This prediction closely agrees with the attenuation measured at BART.

Similarly, the combined effect of the undercar absorption, skirts and under platform plenum was calibrated by adjusting the distance (r) between the skirt gap and the gap between the vehicle and the walkway until the predicted attenuation obtained was similar to that measured during another BART test. In this test an absorbent close-in barrier was located 200 mm away from the vehicle and the noise level was measured before and after the installation of this barrier.

1.5.4 Model Sensitivity

The sensitivity of the model to different gap sizes between the bottom of the skirt and the top of the derailment restraint is shown in *Table 4.* The level of noise exiting the plenum is proportional to:

$$L \approx 10\log_{10}\left(S_{out}\right)$$

Table 4 Noise Reduction Sensitivity To The Clearance Between The Bottom Of The Skirt And The Top Of The Derailment Restraint

GAP SIZE (mm)	NOISE REDUCTION (dBA)
250	6.7
300	5.9
400	4.7
600	2.9

The sensitivity due to different gap sizes between the vehicle and walkway (or between the vehicle and the median) is also proportional to the surface area of the gap and shown in *Table 5.* For the undercar plenum, a variation of outlet gap size from 250-600 mm produces a change in noise reduction of 3.8 dBA. For the under walkway plenum, a variation of outlet gap size from 250-400 mm produces a change in noise reduction of 2 dBA.

Table 5 Noise Reduction Sensitivity To The Clearance Between The Vehicle And Walkway

KINEMATIC ENVELOPE PLUS CURVATURE (mm)	NOISE REDUCTION (dBA)
250	12.7
300	11.9
350	11.3
400	10.7

Different sound absorbent materials produce minor variations on the A-weighted sound reduction. *Table 6* compares the degree of noise reduction predicted for the secondary plenum under the walkway for three alternate lining materials.

Table 6 Noise Reduction Sensitivity Of The Under Walkway Plenum To The Type Of Absorption Material Applied

ABSORPTION MATERIAL	NOISE REDUCTION (dBA)
50 mm Fiberglass	12.7
2.5 mm Almute With 50 mm Honeycomb Backing	12.4
45 mm Pyrok	12.1

1.5.5 Wayside Noise Level Predictions for the Multi-plenum Model

The wayside noise levels (L_{max}) shown in *Table 7* are predicted at ten receptor locations adjacent to the open viaduct with the Multi-plenum System. In this analysis, the plenum gaps are assumed to be 250 mm. A diagram displaying the barrier heights and the receptor locations appears in *Figure 10.* In the interest of comparison, the geometry of the viaduct, the height of the top of rail, the positions of the receptors and the edge wall heights are the same as what was considered for the edge barrier only model.

Table 7 Noise Levels (L_{max}) Predicted For The Multi-Plenum Model At The Ten Noise Receptors Located 25 M From The Track Centerline And With Line Of Site (Los) Indicated At Various Heights Above Ground - Re: 130 Km/H, 12 Car

RECEPTOR LOCATION (Height Above Ground)	NO NOISE MITIGATION (dBA)	1.2 m (2.9 m) EDGE BARRIER (dBA)	2.5 m (4.2 m) EDGE BARRIER (dBA)	4.2 m (5.9 m) EDGE BARRIER (dBA)	5.4 m (7.1 m) EDGE BARRIER (dBA)
OUTBOARD					
1. 1.5 m	88	53.8	50.6	49.4	49.3
2. 7 m (tor)	88	55.8	51.5	49.6	49.3
3. 12 m	88	58.2	53.0	50.2	49.6
4. 17 m	88	61.4	54.9	51.2	50.1
5. 22 m	88	63.4 los	57.2	52.8	51.1
INBOARD					
6. 1.5 m	88	58.1	55.5	53.8	53.4
7. 7 m (tor)	88	62.0	58.0	54.9	53.9

RECEPTOR LOCATION (Height Above Ground)	NO NOISE MITIGATION (dBA)	1.2 m (2.9 m) EDGE BARRIER (dBA)	2.5 m (4.2 m) EDGE BARRIER (dBA)	4.2 m (5.9 m) EDGE BARRIER (dBA)	5.4 m (7.1 m) EDGE BARRIER (dBA)
8. 12 m	88	67.7	61.6	56.9	55.1
9. 17 m	88	74.2 los	67.0	60.2	57.3
10. 22 m	88	74.2 los	74.0 los	64.3	60.5

For 130 km/h train passbys, the results show that at least one of the configurations provides sufficient attenuation for reduction of the wayside noise to the more restrictive target level of 61 dBA. At receptor heights of 1.5, 7, 12, 17 and 22 m above the ground, edge wall heights of 1.2, 2.5, 4.2, 4.2 and 5.4 m, respectively, provide adequate noise reduction. If the train speed is reduced to 100 km/h, edge wall heights of 1.5, 1.5, 2.5, 4.2 and 4.2 m, respectively provide adequate noise reduction, again for the more restrictive target of 61 dBA. The projections for the Multi-plenum System improve the attenuation performance of the edge wall barriers only by 15-20 dBA on the outboard side and 10-15 dBA on the inboard side. These estimates not only indicate that the target direct noise level can be met, but it can be met with a reasonable allowance for error in the prediction.

2. SUMMARY AND DISCUSSION

This report presents an analysis of the wayside noise from EMU traffic along the proposed West Rail Viaduct. Direct noise mitigation alternatives are put forward and evaluated regarding the reduction of wayside noise and compliance with the targeted wayside noise level, which is expressed as a maximum noise level of 64 dBA at 25 m for a 12-car train passby at 130 km/h. If the direct noise from the train only is considered, and not the total wayside noise which includes the structure radiated noise, a maximum target noise level of 61 dBA is suggested. The reference wayside noise level assumed for West Rail is 88 dBA at 25 m for a 12-car train passby at 130 km/h. Consideration is given to the effect of limiting train speed to 100 km/h which would reduce the reference (unmitigated) level to 85 dBA.

One of the solutions evaluated, places tall sound barrier walls on the edge of the viaduct, possibly with sound absorption and cantilevered overhang. Consideration of the noise projections led to an enhancement of the edge wall only design based on creating cascading noise plena located beneath the train and beneath the safety walkways aimed at reducing source noise levels.

The first estimates of the mitigation provided by edge barriers only were strictly empirical and based on noise measurement data collected on a number of transit concrete viaduct structures with low height edge walls. The best performance observed is a 12 dBA reduction. The average noise reduction achieved by sound walls without absorption is 7.5 dBA, whereas with absorption, it is 9.5 dBA. Assuming a reference level of 88 dBA at 25 m from track centre for a 12-car train travelling at 130 km/h, this would produce a wayside noise level of 76 dBA. If the train speed were reduced to 100 km/h, the wayside level would become 73 dBA.

After further consideration, it was decided that the empirical approach to edge wall attenuation based upon low height barriers may have been overly conservative regarding the performance of taller edge walls. A new analysis of the edge barrier sound reduction was, therefore, undertaken based on the modified theory of Maekawa adjusted for (line) source geometry and applied sound absorption. Wayside noise levels were predicted with the new model at ten receptor locations adjacent to the open viaduct. For 130 km/h train passbys, no barrier of any height considered provides sufficient attenuation to reduce the wayside noise to either the target level of 64 dBA for the total wayside noise or of 61 dBA for the direct train noise only. At the top of rail receptor height, the 5.4 m wall provides the best performance of 68 dBA. Among the more constructable and aesthetically palatable alternatives, the noise level for the 2.5 m wall is about 72 dBA. If the train speed is reduced to 100 km/h, these levels become 65 and 69 dBA, respectively, which is still significantly higher than the target 61-64 dBA levels. Cantilevering the tops of the sound walls is not considered as either a practical or effective means of enhancing the attenuation performance of the sound walls.

Since the performance of edge noise barriers by themselves appeared inadequate, the effectiveness was evaluated of combining edge wall noise barriers with added source reduction achieved by constructing noise plena in the space beneath and adjacent to the transit car. The proposed noise reduction system, called the "Multi-plenum System", consists of three components: an undercar sound absorbing plenum; under walkway sound absorbing plena on either side of the vehicle; and edge walls with sound absorption applied. Such a system can always outperform the edge wall only noise attenuation solution because this system can accommodate any edge wall design, supplemented by the at-source attenuation by the Multi-plenum System.

The wayside noise levels for the Multi-plenum System were predicted at ten receptor locations adjacent to the viaduct. The predictions for the Multi-plenum System improve the attenuation performance of the edge wall barriers only by 15-20 dBA on the outboard side and 10-15 dBA on the inboard side. For 130 km/h train passbys, the results show that at least one of the configurations (differing edge wall heights) provides sufficient attenuation for reduction of the wayside noise at all receptor locations to the more restrictive target level of 61 dBA.

It is considered that the very tall walls required in the edge wall only option for direct train noise mitigation would be structurally difficult to achieve (*e.g.*, wind loading), unaesthetic, and would not provide any factor of safety in meeting the wayside noise requirement, if that requirement could be met at all. The Multi-plenum System, on the contrary, meets the wayside noise target with substantial margin for error without the need for operational speed reduction and without tall edge walls, except were there are adjacent high rise structures (of height greater than 22 m, within 25 m of track centreline).

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CONCEPT SPECIFICATION AND STRUCTURE RADIATED NOISE EVALUATION OF THE KCRC WEST RAIL VIADUCT

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1. INTRODUCTION

Contained herein is a summary of findings regarding the concept specification and structure radiated noise evaluation of the KCRC West Rail Project. This work was part of the West Rail Environmental Impact Assessment by ERM-Hong Kong Ltd with subconsultants Wilson, Ihrig & Associates. Much of this work has been previously presented at meetings of the KCRC Operational Noise Working Group in Hong Kong and Ohio and to Members of the KCRC Board, KCRC Technical Staff and EPD. This work has been primarily concerned with the prediction and minimisation of the wayside reradiated noise from the proposed KCRC West Rail Viaduct Structures with consideration given to EMU transit train, freight and mixed use traffic [only EMU trains will operate on the MOS Extension to East Rail].

ERM-Hong Kong has determined in discussion with the Environmental Protection Department and members of the Operational Noise Working Group established by KCRC that given the noise criteria and allowances for the proposed alignment, the total wayside noise target could be expressed as a maximum overall A-weighted noise level at 25 m from the track centerline during a 12 car transit train passby of 64 dBA [71 dBA for MOS at ASR "B" Noise Sensitive Receivers]. For freight and mixed use traffic, the target level is 67 dBA. Thus, the direct noise from the train taken together with the structure radiated noise must be less than or equal to these values. A baseline noise level (no noise mitigation) at 25 m from the track centerline for a 12 car transit train travelling over the viaduct with a concrete deck at 130 km/h is taken to be 88 dBA. Thus a reduction of 24 dBA is required from the noise mitigation measures in order to achieve the target noise level [17dBA for MOS ASR "B" Noise Sensitive Receivers].

1.1 Scope of the Project

This study has progressed forward in four phases as described in *Table 1*. Initially, it was assumed that a full enclosure was necessary for adequate reduction of the direct noise from the train and that different trackforms would be evaluated regarding their effectiveness in reducing the structure radiated noise. Phases 1 and 2 were thus planned to be an empirical study and a Finite Element Analysis (FEA), respectively, of structure radiated noise. After work on these phases had begun, the study was expanded to include the possibility of (cantilevered) edge wall barriers/ semi enclosure as an alternative to full enclosure. As a consequence of the determinations of Phases 1 and 2, Phase 3 was undertaken to evaluate the noise reduction effectiveness of a more elaborate direct noise barrier system consisting of noise plena beneath the car and the safety walkway [termed the "Multi-plenum System"], in addition to edge walls.

Table 1 Chronology of the KCRC Viaduct Noise Study

Chronology
1 Empirical Study of the Re-reradiated Noise from the Viaduct with Full Enclosure
2 FEA Study of Re-Radiated Noise/Analysis of Edge Walls -Semi Enclosure
3 FEA Study of Re-Radiated Noise/Evaluation of the Multi-Plenum Direct Noise Barrier
4 Effect of the Viaduct Structural Design and Civil Considerations on Re-Radiated Noise

In Phase 4, consideration was given to the possibility of eliminating the need for floating slab trackwork by altering the viaduct structure (increasing its mass and stiffness and reducing its noise radiating area) or of providing further noise reduction by structural redesign. Reradiated noise determinations were also made for freight and mixed use lines. In addition, predictions of reradiated noise, or more precisely, the design choices necessary to achieve wayside noise compliance, were to be brought in line with civil (structural) requirements. Finally, a number of special topics were to be addressed relating to the importance of reradiated noise from secondary structures on the viaduct.

2. EMPIRICAL ANALYSIS OF STRUCTURE RADIATED NOISE

For the Initial Assessment Report (IAR), preliminary estimates of reradiated noise reduction from low vibration trackform and floating slab were established by ERM Hong Kong Ltd (Ref 1). These identified a noise reduction of 15 dBA with Low Vibration Track (LVT) and 20 dBA from floating slab. If no full cover was placed upon the viaduct it was determined that a barrier/semi-enclosure system for mitigation of direct train noise could achieve as much as 18 dBA reduction. These preliminary estimates are summarised in *Table 2*.

Table 2 IAR Estimates of Noise Reduction at 25 m - Baseline: Ballasted Track No Facade Correction

Full Enclosure	Noise Reduction
LVT	15
Floating Slab/Stiff Baseplate	20
Barrier/Semi Enclosure	18

An empirical analysis was performed by WIA in the first phase of this project to ascertain whether these reductions were realistic. To determine the projected wayside noise for West Rail concrete viaduct structures, results from a number of noise measurement programs have been reviewed, assembled and interpreted in terms of the West Rail System expected operating characteristics. The measurement programs and reviews considered include several completed at the San Francisco BART system, the

Washington, D.C. Metro system, the Metropolitan Atlanta Rapid Transit System and the Hong Kong MTRC system. In all cases, the portions of the studies applicable to concrete viaduct structures were the subject of this investigation.

For the purposes of this report, results developed in earlier empirical studies by WIA for West Rail viaducts are presented in this Technical Paper which directly bear on the prediction of structure radiated noise and the confirmation of modelling assumptions. The Empirical study began with a data review of the early information developed at the San Francisco BART System. The BART aerial structure or viaduct is the smallest cross-section of all of the viaduct studies and has a relatively low amount of structural radiation compared to the airborne noise. However, even at the BART structures, the low frequency wayside noise, i.e., below 125 Hz, is predominantly structure-radiated and, therefore, provides a starting point for developing the re-radiated noise for the West Rail concrete viaducts. The radiating area, the mass and the stiffness of the viaduct structures, which can vary significantly between different viaduct designs, as well as the stiffness of the track support system are major determinants of the reradiated noise. At systems such as the MTRC where very stiff rail fixation was used in the initial system and early extensions, the radiated noise is significantly greater because of the rail fixation stiffness. Therefore, throughout this study an effort has been made to take into account the effects of the rail fixation stiffness and structure design on the structure vibration levels and re-radiated noise.

Figure 1 presents the average of wayside noise levels from several sets of early measurements with the San Francisco BART system using two-car prototype vehicle trains. This spectrum consists of a combination of structure radiated noise, mostly at low frequencies, and direct train noise which dominates the spectrum above about 200 Hz. The direct noise from the train comes primarily from the under car where it is radiated from the wheels, the rails and the trucks. As is apparent from the chart, after correction of the data for the original measurement speed to 130 km/h and for 12-car length train at 25 m distance, the average overall wayside noise level is about 88 dBA. This matches the assumed wayside overall A-weighted noise level at reference conditions (assuming no noise mitigation) for the West Rail project. The rail was not smooth ground rail at the times of the measurements and therefore represents rail in an average condition of maintenance. This corresponds with the level developed from the Lantau Airport Railway (LAR) MTRC train baseline data for ballasted track after applications of the appropriate correction factors as discussed above. Throughout this study, this spectrum will be considered as the reference spectrum for total wayside noise.

Figure 2 presents data obtained at the covered aerial structure with floating slab located between the Kwai Fong and Kwai Hing Stations and at a comparable section of concrete viaduct north of the Kwai Hing Station. The MTRC viaduct without cover includes the sound barrier which attenuates the higher frequency airborne noise from the trains. The data was also taken in the (noise) shadow beneath, but not directly under, the viaduct thus further reducing the contribution of the train radiated noise. The low frequency re-radiated noise from the MTRC structure is very evident on *Figure 2*. One of the main reasons for the greater amplitude of the low frequency noise than for many of the other viaduct structures is the relatively stiff rail fixation used for the structures at the measurement location. The rail fixation is the very stiff continuous pad with Pandrol clips with embedded shoulders. This design results in higher vibration levels for the concrete structure than with the much more resilient baseplates used on the BART, Washington, D.C. Metro and MARTA structures.

The wayside noise measurement for the covered MTRC structure between Kwai Fong and Kwai Hing Stations has discontinuous floating slab with the stiff continuous pad type of rail support as for the adjacent sections of viaduct which do not have the floating slab track. The data on *Figure 2* show the very effective reduction of the lower frequency noise radiated from the structure. However, the higher frequencies do not show the reduction expected for two reasons: (1) the noise radiated from the floating slab in the 250 to 500 Hz region due to the stiff rail fastening and (2) the interference from background noise for frequencies above 500-1000 Hz.

Figure 3 presents two charts showing the adjustments made to the data from the MTRC structure intended to eliminate the effects of background noise which affected the higher frequency noise data, to eliminate the airborne noise component from the trains, and to eliminate characteristics of the spectra which can be attributed to the specific design of the structure. For instance, the resonance in the frequency range of 300-400 Hz for the floating slab section is not due to background noise. Analysis indicates it is associated with the fundamental longitudinal bending mode of the mini slab. But since this characteristic is sensitive to the design details of the floating slab, it was removed for the purpose of developing a generic projection. Later in this study, when more detailed minislab designs are considered, this spectral characteristic reappears and is considered in the analysis because the affect of the resonance is somewhat unavoidable given the range of floating slab designs under consideration. The two adjusted spectra on *Figure 3* indicate then the radiated noise as measured at the MTRC covered structure with the very stiff rail fixation characteristic of the MTRC structure.

Figure 4 presents the results for the BART and MARTA type concrete viaducts with relatively soft resilient rail fasteners (20 to 25 kN/mm) superimposed with the structure radiation from the uncovered MTRC structure with the very stiff continuous rail support. As is evident, the low frequency noise from the BART and MARTA structures are very similar. The average for the BART and MARTA trains establish the low frequency radiated noise and the upper frequency portion of the data curve is the estimated radiated noise from the viaduct with the airborne component from the train eliminated. Note that the MARTA data is for a structure with sound barrier wall so that it does include some increased radiating area compared to the BART structure data.

Figure 4 indicates then the difference in radiated noise which could be expected from the MTRC structures with a more resilient rail fixation system. Note that resilient rail fixation effects are generally limited to the frequency range above 31.5 Hz, as is shown by the data of *Figure 4*. The data in *Figure 4* indicate the correction factor which can be applied to the MTRC structure noise data for a more resilient rail fixation.

Figure 5 presents the final results showing the projected re-radiated noise from the MTRC concrete viaduct as corrected to the KCRC operating conditions. The charts on *Figure 5* also show the estimated additional effect of the Sonneville type rail fixation in reducing the radiated noise from the structure. This difference is based on measurements of the effect of the Sonneville rail fixation compared to a standard resilient direct fixation baseplate system. The primary effect is in the frequency range between 30 Hz and 250 Hz. Generally, structure vibration measurements show no significant difference at frequencies above 250 Hz with the Sonneville type track compared to resilient direct fixation baseplates.

The final chart on *Figure 5* indicates the noise level for the covered MTRC viaduct with floating slab, corrected to the use of a low stiffness rail fixation system and to the operating conditions for the KCRC West Rail Project.

As is evident on the charts of *Figure 5*, the noise level with the covered aerial structure and the Sonneville type track is 71 dBA for the 130 km/h, 25 m operating condition. With the floating slab/soft fastener track, the overall wayside noise at 25 m is 61 dBA for the same operating conditions. The performance with respect to noise reduction of the four trackform types are summarised in *Table 3* for the empirical study. The empirical estimate derived by WIA for the low vibration trackform is 14 dBA as compared to the West Rail Initial Assessment Report of 15 dBA reduction. The Cologne Egg provides 13 dBA reduction, whereas the floating slab with the stiff baseplate provides approximately 19 dBA reduction as compared to the 20 dBA reduction determined by the Initial Assessment Report. Employing soft baseplates on the floating slab increases the noise reduction from 19 to 24 dBA. The floating slab system with soft baseplates is the only trackform which provides an adequate reduction of the wayside re-radiated noise to below target maximum level of 64 dBA.

Table 3 Empirical Study of Estimates of Noise Reduction at 25 M - Baseline: Ballasted Track, No Facade Correction, 12-Car Train at 130 Km/H, Full Enclosure

	ERM Initial Assessment Report	Further Empirical Study
LVT	15	14
Cologne Egg	-	13
Floating Slab/Stiff Baseplate	20	19
Floating Slab/Soft Baseplate	-	24

For the floating slab track to be effective in mitigating to the extent required the structure vibration which causes the re-radiated noise, it is essential that a resilient rail fixation system be used at the floating slab. The recommended parameters are that the floating slab be a discontinuous type made up of 1.5 m or 3 m length precast segments with total weight not less than 2,000 kg per m of track and with resilient rail fixation to the floating slab. With resilient rail baseplates, the baseplate assembly should be in the range of 20 to 25 kN/mm static stiffness and not more than 30 to 35 kN/mm dynamic stiffness. The baseplates should spaced at not less than 750 mm on centre. With closer spacing, a softer baseplate would be necessary.

For vibration isolation of the cover from the main structure, a relatively stiff isolation assembly could be used to effectively reduce the radiated noise. In fact, a system with resonance frequency in the range of 50 to 100 Hz would be satisfactory. The A-weighted noise level is affected primarily by the higher frequency noise, e.g., noise at 250 Hz and higher frequencies.

Because it is necessary to reduce only the higher frequency noise from the cover, a relatively stiff rubber pad type isolation provided between the cover and the viaduct deck could be very effective in reducing the radiated noise at higher frequencies. Even a relatively stiff continuous rubber pad, such as the continuous rail support pad used on the early MTRC structures, would be satisfactory. The fastening system must, of course, be arranged so that the fasteners do not cause a short-circuiting path around the rubber pad separating the two parts of the structure assembly. Rubber or neoprene grommets and sleeves can be used to provide isolation at anchor bolts which would be used.

3. MODEL FOR DETERMINATION OF STRUCTURE RADIATED NOISE

In the previous section, results were summarised from the study submitted on 13 July 1997, Ref. 1, of the expected re-radiated noise from the fully enclosed structure based on available empirical data from measurements at other transit facilities. This section describes the model used for the theoretical determination of the re-radiated noise. Central to this model is a finite element analysis (FEA) of the vibration transmission from the train into the trackform and down through the structure. From the vibration levels within the structure determined from the FEA, the structure radiated wayside noise is obtained at the standard reference conditions of 12-car train travelling at 130 km/h and at a distance of 25 m from the track centre.

The finite element analysis of the structure is performed using the ANSYS 5.3 Finite Element Computer Program. The vibration levels in the structure are obtained from an analysis performed in the frequency domain. In all finite element analyses performed in this report, except the first of the full enclosure, a simply supported viaduct is assumed with pier spacing of 30 m. The model of the full enclosure is continuous over 5 spans and assumes a span length of 40 m. Variation in pier spacing will have an effect only at very low frequencies affecting ride quality and structural stability.

As vibration levels from one span to the next drop as much as 20 dB across a joint, the viaduct section modelled is between two joints. Thus, for a simply supported viaduct, only one span is modelled, whereas for the initial covered design, a 5 span section is studied. The load applied to the viaduct is one axle set on one track applied at midspan of the viaduct. Geometric symmetry allows the model to be reduced to half size along its length. Thus the simply supported span is modelled from midspan to the pier whereas the five span model is reduced to 2.5 spans. By applying symmetric and antisymmetric loading, running the model for each case and summing the results, the model size can be further reduced by another factor of two because modelling only ½ of the viaduct cross section is necessary.

The reduction of the model to 1/4 size is very important because it is necessary to employ a fine element mesh in order to resolve the vibration at high frequency. This fine mesh results in a Finite Element Model with as many as 30000 degrees of freedom and takes roughly 8 hours of computation time on a modern high speed workstation to calculate one case. Beam elements are used for the rail, plate elements for the floating slab, and brick elements for the structure. Effort was made to keep the characteristic length of an element on the order of 1/3 m, thus allowing resolution of propagating waveforms in the 300-700 Hz frequency range, which is the critical range for determining the overall A-weighted reradiated noise level.

Because the reduction of vibration across an expansion joint is on the order of 20 dB, it is assumed that the excitation of the span between joints is caused by the wheel sets located on the span. In the Finite Element Model, one wheel set is applied to the rail with primary and secondary suspensions incorporated and with unsprung mass, truck mass and coach mass included. Basic parameters of the model are listed in Appendix A. Excitation is applied by force via contact patch between wheel and rail such that at each frequency the roughness amplitude presented in *Figures 6 and 7* for wheel and rail roughness, respectively, is satisfied. Thus, it is assumed that roughness excitation is the major source of vibration in the structure as opposed to the moving impact load. At any point along the viaduct span, the vibration level due to all wheel sets acting on that structure section is obtained by an energetic incoherent sum of the contributions due to each wheel set. The contribution to the vibration level from each wheel set is obtained from the FEA for a single wheel set by using the vibration level determined by the model at the cross section whose distance from the single axle applied at midspan is the same as that from the axle in question to the structure section of interest along the viaduct span.

It can be seen in *Figures 6* and *7* (Ref. 2), that the roughness spectra for wheel and rail are very similar to that obtained by Remington in 1987, Ref. 3. The FEA uses an average of the roughness for the wheel and for the rail. It can also be seen that this level of roughness falls in the middle of the data presented in these figures. It thus represents neither the best nor the worst maintained wheel/rail but a wheel/rail in an average condition. For system wide projections of noise of the type presented in this work, an average condition of maintenance is the most realistic and therefore the most appropriate.

As a check of the assumption of wheel/rail roughness, a finite element analysis was performed on a generic viaduct with 54 kg/m rail and (soft) 21 KN/mm baseplates. The vertical vibration of the rail was determined, which incidentally, is not sensitive to the details of the support system beneath the trackform. It also provides a good measure of the appropriateness of the roughness assumption. This calculated vertical vibration is presented in *Figure 8* and compared to measured rail vertical vibration at the Washington Metro A13 aerial structure and Hightower Bridge at MARTA. Measurements on the WMATA A13 structure were made along sections of track with several types of stiff baseplates and several types of soft baseplates installed. Averaged vibration levels for the stiff and the soft baseplates are presented in *Figure 8*. The rails at the measurement locations and the wheels of most of the passby vehicles were in average to good condition. The calculated level of rail vibration compares favourably to the measured levels providing confidence in the assumed roughness spectra.

The vibration of the viaduct is converted to (reradiated) noise using the model developed by WIA for analysis of the Tsing Ma Bridge (TMB) (Ref. 4) , the Ma Wan Viaduct and the Kap Sui Mun Bridge (Ref 5). In the conversion to noise, the vibration levels of the radiating structural components at each cross section are weighted by cross section perimeter and cutoff frequency and energetically summed to obtain a sound intensity level for the cross section at a (cylindrical) radial distance from the viaduct. This sound intensity level per unit length of viaduct is then considered generic and incoherently integrated over the length of the train to obtain the sound intensity level due to the whole train at the given radial distance.

This method was recently put to test using vibration and measurement data taken on the TMB during passbys of work trains (Ref. 6). During the passbys of the work trains, vibration measurements were made on all of the major noise radiating trackform and bridge components. The radiated noise of each of these components was calculated as well as the total structural noise using the method described above. These spectra are shown in *Figure 9*. In *Figure 10*, the calculated total radiated noise determined from the vibration measurements is compared with measured noise 25m below and 25m diagonally below the track deck. Excellent agreement is shown between the calculated and measured levels, both on a spectral and an overall basis.

A final calibration of the finite element based reradiated noise model is presented in *Figure 11*. In that figure, the measured wayside noise level at the covered viaduct near Kwai Hing (MTR), adjusted to KCRC reference conditions is displayed. This measurement data is compared to a prediction of the reradiated noise using the method described above assuming trackform parameters relating to support stiffness and slab running weight similar to those specified for the Kwai Hing trackform. Good agreement between measurement and prediction is found up to about 600 Hz, which is the limit of the Finite Element based prediction. Above 600 Hz, the predicted reradiated noise is assumed to fall off at a rate of 12 dB per octave. Note that the resonance associated with the first longitudinal bending mode of the floating minislabs appears in both the measured and predicted results as is a major determinant in the overall A-weighted level.

4. RE-RADIATED NOISE ANALYSIS OF THE FULL ENCLOSURE

As a continuation of the Empirical Study, a Finite Element Analysis was performed to assess the reradiated noise from the fully enclosed viaduct with different trackforms. The results of this study are reported in Ref. 7. This reference also contains an assessment of the direct noise from the train and the mitigation of that noise by use of edge wall barriers/ semi enclosures. As this was a preliminary study wherein most of the issues were revisited in greater detail at a later date, it for the most part suffices to direct the reader to Ref 7 for further reading. A few of the issues, however, are relevant to the current report and are presented below. These are the difference in overall A-weighted levels with and without full enclosure and comparison of the expected noise reduction obtainable with the different trackform options.

As way of background, the Finite Element Model used for this part of the study assumed a fully enclosed viaduct with five spans between expansion joints and 40 m between piers. The cross section representation of the viaduct is shown in *Figure 12*, with isometric views of the inside and outside shown, respectively, in *Figures 13* and *14*.

The types of rail fixation included in the finite element analysis are:

- Sonneville type low vibration track, LVT, directly on the standard viaduct structure;
- Low stiffness egg type direct fixation baseplate;
- Floating slab track with high stiffness resilient rail fixation to the slab, similar to some rail fixation used at MTRC structures, and
- Floating slab track bed with low stiffness rail fixation, representing a fully effective floating slab track design.

The rail fixation parameters used for the analysis model are:

- LVT with dynamic stiffness of 44 kN/mm per block, block mass of 100 kg, spacing of 643 mm and rail pad with dynamic stiffness of 190 kN/mm.
- Egg type resilient baseplate with dynamic stiffness of 5.3 kN/mm, spacing of 643 mm.
- Concrete floating slab elements of 9 m length, 2100 Kg/m mass, support dynamic stiffness of 12.5 kN/m and rail support stiffness of 70 kN/mm at 643 mm spacing; and
- Concrete floating slab as for 3 but with rail baseplate stiffness of 9 kN/mm at 643 mm spacing.

These parameters roughly correspond to the trackforms considered in the preliminary empirical analysis.

The predicted wayside noise levels of reradiated noise for KCRC reference conditions (and level with the top of rail) are reported in *Table 4* for full enclosure and for several different edge wall heights. It can be seen that there is little difference in reradiated noise calculated for low vs high edge walls for any of the trackform options. However, there is a 2-4 dBA increase in the wayside noise level for LVT, soft baseplates and floating slab with stiff plates when the viaduct is fully enclosed. This is caused by radiation from the roof of the enclosure and an increase in radiation from the edge walls due to structural interaction between the edge walls and the roof. The effect is not significant in the case of the floating slab with soft baseplates where the difference with and without the roof is less than 1 dB. This is explained by the fact that the difference appears primarily in the lower frequencies and the floating slab with soft baseplates effectively removes the low frequency contributions whereas this is not the case with the other trackforms considered.

The prediction of the wayside noise levels for reference KCRC conditions for the empirical and the FEA of the full enclosure are presented in *Table 4* and compared to the Initial Assessment Report in Table 5. As in the empirical analysis, the FEA indicates that the floating trackslab with soft baseplates is the only track form considered which will reduce the reradiated noise level to below the targeted maximum of 64 dBA. The preliminary, empirical and FEA estimates for the floating slab with stiff baseplates agree; however, the FEA indicates rather disappointing performance for both the LVT and the egg type baseplate when compared with the estimates presented in the Empirical Study. This can be explained by the fact that the reductions assumed for these trackforms were obtained from installations, such as at grade and in tunnels, were the surface upon which the trackform is mounted is very stiff, or in other words, is a high impedance mount. Vibration transmission reduction systems work best when they are installed on a high impedance mounting. The viaduct structure is, by contrast, not a high impedance mount. Therefore optimal performance cannot be expected from resilient mounts placed on a viaduct. The reason why the floating slab reductions are more consistent is because the empirical projections are based on actual measurement data taken on the MTR viaduct with floating slab installed, and not on at grade or tunnel installations.

Table 4 Wayside Noise Levels for Re-Radiated Noise at Top-of-Rail Elevation, 25 M, 130 Km/Hr, 12-Car Train

Configuration	Noise Levels dB(A) Re Radiated
LVT	
Fully Enclosed	79
Full Height Barrier	76
4.3 m Height Barrier	76
2.5 m Height Barrier	76
1.5 m Height Barrier	76
Cologne Egg	
Fully Enclosed	76
Full Height Barrier	75
4.3 m Height Barrier	74
2.5 m Height Barrier	74
1.5 m Height Barrier	74
Floating Slab with Stiff Baseplates	
Fully Enclosed	67
Full Height Barrier	63
4.3 m Height Barrier	63
2.5 m Height Barrier	63

Configuration	Noise Levels dB(A)

Configuration	Noise Levels dB(A) Re Radiated
1.5 m Height Barrier	63
Floating Slab with Soft Baseplates	
Fully Enclosed	57
Full Height Barrier	56
4.3 m Height Barrier	56
2.5 m Height Barrier	56
1.5 m Height Barrier	56

Table 5 Prediction of L_{max} (dBA) at 25 m for 130 Km/Hr, 12-Car Train

	ERM Initial Assessment Report	Empirical	FEA
Full Enclosure			
LVT	70	71	79
Cologne Egg	-	72	76
Floating Slab/Stiff Fastener	65	66	67
Floating Slab/Soft Fastener	-	61	57

5. PREDICTED AND WAYSIDE NOISE ANALYSIS OF THE MULTI PLENUM SYSTEM WITH EDGE WALLS

During the empirical study, it was decided that full enclosure along the entire length of the West Rail Viaduct was unacceptable for a number of reasons relating to cost, safety considerations and aesthetics. In the Ref. 8, [the preceding technical paper in the MOS EIA technical annex], the effectiveness of an alternative strategy to full enclosure is considered for the reduction of the direct noise from the train to a level sufficiently below the target maximum of 64 dBA. Edge walls of various designs were first considered and it was found that even with the most optimistic expectations of performance, the target criterion would still be exceeded. To achieve this level of reduction, very tall edge walls would have to be erected which would be impractical if not cost prohibitive to build, on account of wind loading, and would also be unaesthetic.

An alternate system, termed the "Multi plenum System", was conceived at the 1st KCRC West Rail Workshop on Noise by the Operational Noise Working Group and evaluated in Ref. 8 regarding its effectiveness in mitigating the direct train noise. The concept is portrayed for the viaduct cross section in *Figure 15* for tangent track, and in *Figures 16-17* for curved track. Additional mitigation of direct train noise is achieved by creating noise plena beneath the vehicle and under edge and centre walkways to attenuate the noise source (beneath the train). Edge walls of considerably lower height are shown in Ref. 8 to be adequate in the reduction of the direct noise, when employed on the viaduct together with the plena. This then implies that having employed this scheme, satisfaction of the (total) maximum wayside noise criterion depends on adequate reduction of the structure radiated noise, just as in the case of full enclosure.

A Finite Element Model of the viaduct with tangent track, shown in *Figure 15*, was constructed to determine the structure radiated noise levels for the LVT, the soft baseplates and the floating slab trackforms. A plan view of the floating mini slabs appears in *Figure 18*, showing the lateral and longitudinal resilient restraint pads and 4 egg type baseplates on each mini slab.

The rail fixation parameters used for the analysis of the multi plenum viaduct are:

- LVT with dynamic stiffness of 20 kN/mm per block, block mass of 100 kg, spacing of 750 mm and rail pad with dynamic stiffness of 200 kN/mm.
- Egg type resilient baseplate with dynamic stiffness of 12 kN/mm, spacing of 750 mm.
- 12 Hz Concrete floating mini slab elements of 1.5 m length, 2844 Kg/m mass, bearing dynamic stiffness of 6.5 kN/mm and rail support stiffness of 12 (soft), 30 (moderate) and 70 (stiff) kN/mm at 750 mm spacing.

The viaduct is assumed to consist of simply supported spans of 30m. Cross sections and isometric views of the finite element discretization are shown in *Figures 19 and 20*, respectively. The estimated structure radiated wayside noise for the five different trackforms is shown in *Figure 21*. It is seen that only the floating slab trackform with moderate to soft baseplates have overall A-weighted levels (63 and 58 dBA, respectively) less than the target of 64 dBA. The levels for the egg type fastener and the LVT are 75 and 74 dBA, respectively, which is roughly 10 dBA higher than the criterion. It is interesting to note that the level with floating slab and stiff baseplate is 69 dBA, indicating that the benefits of the floating slab can be compromised by selection of a baseplate which is too stiff. As mentioned previously the 400 Hz resonance appearing in the spectra d with the floating slab is attributable to the 1st longitudinal bending mode of the slab. Experiments in which the slab is lengthened, however, indicate that there are other resonances, caused primarily by the bending of the viaduct structural elements and occurring near 400 Hz, which become evident and tend to dominate the A-weighted level once the slab resonance is shifted to a lower frequency. As will be seen, it is not a simple matter of just lengthening the slab to gain a significant reduction in the A-weighted level.

One disadvantage to the use of floating slab trackform is that the slab itself radiates noise. The stiffer the baseplates, the more the slab radiates. This will become an issue only if the slab radiated noise becomes on the order of or exceeds the train noise. This trend appears in the slab radiated noise shown in *Figure 22*. The A-weighted noise level of the slab with stiff baseplates is 88 dBA, which is the same as that for the train noise, whereas the noise level for the moderate and soft baseplates is considerably less than that of the train.

Figure 23 shows the reference train with the structure radiated noise removed and *Figure 24* displays the noise receptors and sound barriers of different heights considered in the study of the mitigation of the direct train noise Ref 8. In *Figures 25-28*, the direct noise and the structure radiated noise is combined at receptor location 7 (25 m from track centreline and at top of rail) to obtain the total wayside noise, with and without the attenuation provided by the multi plenum and a 1.2 m high (measured from the walkway) edge wall system.

The combined noise from the train, deck and floating slab beneath the train are shown in *Figure 25* with no mitigation applied. For the LVT, the egg type fastener and the soft and moderate baseplates on the floating slab, the overall A-weighted combined noise is approximately that of the train noise alone. However the combined noise from the train and from the floating slab with the stiff baseplates is 91 dBA, or 3 dBA higher than the train noise alone.

In *Figure 26*, the structure radiated noise shown in *Figure 21* is energetically added to the combined under car noise displayed in *Figure 25* to obtain the total wayside noise with no mitigation applied. Comparison of *Figures 25* and 26 indicates that if there is no mitigation of the noise from the under car, it will completely determine the total overall A-weighted wayside noise level.

In *Figure 27*, the combined noise from the train, deck and floating slab beneath the train, as shown in *Figure 25*, is attenuated with the multi plenum system and the 1.2 m high edge wall. The overall A-weighted level after attenuation of the train noise only is 62 dBA as given in *Table 6* (taken from Ref 8) wherein the noise levels predicted for the multi plenum model at the ten receptor shown in *Figure 24* are given. It can be seen in *Figure 27* that the overall A-weighted levels for the LVT and egg type track, as well as the floating slab with soft baseplates is also about 62 dBA. The levels for floating slab with moderate and stiff baseplates are 64 and 66 dBA, respectively, again due to the additional under car noise radiated from the floating slab.

Table 6 Noise Levels (L_{max}) Predicted for the Multi Plenum Model at the Ten Noise Receptors Located 25 m from the Track Centerline and with Line-Of-Sight (Los) Indicated at Various Heights Above Ground -Re: 130 Km/H, 12-Car

RECEPTOR LOCATION (Height above Ground)	NO NOISE MITIGATION - dBA-	1.2 m (2.9 m) EDGE BARRIER - dBA -	2.5 m (4.2 m) EDGE BARRIER - dBA-	4.2 m (5.9 m) EDGE BARRIER - dBA-	5.4 m (7.1 m) EDGE BARRIER - dBA-
OUTBOARD:					
1. 1.5 m	88	53.8	50.6	49.4	49.3
2. 7 m (tor)	88	55.8	51.5	49.6	49.3
3. 12 m	88	58.2	53.0	50.2	49.6
4. 17 m	88	61.4	54.9	51.2	50.1
5. 22 m	88	63.4 los	57.2	52.8	51.1
INBOARD:					
6. 1.5 m	88	58.1	55.5	53.8	53.4
7. 7 m (tor)	88	62.0	58.0	54.9	53.9
8. 12 m	88	67.7	61.6	56.9	55.1
9. 17 m	88	74.2 los	67.0	60.2	57.3
10. 22 m	88	74.2 los	74.0 los	64.3	60.5

Figure 28 is analogous to *Figure 26* in that the structure radiated noise shown in *Figure 21* is energetically added to the combined under car noise displayed in *Figure 27* except now the under car noise is attenuated by the multi plenum system and the 1.2 m high edge wall. It is only the total noise for the floating slab with soft baseplates that satisfies the maximum 64 dBA limit at Receptor 7 with a 1.2 m high edge wall. The overall A-weighted noise levels presented in *Figures 25-28* are summarised in *Table 7.*

Table 7 Noise Levels (L_{max}) Estimated at Noise Receptor 7 (Inboard Tor) for the Different Trackform Options - Re: 130 Km/H, 12-Car

TRACKFORM	NO NOISE MITIGATION - dBA-	DIRECT NOISE AND UNDERCAR COMPONENT - dBA-	STRUCTURE RADIATED NOISE W/O UNDERCAR COMPONENT - dBA-	TOTAL NOISE - dBA -
1. Cologne Egg				
12 kN/mm	88	62	75	75
2. LVT				
20 kN/mm	88	62	74	74
3. Floating Slab				
70 kN/mm	88	66	69	71
4. Floating Slab				
30 kN/mm	88	64	63	66
5. Floating Slab				
12 kN/mm	88	63	58	64

There are several conclusions which can be drawn from *Table 7*:

- Only floating slab track from with relatively soft baseplates will be capable of reducing total wayside noise to within compliance.
- Placing stiff base plates on floating slab not only increases the noise radiated from the viaduct, but also from the floating slab itself.
- It is not sufficient for the structure radiated noise and the mitigated under car noise to be each less than 64 dBA to ensure the total wayside noise is less than 64 dBA because the total wayside noise is the energetic sum of the two. Consider the case of floating slab with moderately stiff baseplates: the mitigated under car noise and the viaduct structure radiated noise are 64 and 63 dBA, respectively, whereas the total noise is 66 dBA. The energetic sum of the two can be as much as 3 dBA higher than either of the two in the worst case of their spectra being identical. If the spectra are similar, the structure radiated noise and the mitigated under car noise levels must be each roughly 61 dBA in order for the total noise to be within compliance.
- In the case of the floating slab with soft baseplates, the total noise level is increased by 1 dBA over the mitigated under car noise (63 dBA) even though the overall A-weighted level of the mitigated under car noise is 4 dBA higher than that of the structure radiated noise. Thus the total noise level will be within compliance when either the structure radiated noise or the mitigated

under car noise is near the maximum level (64 dBA) only if the other is significantly below (by roughly 5 dBA) the maximum level.

It should be noted that in the above example, neither the floating slab trackform nor the viaduct structure are optimised for maximum reradiated noise reduction. If necessary, the edge wall can also be made higher to further reduce the under car noise. Thus, although it is true in principle that the floating slab trackform with relatively soft baseplates is necessary for wayside noise compliance, the extent to which the noise can be reduced depends on the detail design of the viaduct, the trackform and the multi plenum/edge wall system.

6. EFFECT OF STRUCTURE TRACKFORM AND CIVIL REQUIREMENTS ON PREDICTED NOISE LEVELS FOR THE EMU LINE

In this section two important topics are discussed. First, the effect of the viaduct design on the reradiated noise is considered in order to resolve the issue of whether the need for floating slab trackform can be eliminated by alteration of the design of the viaduct. If floating slab cannot be eliminated then it would be useful to determine roughly how much noise reduction can be gained from structure optimisation. The second major issue concerns whether it will be possible to design a floating slab for the EMU and for the mixed use lines (freight and EMU) which will satisfy both the noise reduction and the civil (structural) requirements.

We begin with consideration of viaduct structural changes which are within or approaching the limit of practicality but which it is believed will lead to lower levels of reradiated noise. The three changes which lead toward this objective are to reduce the radiating area of the structure, to increase its mass and to increase its stiffness. It must be remembered that redesign is limited by the fact that the multi plenum/ edge wall system must be installed on top of the viaduct for adequate reduction of the under car noise and that this system has certain spatial requirements. One design which significantly reduces the radiating area is a single track as opposed to a double track viaduct, as shown with the multi plenum/ edge wall system in *Figure 29* without floating slab, and in *Figure 30* with floating slab.

In *Figure 31* the concept is taken further, by doubling the thickness of all of the structural members. Although this example probably goes beyond what is buildable, it will illustrate the advantages of a very significant increase in the mass and stiffness of the viaduct.

The estimated reradiated noise for different viaduct designs is shown in *Figure 32* for the reference KCRC conditions and dynamic (soft) baseplate stiffness of 12 kN/mm. As presented earlier, the overall A-weighted levels for the two track viaduct with and without the 12 Hz floating slab are 58 and 75 dBA, respectively. The level for the standard single track viaduct with no floating slab is 72 dBA, whereas for the stiff massive version it is 69 dBA. Thus for a single track structure with significantly reduced radiating area and significantly increased mass and stiffness, the reradiated noise level is still 5 dBA over the criterion even with very soft baseplates. With more moderate baseplates, as shown in *Figure 33*, the overall A-weighted level for the stiff massive single track structure is 72 dBA or 8 dBA over the target level. It is therefore concluded that compliance cannot be achieved without floating slab by optimisation of the structure. It should be noted, however, that the low frequency rumble noise is significantly mitigated by the viaduct changes, almost down to the performance level of the floating slab.

Viewed from a different perspective, optimisation of the structure can be very beneficial. The more that reradiated noise reduction can be achieved from the structural design, the more latitude there will be for civil considerations in the trackform design. In *Figure 32*, there is a 6 dBA advantage in noise level between the 'standard' two track viaduct and the stiff massive single track viaduct.

Analysis up to this point has not taken into account the major civil requirement on trackform design impacting the reradiated noise consideration, that is, the vertical deflection of the rail. Also, the viaduct had been redesigned with thicker cell walls, thereby increasing somewhat the stiffness and mass of the viaduct. In order to make more realistic reradiated noise projections, these factors needed to be taken into account.

Figures 34 and *35* show the revised FEA model cross sections for the two track and single track viaducts, respectively, with the strengthened cell walls. Additionally it was agreed with KCRC that, as a working assumption, the vertical static deflection for the EMU and freight lines would be limited to 7 and 5 mm, respectively. One configuration for the mini slab trackform which satisfies the 7 mm requirement for the EMU line is 21 kN/mm dynamic (15 kN/mm static) baseplates on 750 mm centers with 13 Hz 1.5 m mini slabs (2844 kg/m running mass) on 7.1 kN/mm dynamic stiffness bearings. This trackform/viaduct design shall be referred to as the current EMU configuration.

The reradiated noise from the slab and from the structure for this revised configuration are shown in *Figures 36* and *37*, respectively, and compared with the previously analysed floating slab/ viaduct configuration. It can be seen that the slab radiated noise is similar to the previous 12 Hz floating slab model with 30 kN/mm baseplates whereas the structure radiated noise is similar to the previous 12 Hz floating slab model with 12 kN/mm baseplates. Since these previous cases were shown to satisfy the total noise wayside requirement, these results indicate - by similarity that it is possible to construct a floating slab trackform on the current (nonoptimized) two track viaduct design which satisfies the most important civil requirement of 7 mm static vertical rail deflection as well as the wayside noise requirement.

The reradiated noise levels from the slab and from the viaduct are plotted for the single and two track current EMU configurations in *Figure 38*. The overall A-weighted levels for the slab noise are similar because the trackform impedance mount does not have a significant effect on the slab vibration at the higher frequencies. However the structure radiated noise for the single track viaduct is 55 dBA, or 4 dBA lower than that for the two track viaduct.

Another kind of structural alteration is considered in *Figure 39*, with the FEA implementation shown in *Figure 40*. In this case an attempt was made to increase the stiffness or impedance of the mount beneath the floating slab support bearings by increasing the number of cells from one to three and moving the cell walls to beneath the bearings. A comparison of the slab and structure radiated noise for the one vs three cell viaduct designs is shown in *Figure 41*. The 12 Hz floating slab trackform with 30 kN/mm dynamic stiffness baseplates is assumed. The slab noise radiation is roughly similar, whereas the reradiated noise from the three cell viaduct is about 3 dBA lower than for the one cell viaduct. Note that due to the large difference in spectra between 160 and 400 Hz, the reduction of the reradiated noise could be considerably greater if the structural resonances at the higher frequencies were to align differently.

7. EFFECT OF STRUCTURE TRACKFORM AND CIVIL REQUIREMENTS ON PREDICTED NOISE LEVELS FOR THE FREIGHT AND MIXED USE LINES

The operational, wayside noise and civil requirements for the freight and mixed use lines are quite different from those for the EMU only line. If double stack freight is allowed, the maximum axle load, from the standpoint of rail fatigue life, is 32 tonnes. For single stack freight, it would be 22 tonnes whereas for the EMU line it is 18 tonnes. As shall be seen, the agreed upon maximum vertical static rail deflection of 5 mm will have very different consequences with regards to meeting the maximum wayside noise target of 67 dBA for these different tonnage requirements.

Besides the maximum static vertical rail deflection requirement, civil requirements demand a baseplate which can stand up to the punishment that the freight loading delivers to the baseplate. KCRC prescreened baseplates for freight usage and found that the ATP Acoustic Loadmaster may be suitable. In order to interject realism into the wayside noise projections for freight, WIA used the Loadmaster dynamic characteristics for the baseplate in the reradiated noise modelling. These characteristics were obtained from dynamic tests performed on the Loadmaster by WIA and are summarised in *Table 8*. The dynamic stiffness for this baseplate at the 22 tonne axle load for single stack freight is 49 kN/mm whereas for the 32 tonne load for double stack freight, it is 58 kN/mm. These stiffnesses are considerably higher than the value of 21 kN/mm used in the current EMU configuration. Additionally, the baseplate centre spacing was reduced from 750 mm to 600 mm which further increases the effective stiffness of the baseplates.

Table 8 Selected Operational and Performance Data Pertaining to the Use of the Acoustic Loadmaster for Freight

AXLE LOAD (tonnes)		STIFFNESS (kN/mm)		DYNAMIC-TO-STATIC RATIO
Maximum	Noise	Static	Dynamic	
18	15	3.5	46.4	1.97
22	18	25.7	49.1	1.91
32	25	31.2	58.4	1.87

Other than the floating slab trackform properties, the other modelling parameters for freight are assumed to be the same as those for the EMU line, as described in Appendix A. The Acoustic Loadmaster or another baseplate with similar dynamic properties is assumed to be used in all instances on the freight only and mixed use lines. In the first attempt to satisfy the static rail deflection requirement, the slab running weight of 2844 kg/m was kept the same as in the EMU line. Since the baseplate centre spacing was decreased to 600 mm, the length of the (mini) slab module was increased to 1.8 m with six baseplates on top of and six support bearings underneath each slab. In order to meet the static deflection requirement with double stack freight, the dynamic stiffness of the slab support bearings was increased to 14 kN/mm, which resulted in a 20.5 Hz floating slab. The reradiated noise from the slab and structure for this configuration is shown in *Figure 42*. The overall A-weighted wayside noise levels for the slab and the structure are 88 and 70 dBA, respectively. Thus the target of 67 dBA total maximum wayside noise level will be exceeded by this configuration.

If the running slab weight is doubled from 2844 kg/m to 5688 kg/m the resonance frequency of the slab will be reduced from 20.5 Hz to 14.5 Hz with no change in the static rail deflection, all other things being equal. There is a significant structural consequence to this alteration because the viaduct needs to be designed to carry the extra weight. A comparison of the reradiated noise, assuming 32 tonne freight, is made for the different mass floating slabs and is presented in *Figure 43*. Unfortunately, there is very little difference in the overall A-weighted levels, of either the slab or the viaduct reradiated noise. The resonance (spectral) structure in the viaduct response has certainly changed; however, the summation leads to similar A-weighted levels.

For the 22 tonne axle freight, the 1.8 m module length mini slab is again chosen, except in this instance, the running slab mass is assumed to be 4266 kg/mm. In order to satisfy the static rail deflection requirement, a bearing dynamic stiffness of 8.8 kN/mm is required. This results in a slab resonance frequency of 13.2 Hz. The reradiated noise spectra for the slab and viaduct are presented in *Figure 44*. The overall A-weighted levels for the slab and viaduct are 86 and 66 dBA, respectively. These levels indicate that the structure radiated noise is below the targeted level of 67 dBA.

In *Figure 45*, all conditions and design parameters are kept as in *Figure 44* except that the slab length is increased to 5.4 m from 1.8 m. The structure and slab radiated noise for both cases is compared in *Figure 45*. Again, as in the case of the floating slabs of different resonance frequencies, the resonance structure of the reradiated noise at higher frequencies is changed in the viaduct; however, there is little difference in the overall A-weighted levels for either the slab or the viaduct.

Figure 46 considers the same conditions and comparisons as in *Figure 45*, except the viaduct structure is assumed to be the strengthened three cell viaduct. For the 5.4 m slab the structure radiated noise is about the same for the two viaduct cross sections; however, for the 1.8 m slab, the structure radiated noise is reduced by 5 dBA with the strengthened three cell structure to 61 dBA. This results from the fact that the dominant resonance at higher frequencies for the 1.8 m slabs falls in the frequency range where the strengthened three cell viaduct is very effective at reducing the noise level. Fortuitous alignment of resonances did not occur in the case of the longer slabs.

The reradiated noise for 22 tonne axles on a single track viaduct is shown in *Figure 47* for the 5.4 m and the 1.8 m floating slab trackforms. In this case the reradiated noise levels for both trackforms is similar, with the structure radiated level at about 62 dBA, or 5 dBA below the targeted level.

There are several conclusions which can be stated concerning the freight study:

- The Acoustic Loadmaster or another baseplate with similar performance appears have the potential to satisfy the civil and perhaps the noise requirements for the freight and mixed use lines, at least for the 22 tonne axle (single stack) freight
- It was not possible to satisfy both the static rail deflection requirement and the wayside noise requirement for the 32 tonne (double stack) freight, given the design variations considered in this study. The exceedance was 3 dBA which could potentially be eliminated by viaduct structure optimisation.
- No significant advantage in reducing the A-weighted levels was obtained from either increasing the floating slab length or significantly increasing its mass
- For the 22 tonne axles, the structure radiated noise was reduced to 61 dBA for 13.2 Hz mini slabs on a strengthened three cell, two track viaduct, and to 62 dBA for the same trackform on a 'standard' single track viaduct. These levels are about 5 dBA below the targeted wayside criterion for freight.

In the case of strengthening the viaduct by the three cell design, a benefit of 5 dBA reduction was achieved for the short slabs, whereas for the longer slabs, there was no appreciable benefit. This is a consequence of the resonance interaction of the viaduct and the trackform, indicating that structural optimisation is possible but requires some analysis.

8. MISCELLANEOUS TOPICS

In this section a number of miscellaneous topic are addressed.

Figure 48 shows a comparison of the noise radiated from a 12 Hz floating slab of different lengths relative to the 1.5 m mini slab module for the dynamic baseplate stiffness of 30 kN/mm. The 4.5 module on the average does not show much difference in performance from the 1.5 m length slab. However, it has a considerably different resonance structure which can amplify or attenuate different frequency bands compared to the mini slab. Thus performance benefit or loss depends on slab-structure resonance interaction. The longer slabs radiate higher noise levels over most of the frequency range.

In *Figure 49*, the noise radiated from slabs in front of the train are shown. By 7 m ahead of the train, the overall A-weighted noise level is reduced by over 30 dBA. This indicates that radiation of noise from the slab in front of and behind the train (and therefore outside of the undercar plenum) does not significantly contribute to the wayside noise.

Measurement data of rail vibration from the WAMATA A13 Aerial structure and from the MARTA Hightower Bridge are presented in *Figure 50*. Comparison of the data taken for the soft vs the stiff fasteners at WAMATA indicates that although there is higher vibration of the rail when soft baseplates are used, this difference occurs primarily at lower frequencies. Therefore, there is very little effect on the A-weighted level. In *Figure 51*, this difference is plotted to show more clearly that the higher rail velocities in the case of the soft baseplates occurs only at the lower frequencies. Since the cutoff frequency of the rail is quite high, very little of this low frequency increase is radiated as noise away from the rail. The reference spectrum for the train noise does therefore not have to be corrected because soft baseplates will be employed as part of the reradiated noise mitigation.

The results presented in *Figures 50* and 51 were for soft and stiff baseplates directly attached to the viaduct. In *Figure 52*, the calculated rail vibration is presented with and without floating slab. Again it is seen that differences occur only at low frequencies which do not radiate as noise from the rail, leaving the a-weighted level unchanged. The reference spectrum for the train noise does therefore not have to be corrected because floating slab will be employed as part of the reradiated noise mitigation.

In *Figures 53* and 54, comparisons are made of respectively of the rail vibration and the noise radiated from the rail under and ahead of the train. *Figure 54* shows first that the model calculation of the noise radiated from the rail beneath the train agrees quite favourably with the assumed train noise reference spectrum, of which the rail noise is a part. Secondly, it shows that by about 10 m in front of the train, the noise radiated from the rail drops to a level that can be adequately mitigated by the edge wall only, without the need of coverage by the undercar plenum. The rail out in front of the train need not therefore be considered as a separate line source in the determination of the total wayside noise. As a modelling assumption, the radiating rail out in front of and behind the train can be adequately taken into account by assuming that the train is 1/4-1/2 car longer than it is actually to account for this radiation.

This assumption about how far in front of and behind the train the rail radiates significant noise is further substantiated by the measurement data taken during a train passby on the LA Metro and shown in *Figure 55*. For the microphone placed 1.2 m from the train, it can be seen that the high noise levels occur only when the train is adjacent to the microphone, and not before or after the passby.

In *Figure 56*, measurement data is shown indicating the increase in noise due to the presence of switches and crossovers. The increase in direct noise is taken from wayside noise measurements made with and without a switch installed on the BART San Leandro test track. The difference in overall A-weighted level of 8.5 dBA is not sensitive to speed between roughly 45-130 kM/h. The difference in reradiated noise was obtained from simultaneous measurements taken on the concrete decks of two adjacent simply supported spans of the MARTA Hightower bridge one span supported a crossover and the other supported simple tangent track.

In *Figure 57*, the noise radiated from the opposite track slab is presented for the current EMU configuration. It shows that the radiated noise level is 28 dBA and therefore can be neglected in the determination of the total wayside noise. In *Figure 58*, the structure radiated noise levels are traced from the floating slab under the train to the floating slab on the opposite track to show the reduction of radiated noise from one slab to the other.

9. CONCLUSIONS

9.1 Empirical and Full Enclosure FEA Study

In Phase 1, empirical data was gathered from previous studies on reradiated noise levels near transit train concrete viaduct structures and also on the vibration reduction performance of resilient baseplates, low vibration trackwork (LVT) and floating slab trackwork. After the data was applied to the KCRC West Rail Viaduct, it was found that with full enclosure, only the floating slab trackform provides sufficient reduction of the structure radiated noise. In Phase 2, the FEA was performed on the KCRC West Rail Viaduct to determine the structure radiated noise. The FEA also predicted that only the floating slab trackform provides sufficient reduction of the structure radiated noise.

9.2 Reradiated Noise Analysis of the Viaduct with the Multi Plenum System with Edge Walls

- The multi-plenum direct noise barrier together with floating slab trackform and resilient baseplates can reduce the total wayside noise to the targeted wayside noise level.
- Only floating slab track from with relatively soft baseplates will be capable of reducing total wayside noise to within compliance.

- Placing stiff base plates on floating slab not only increases the noise radiated from the viaduct, but also from the floating slab itself.
- It is not sufficient for the structure radiated noise and the mitigated undercar noise to be each less than 64 dBA to insure the total wayside noise is less than 64 dBA because the total wayside noise is the energetic sum of the two. If the spectra are similar, the structure radiated noise and the mitigated undercar noise levels must be each roughly 61 dBA in order for the total noise to be within compliance.

9.3 Effect of Structure Trackform and Civil Requirements On Predicted Noise Levels for the Emu Line

- Structural redesign, within practical limits, will not provide adequate reduction of the reradiated noise, and therefore, will not eliminate the need for floating slab.
- Low frequency rumble noise can be significantly mitigated by the viaduct changes.
- The more that reradiated noise reduction can be achieved from the structural design, the more latitude there will be for civil considerations in the trackform design.
- It is possible to construct a floating slab trackform on the current (nonoptimized) two track viaduct design which satisfies the civil requirement of 7 mm static vertical rail deflection and the wayside noise requirement.

9.4 The Freight and Mixed Use Study

- It was not possible to satisfy both the static rail deflection requirement and the wayside noise requirement for the 32 tonne (double stack) freight. The exceedance was 3 dBA which could potentially be eliminated by viaduct structure optimisation.
- No significant advantage in reducing the A-weighted levels was obtained from either increasing the floating slab length or significantly increasing its mass.
- For the 22 tonne axles, the structure radiated noise levels are about 5 dBA below the targeted wayside criterion for freight.

In the case of strengthening the viaduct by the three cell design, a benefit of 5 dBA reduction was achieved for the short slabs, whereas for the longer slabs, there was no appreciable benefit.

9.5 Conclusions from Miscellaneous Topics

- Longer slabs radiate higher noise levels over most of the frequency range.
- Radiation of noise from the slab in front of and behind the train does not significantly contribute to the wayside noise.

- The reference spectrum for the train noise does not have to be corrected because soft baseplates will be employed as part of the reradiated noise mitigation.
- The reference spectrum for the train noise does therefore not have to be corrected because floating slab will be employed as part of the reradiated noise mitigation.
- As a modelling assumption, the radiating rail out in front of and behind the train can be adequately taken into account by assuming that the train is 1/4-1/2 car longer than it is actually to account for this radiation.
- At switches and crossovers, the difference in overall A-weighted level is 8.5 dBA. The difference in reradiated noise is 4 dBA.

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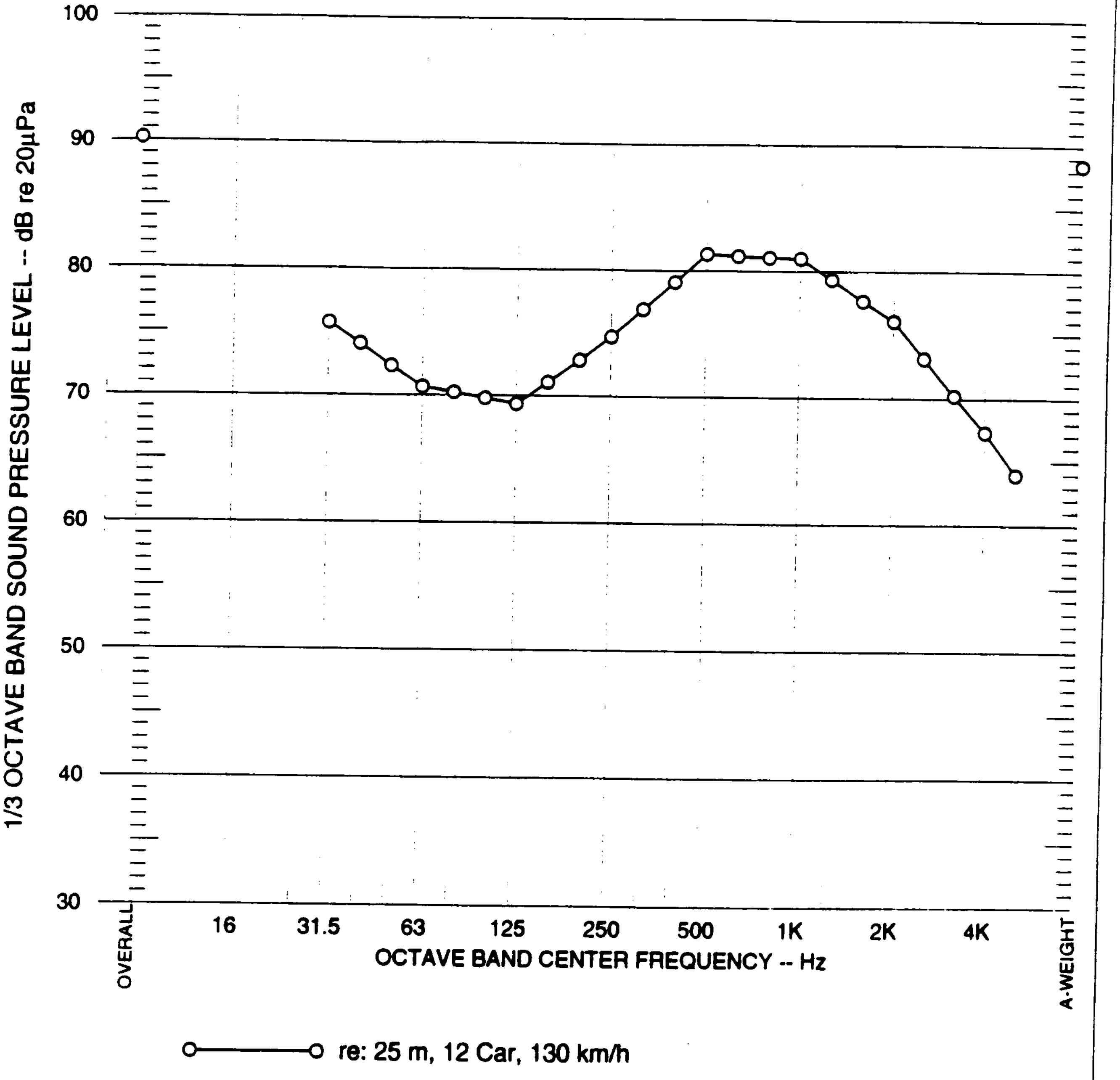


NOT TO SCALE

W I A

REFERENCE VIADUCT NOISE SPECTRUM

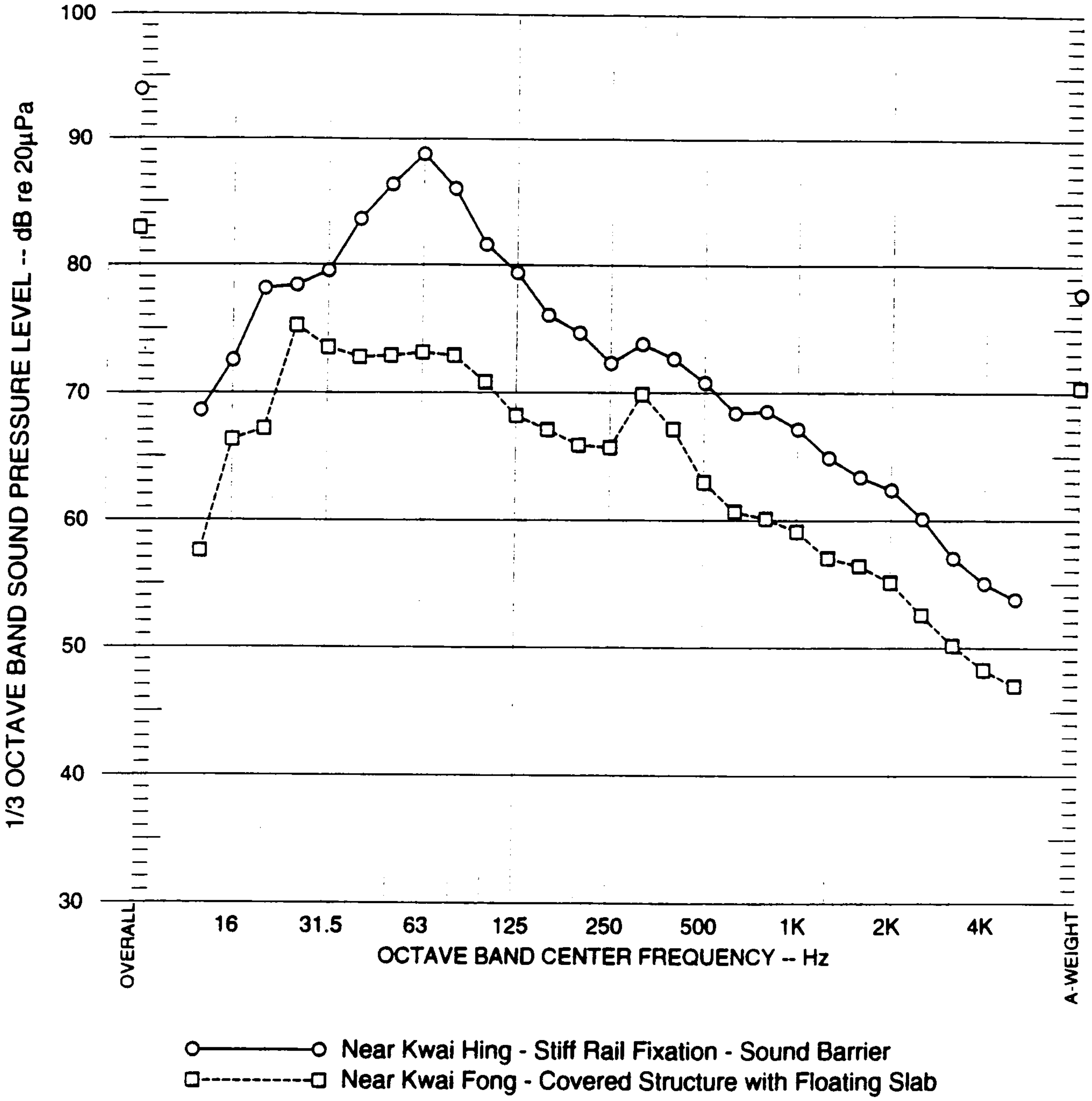
FIGURE 1

Contract/C1588/C1588_31

ERM

KOWLOON - CANTON RAILWAY CORPORATION

WEST RAIL: TS900 EIA STUDY



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MEASURED NOISE LEVELS FROM MTRC TRANSIT TRAIN PASSBYS ON THE TUEN WAN LINE - CORRECTED TO A 12-CAR TRAIN AT 130 kph AND 25m DISTANCE

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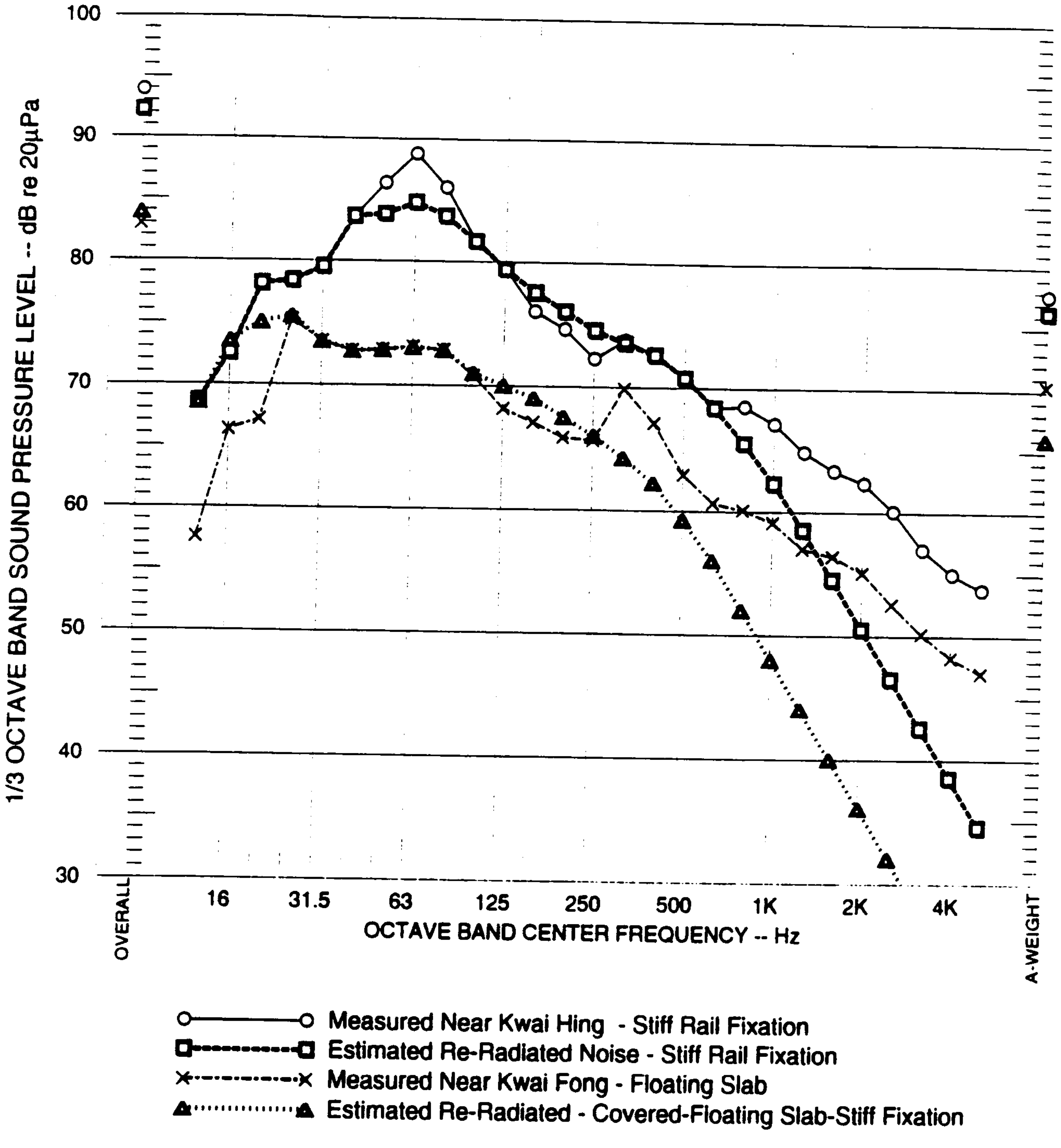
FIGURE
2

Contract/C1588/C1588_32

ERM

KOWLOON - CANTON
RAILWAY CORPORATION

WEST RAIL: TS900 EIA STUDY



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ESTIMATED STRUCTURE RADIATED NOISE FROM MTRC TRAIN PASSBYS AT COVERED VIADUCTS - CORRECTED TO A 12-CAR TRAIN AT 130 kph AND 25m DISTANCE

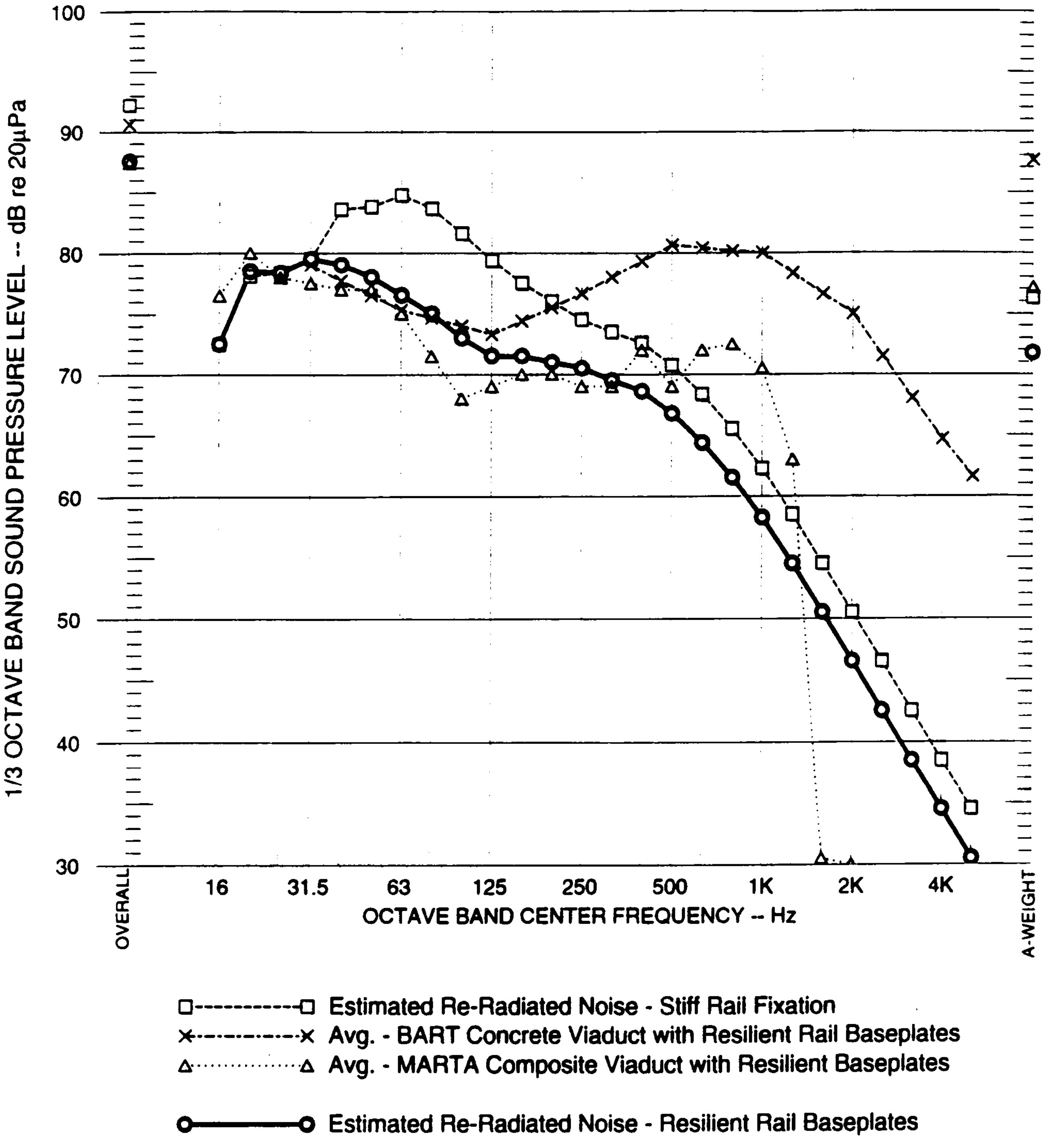
FIGURE
3

Contract/C1588/C1588_33

ERM

KOWLOON - CANTON RAILWAY CORPORATION

WEST RAIL: TS900 EIA STUDY



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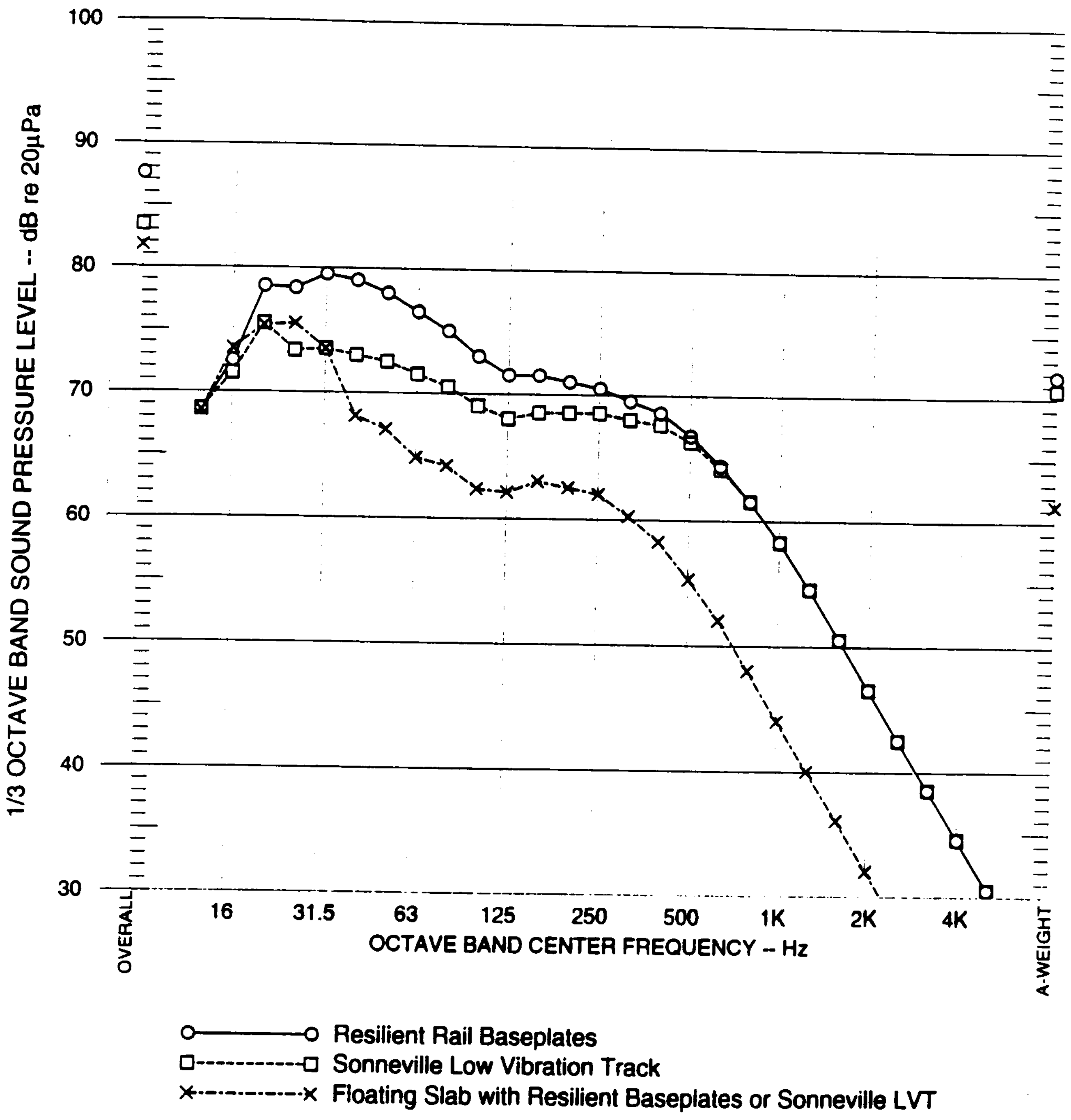
ESTIMATED NOISE LEVELS FROM MTRC TRAIN PASSBYS ON THE COVERED VIADUCT WHERE RESILIENT RAIL BASEPLATES ARE INSTALLED

FIGURE
4

Contract/C1588/C1588_34

ERM

KOWLOON - CANTON
RAILWAY CORPORATION
WEST RAIL: TS900 EIA STUDY



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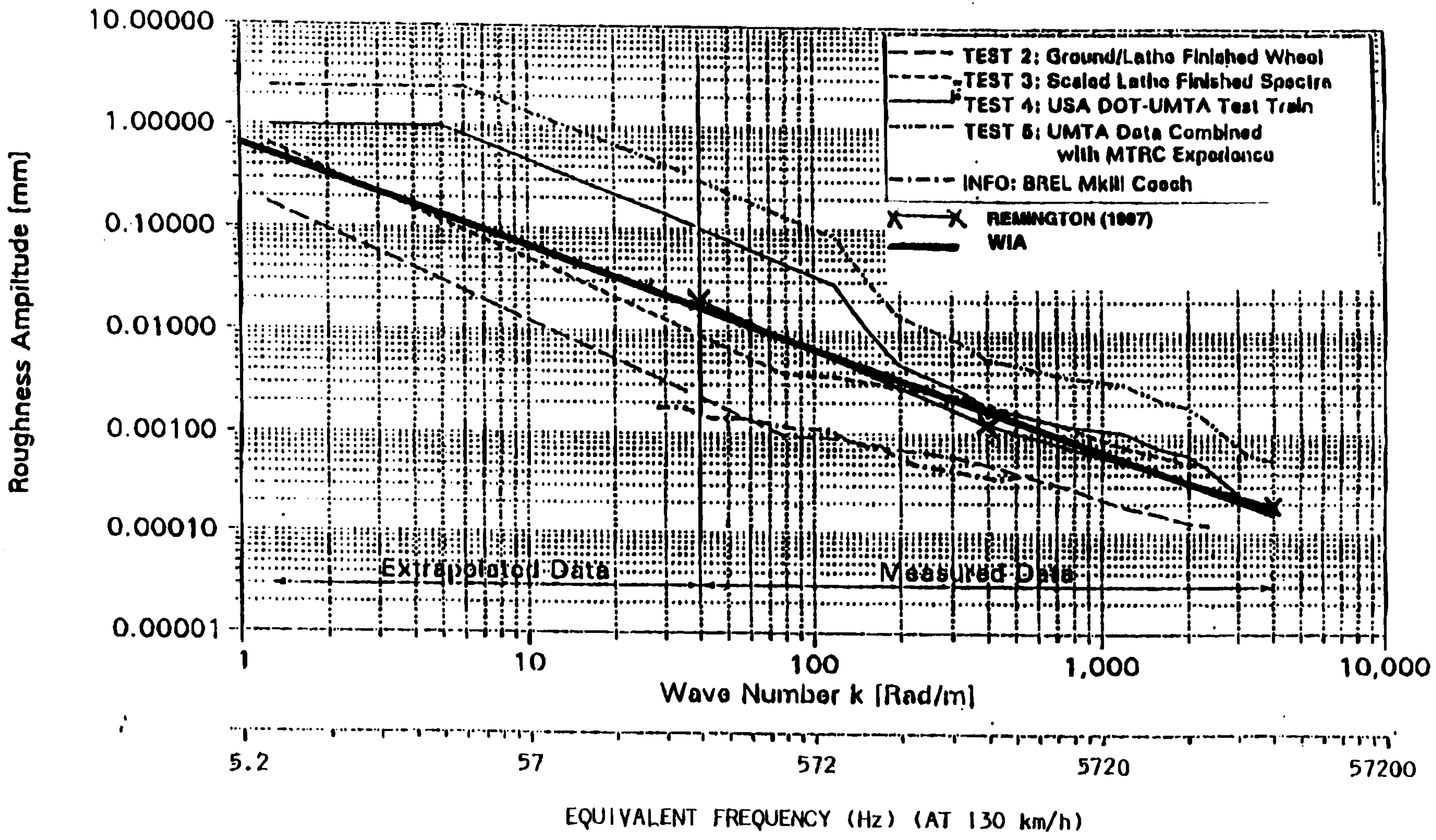
ESTIMATED NOISE LEVELS FROM KCRC WEST RAIL SYSTEM TRAIN PASSBYS ON THE COVERED CONCRETE AERIAL STRUCTURE - 12-CAR TRAINS AT 130 kmh AND 25m DISTANCE

FIGURE
5

Contract/C1588/C1588_35

ERM

KOWLOON - CANTON
RAILWAY CORPORATION
WEST RAIL: TS900 EIA STUDY



NOT TO SCALE

WHEEL ROUGHNESS SPECTRA

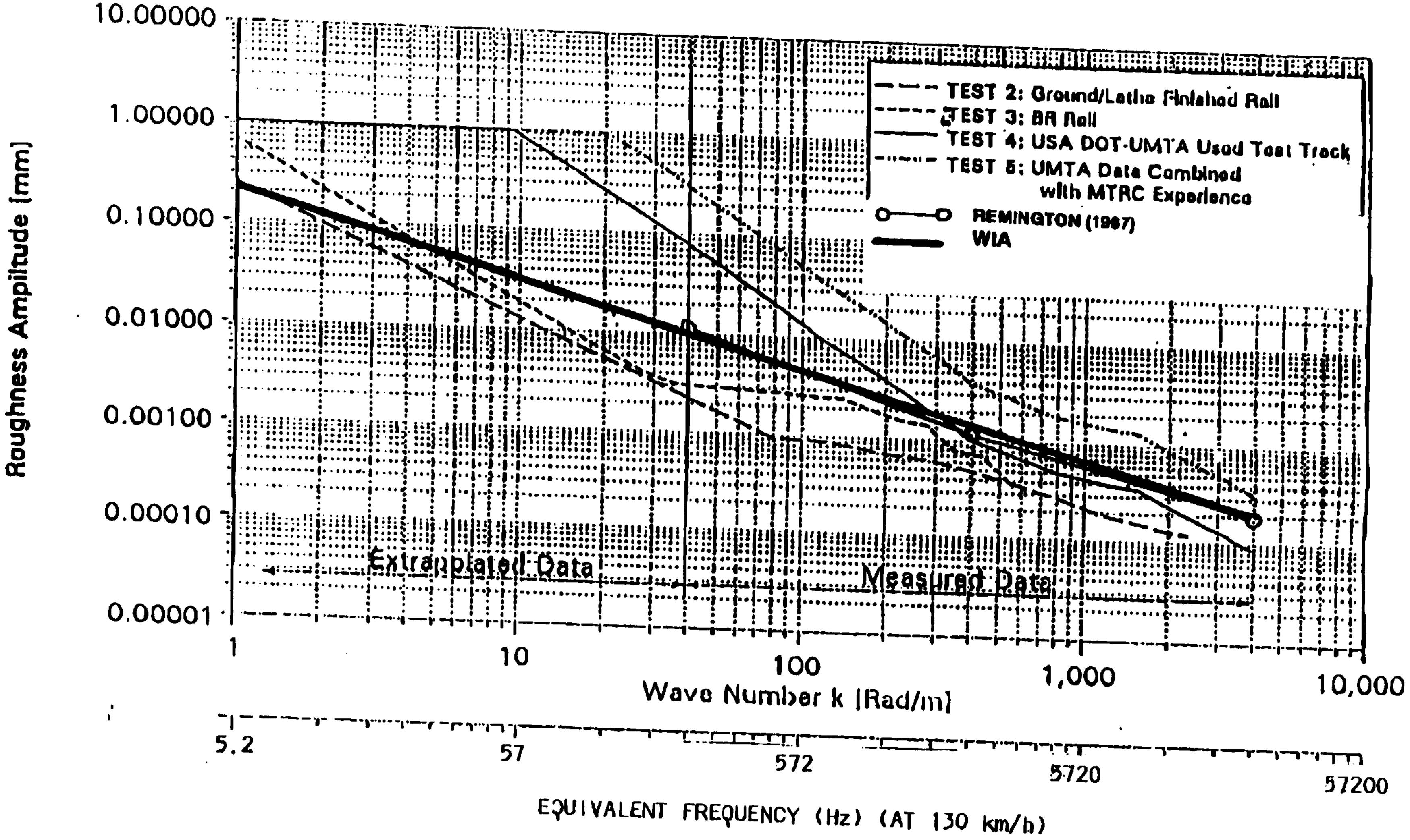
FIGURE 6

Contract/C1588/C1588_36

ERM

KOWLOON - CANTON RAILWAY CORPORATION

WEST RAIL: TS900 EIA STUDY



NOT TO SCALE

RAIL ROUGHNESS SPECTRA

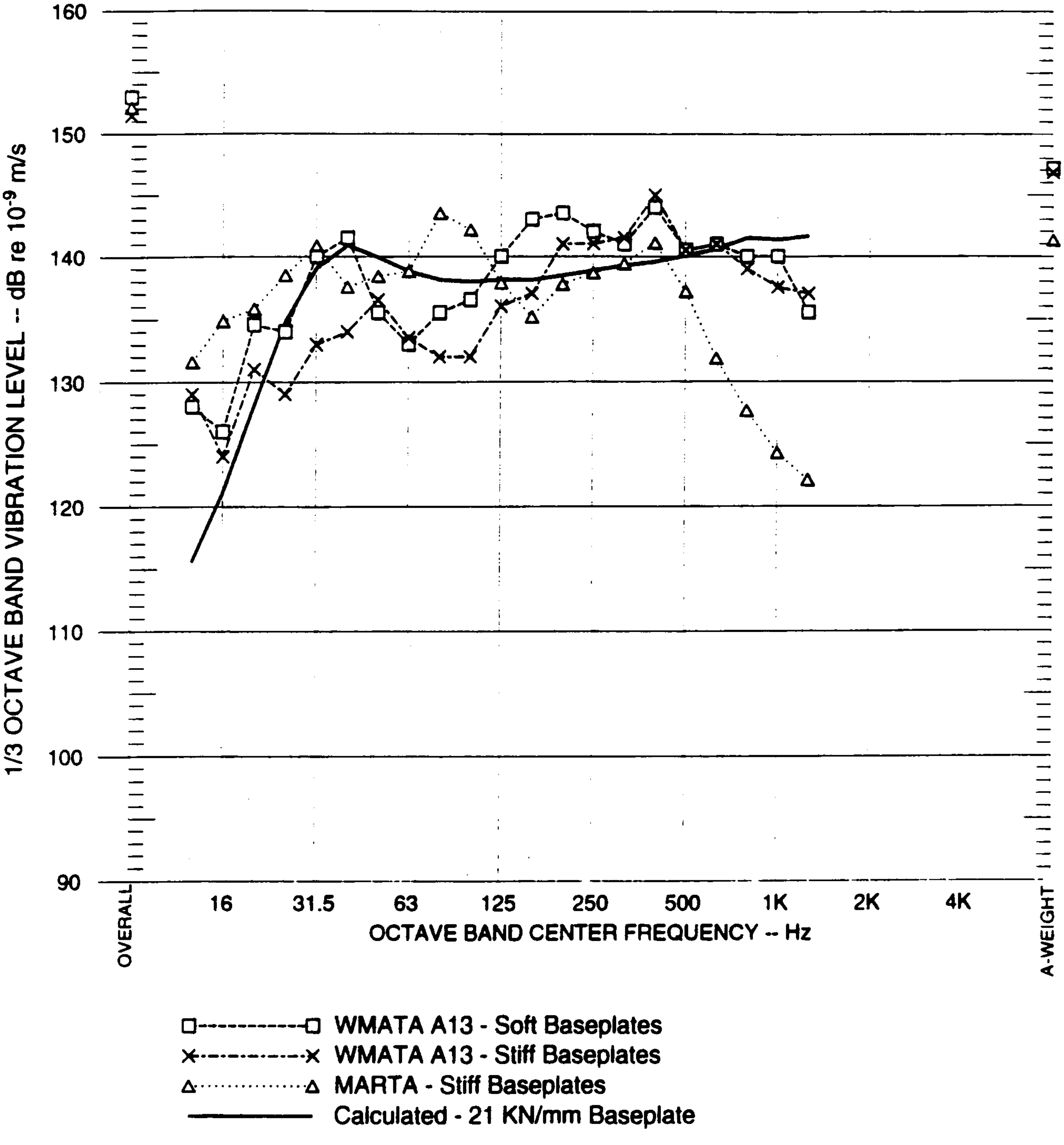
FIGURE
7

Contract/C1588/C1588_37

ERM

KOWLOON - CANTON
RAILWAY CORPORATION

WEST RAIL: TS900 EIA STUDY



NOT TO SCALE

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COMPARISON OF MEASURED AND CALCULATED RAIL VIBRATION

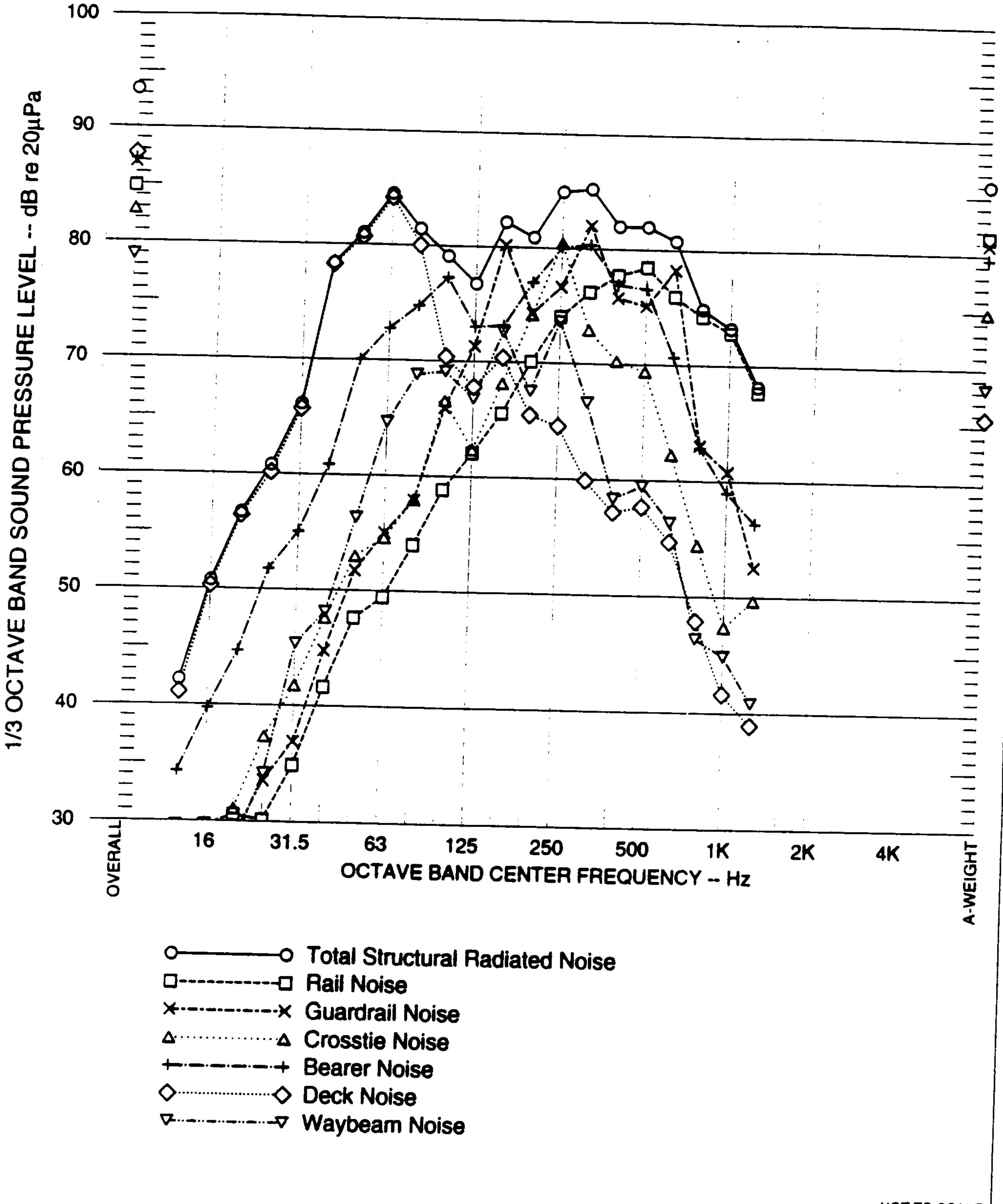
FIGURE 8

Contract/C1588/C1588_38

ERM

KOWLOON - CANTON RAILWAY CORPORATION

WEST RAIL: TS900 EIA STUDY



NOT TO SCALE

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CALCULATED NOISE RADIATION FROM TSING MA BRIDGE TRACKFORM DECK AND WAYBEAM VIBRATION FOR TEST TRAIN - 25m - 55kmh SPEED

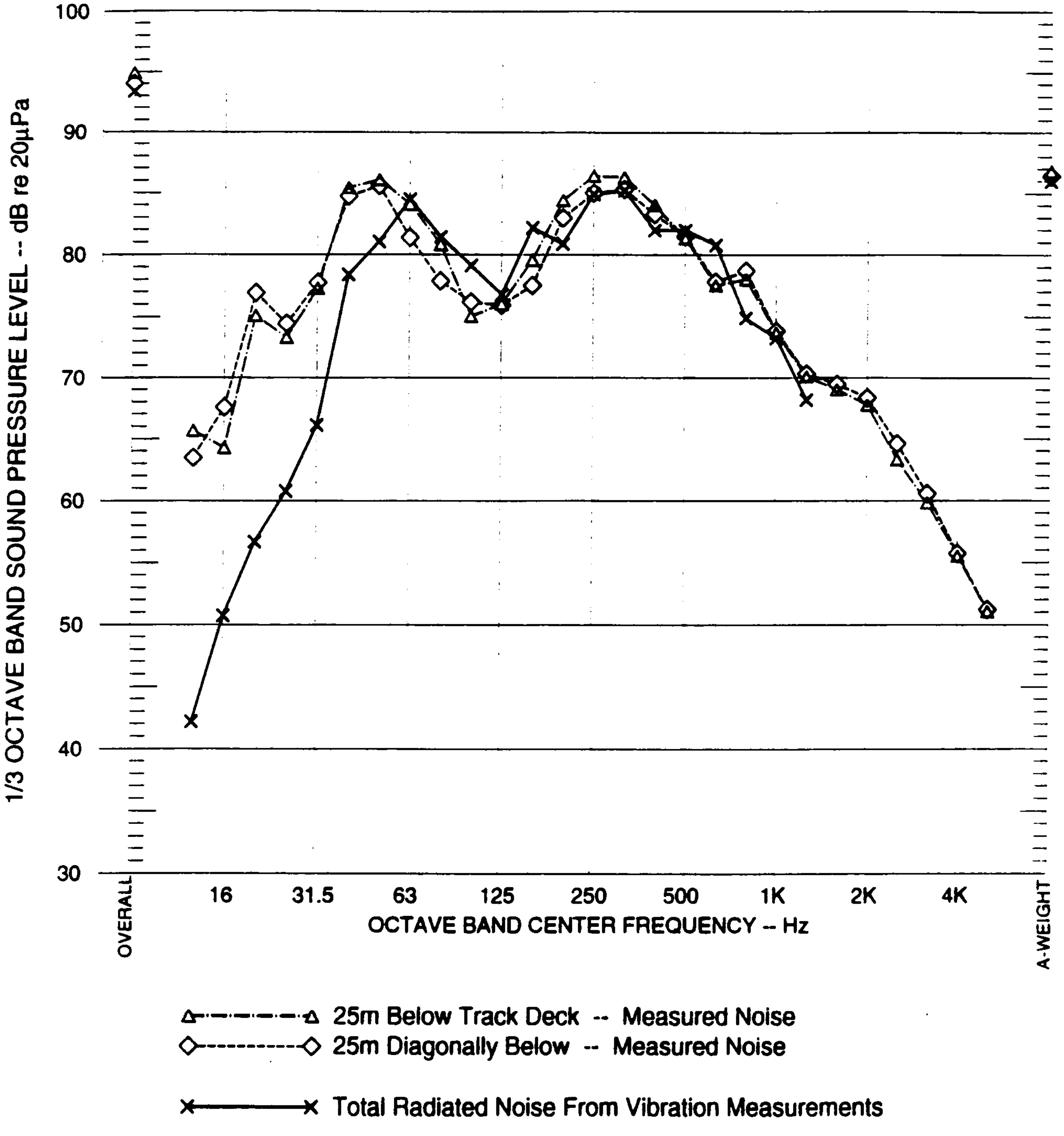
FIGURE
9

Contract/C1588/C1588_39

ERM

KOWLOON - CANTON RAILWAY CORPORATION

WEST RAIL: TS900 EIA STUDY



NOT TO SCALE

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MEASURED NOISE CALCULATED FROM MEASURED VIBRATION FOR TEST TRAIN ON TSING MA BRIDGE - 25m - 55 kmh SPEED

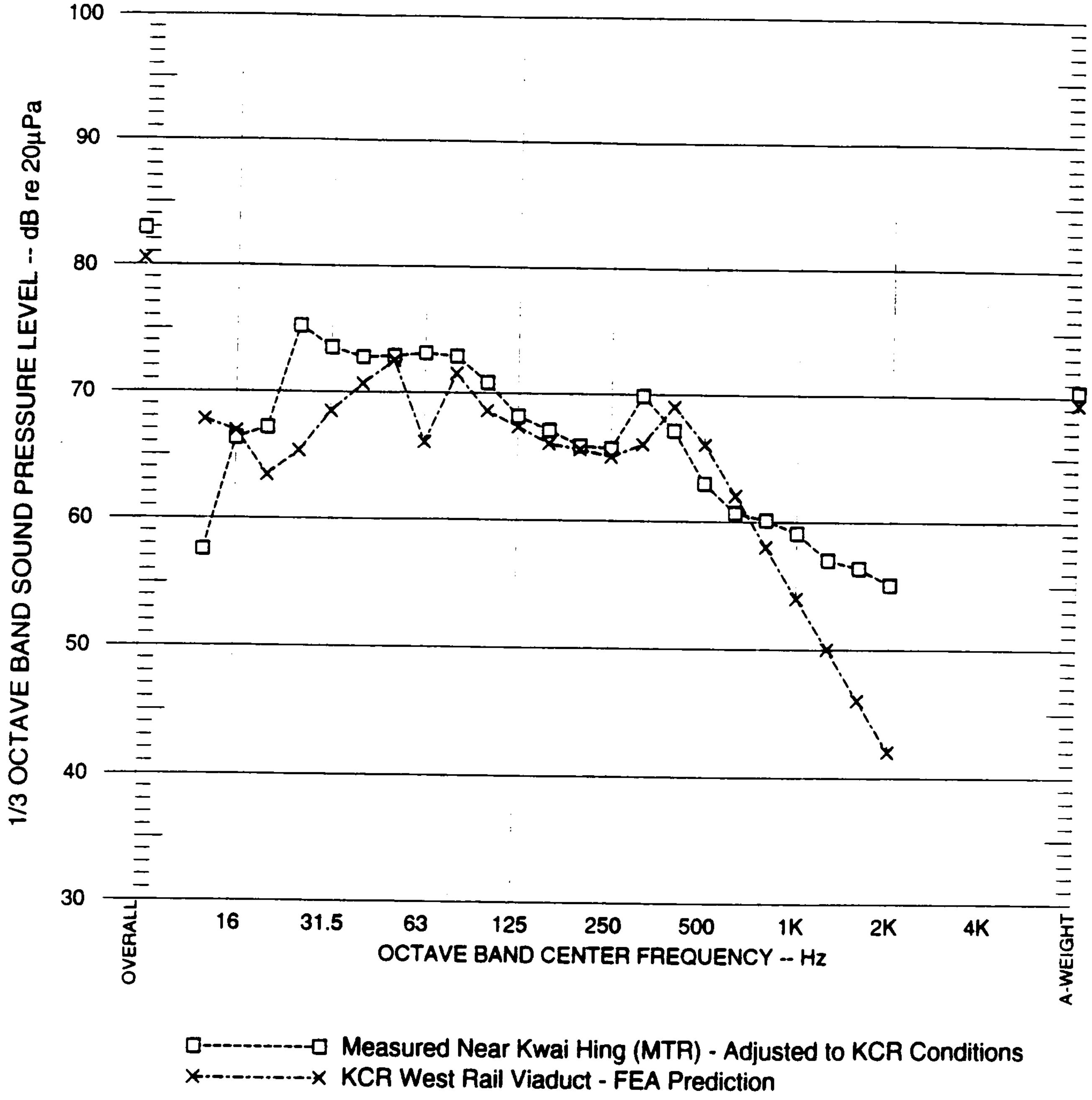
FIGURE
10

Contract/C1588/C1588_40

ERM

KOWLOON - CANTON
RAILWAY CORPORATION

WEST RAIL: TS900 EIA STUDY



NOT TO SCALE

STRUCTURE RADIATING NOISE FROM THE KCR VIADUCT WITH A 12Hz FLOATING SLAB AND STIFF (70kn/mm Dyn.) BASEPLATES - re: 12 CAR, 100kmh, 25m DISTANCE

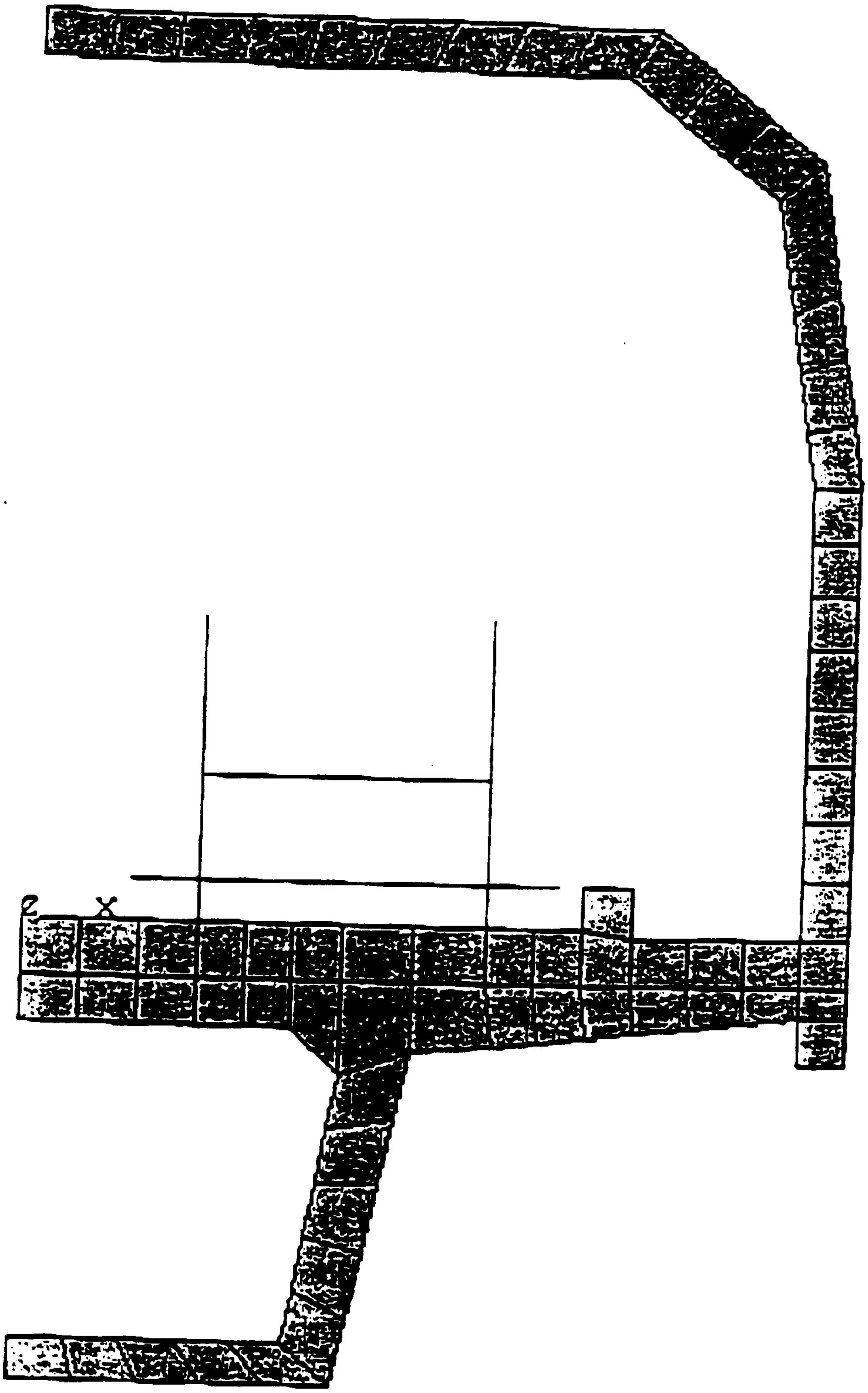
FIGURE 11

Contract/C1588/C1588_41

ERM

KOWLOON - CANTON RAILWAY CORPORATION

WEST RAIL: TS900 EIA STUDY



W I A

CROSS SECTION REPRESENTATION OF FEA MODEL OF VIADUCT WITH FULL CONCRETE ENCLOSURE

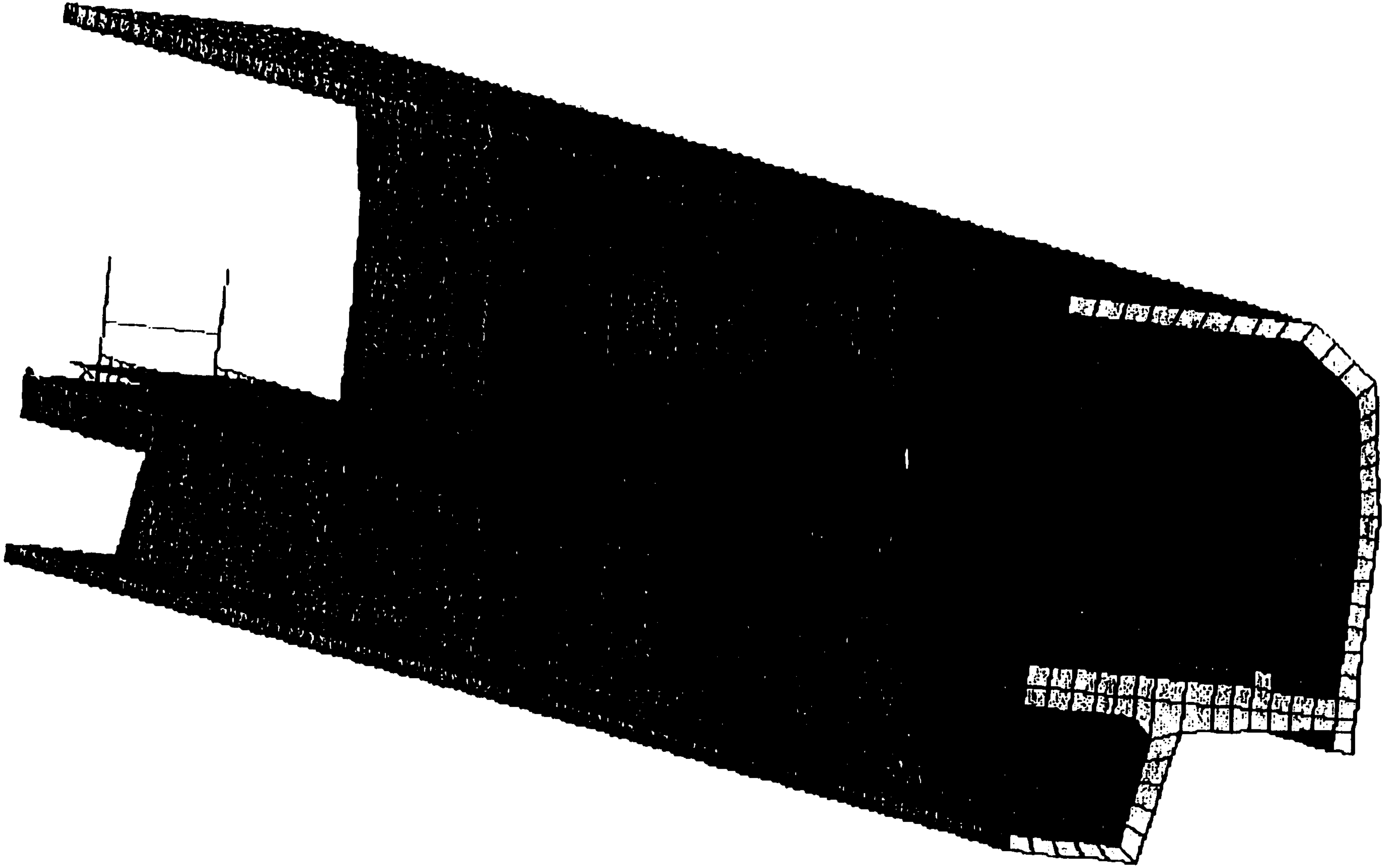
FIGURE 12

Contract/C1588/C1588_42

ERM

KOWLOON - CANTON RAILWAY CORPORATION

WEST RAIL: TS900 EIA STUDY



ISOMETRIC VIEW OF FEA MODEL OF VIADUCT WITH ENCLOSURE SHOWING MODEL GRID AT THE BOX BEAM AND SIDE WALL

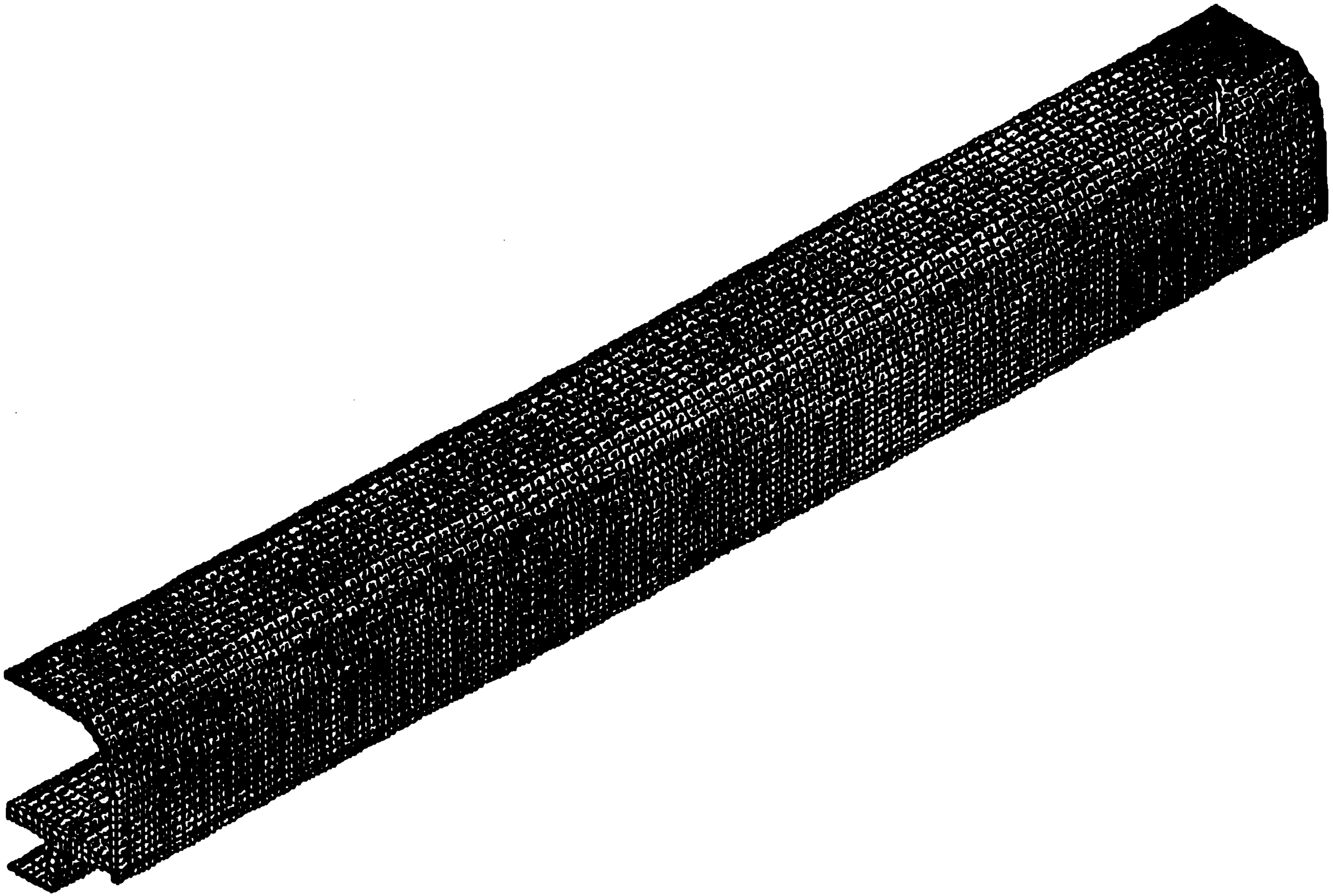
FIGURE 13

Contract/C1588/C1588_43

ERM

KOWLOON - CANTON RAILWAY CORPORATION

WEST RAIL: TS900 EIA STUDY



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ISOMETRIC VIEW OF FEA MODEL OF VIADUCT WITH FULL ENCLOSURE

FIGURE 14

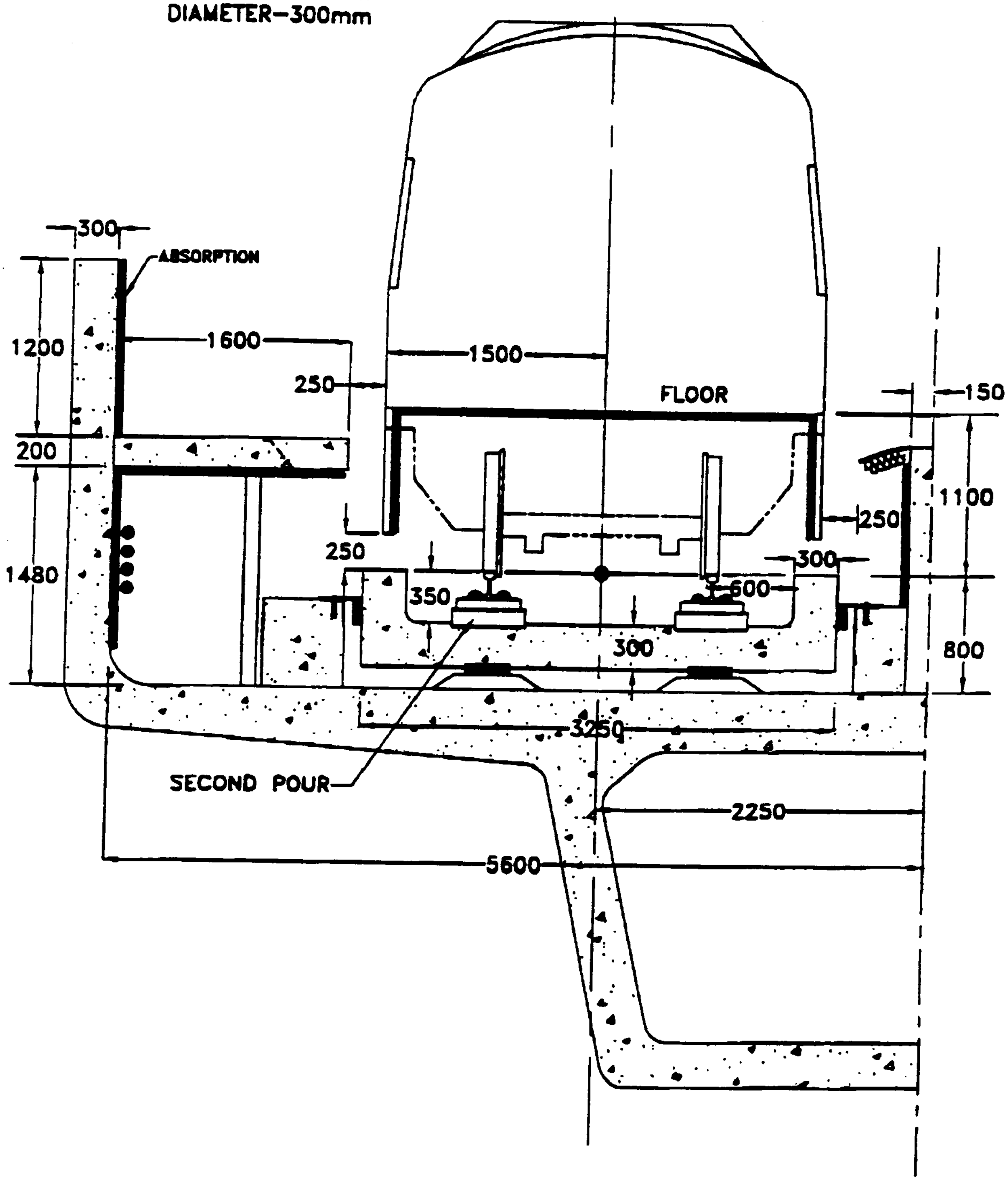
Contract/C1588/C1588_44

ERM

KOWLOON - CANTON RAILWAY CORPORATION

WEST RAIL: TS900 EIA STUDY

BEARING: THICKNESS-75mm
DIAMETER-300mm



CROSS SECTION OF KCRC WEST RAIL VIADUCT DESIGN WITH EDGE WALL AND DOUBLE PLENUM - TANGENT TRACK

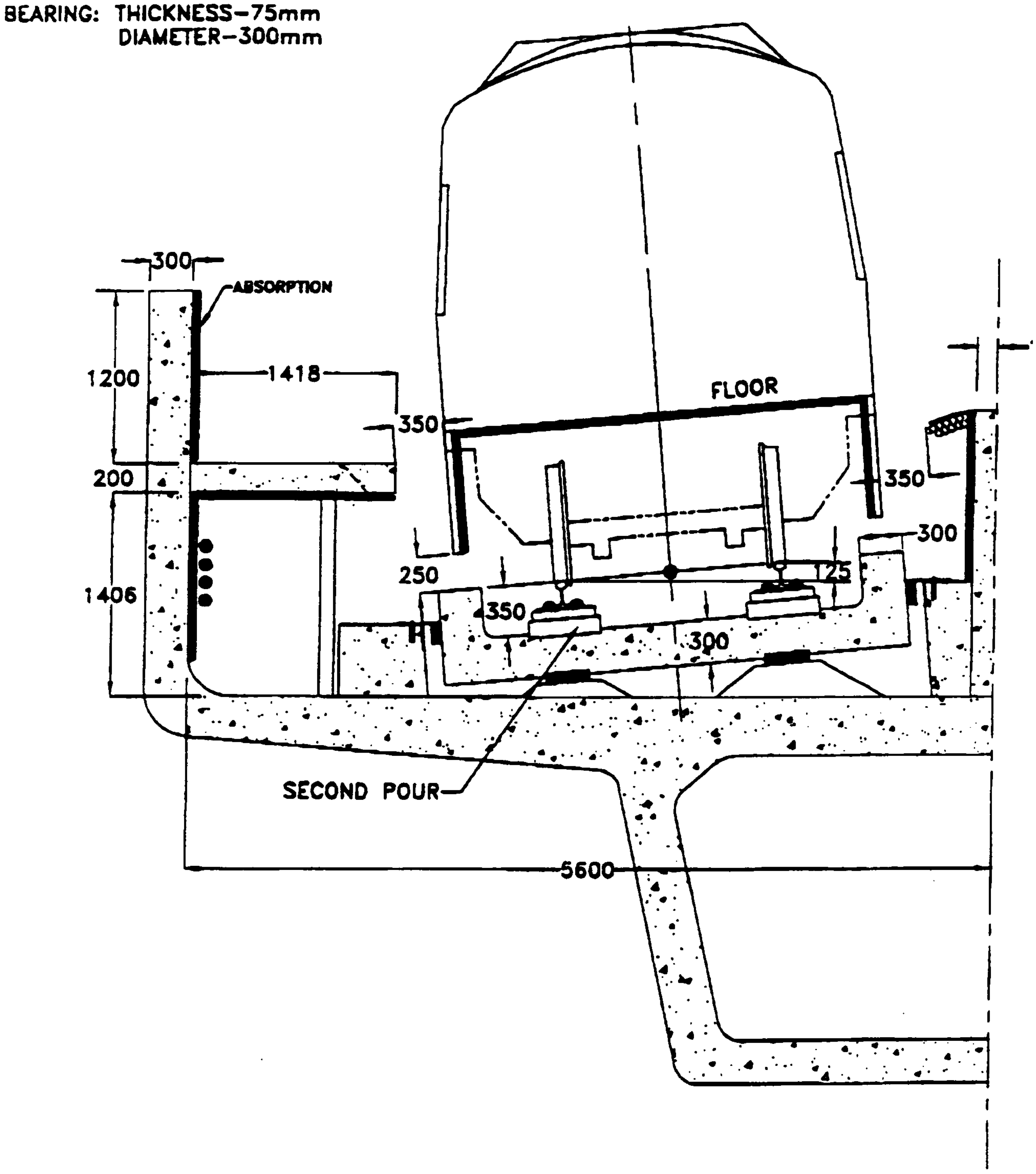
FIGURE 15

Contract/C1588/C1588_45

ERM

KOWLOON - CANTON RAILWAY CORPORATION

WEST RAIL: TS900 EIA STUDY



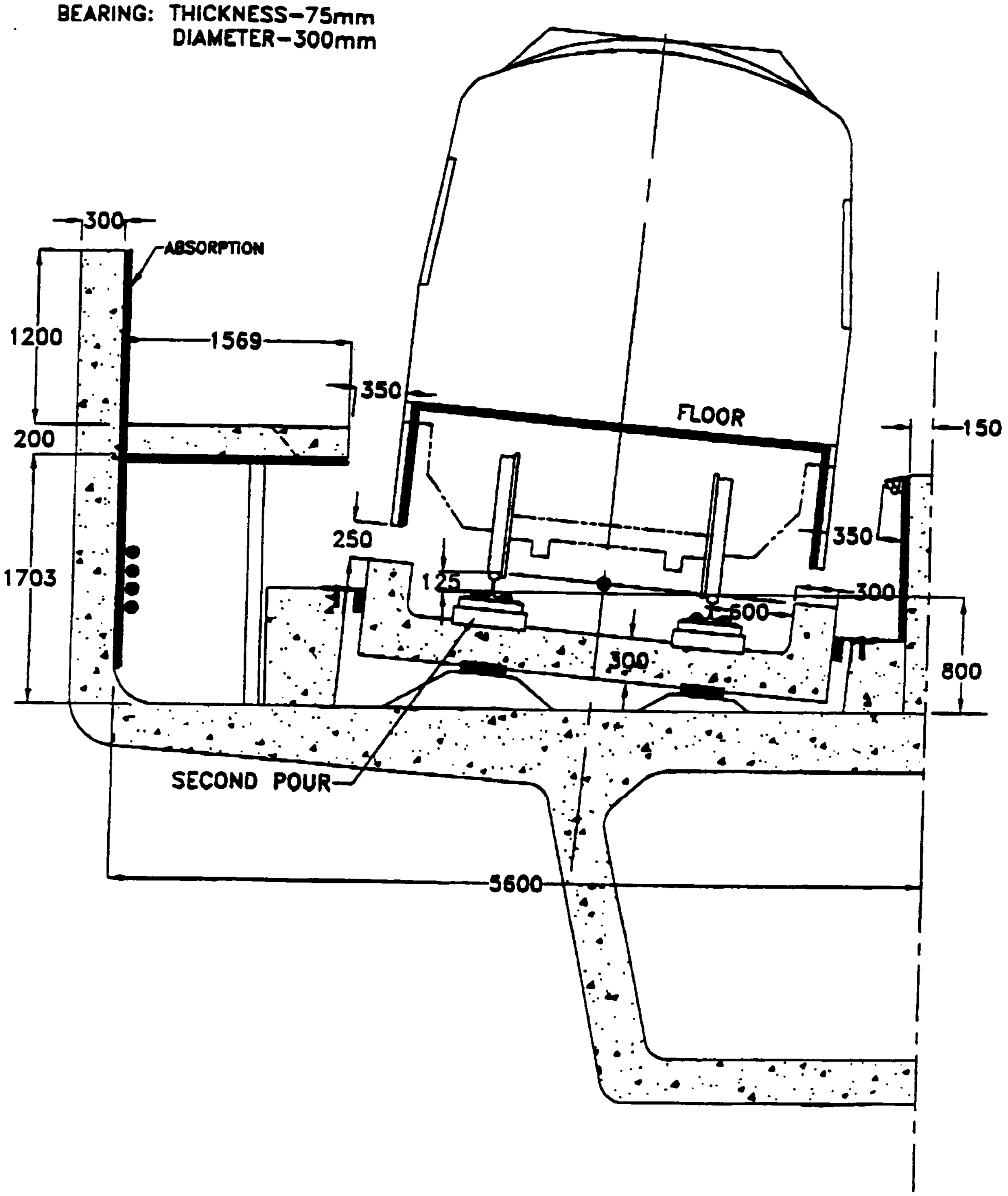
CROSS SECTION OF KCRC WEST RAIL
VIADUCT DESIGN -
SUPERLEVATED TRACK (125mm)

FIGURE
16

Contract/C1588/C1588_46

ERM

KOWLOON - CANTON
RAILWAY CORPORATION
WEST RAIL: TS900 EIA STUDY



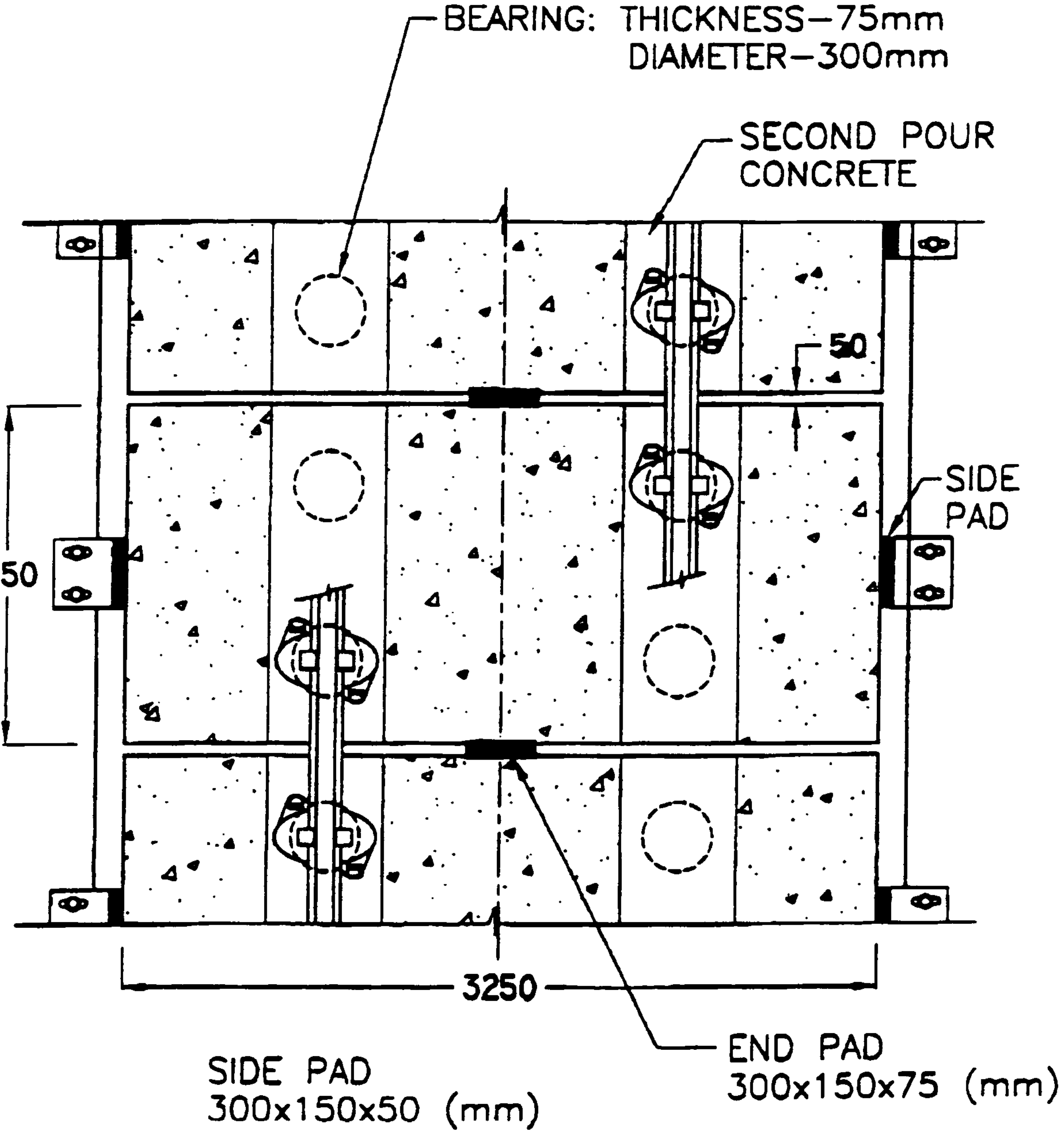
CROSS SECTION OF KCRC WEST RAIL VIADUCT DESIGN - SUPERLEVATED TRACK (125mm)

FIGURE 17

Contract/C1588/C1588_47

KOWLOON - CANTON RAILWAY CORPORATION

WEST RAIL: TS900 EIA STUDY



PLAN VIEW OF FLOATING SLAB MODULE WITH EGG TYPE BASEPLATES

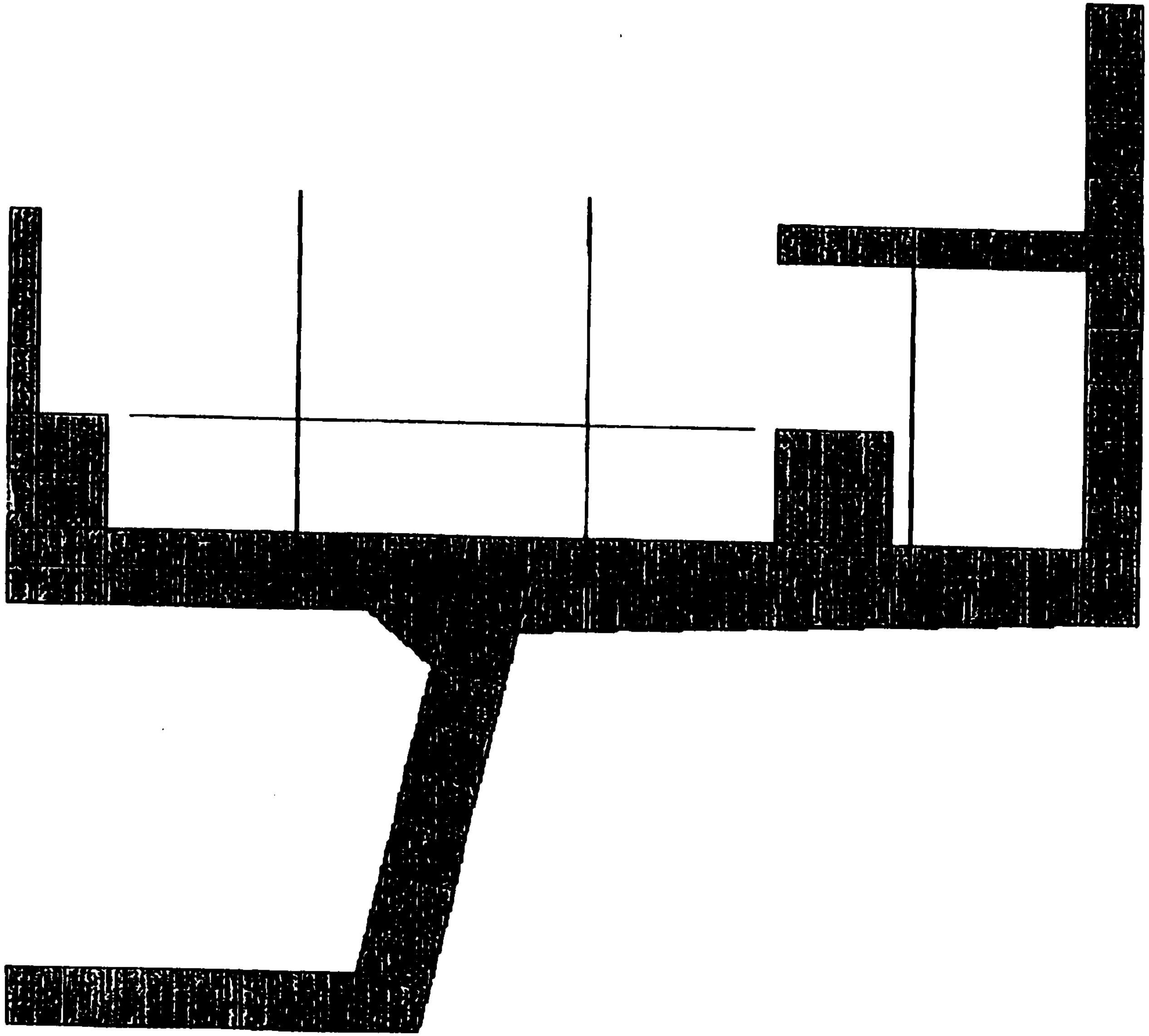
FIGURE
18

Contract/C1588/C1588_48

ERM

KOWLOON - CANTON RAILWAY CORPORATION

WEST RAIL: TS900 EIA STUDY



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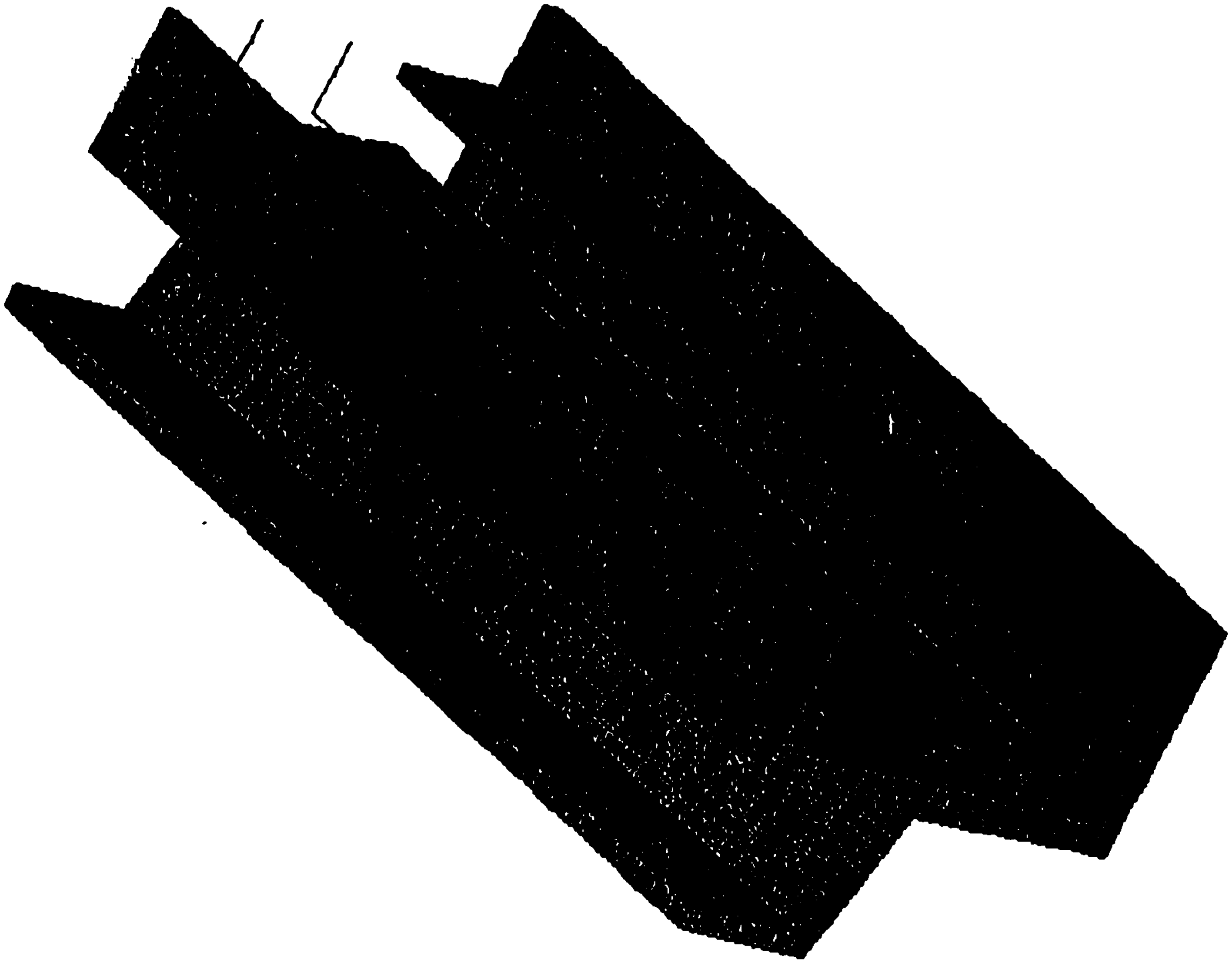
FINITE ELEMENT MODEL OF THE KCRC WEST RAIL VIADUCT CROSS SECTION

FIGURE
19

Contract/C1588/C1588_49

ERM

KOWLOON - CANTON
RAILWAY CORPORATION
WEST RAIL: TS900 EIA STUDY



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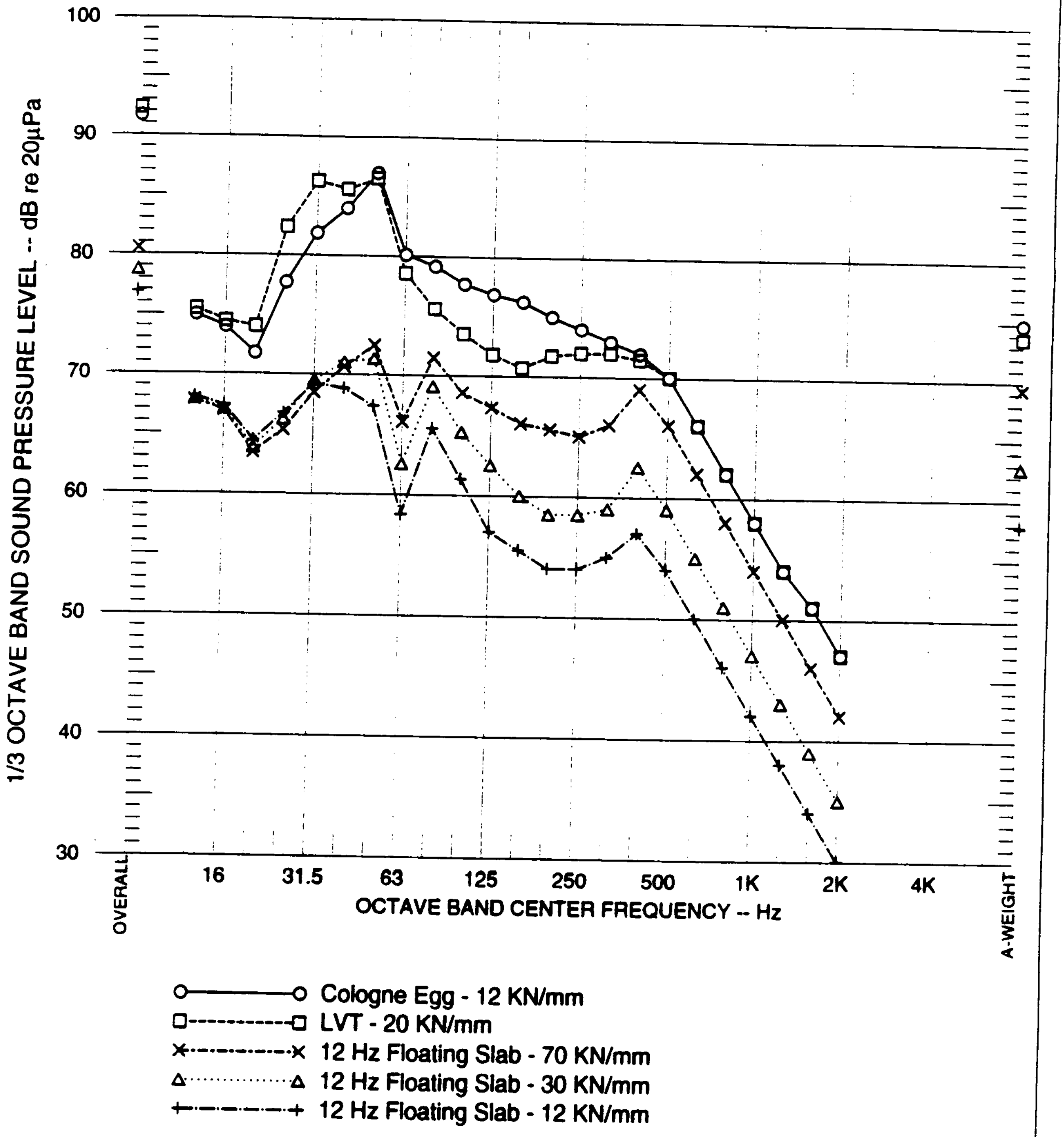
ISOMETRIC VIEW OF THE KCRC WEST RAIL VIADUCT
FINITE ELEMENT MODEL

FIGURE
20

Contract/C1588/C1588_50

ERM

KOWLOON - CANTON
RAILWAY CORPORATION
WEST RAIL: TS900 EIA STUDY



NOT TO SCALE

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ESTIMATED STRUCTURE RADIATED NOISE
FROM THE KCRC VIADUCT -
re: 12 CAR, 130 kmh, 25m DISTANCE

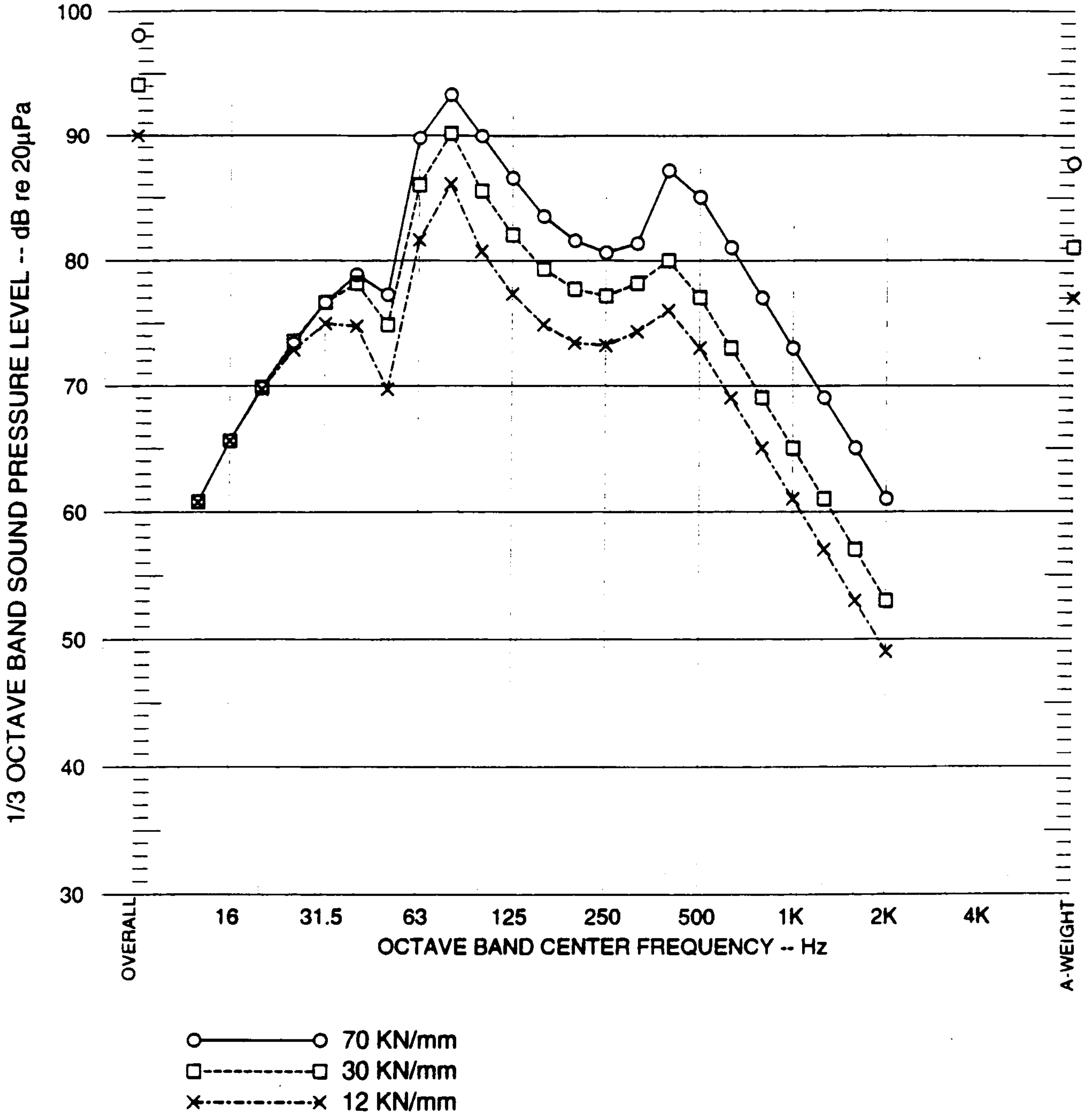
FIGURE
21

Contract/C1588/C1588_51

ERM

KOWLOON - CANTON
RAILWAY CORPORATION

WEST RAIL: TS900 EIA STUDY



NOT TO SCALE

W I A

ESTIMATED STRUCTURE RADIATED NOISE FROM THE KCRC VIADUCT - 12 Hz floating slab - re: 12 CAR, 130 kmh, 25m DISTANCE

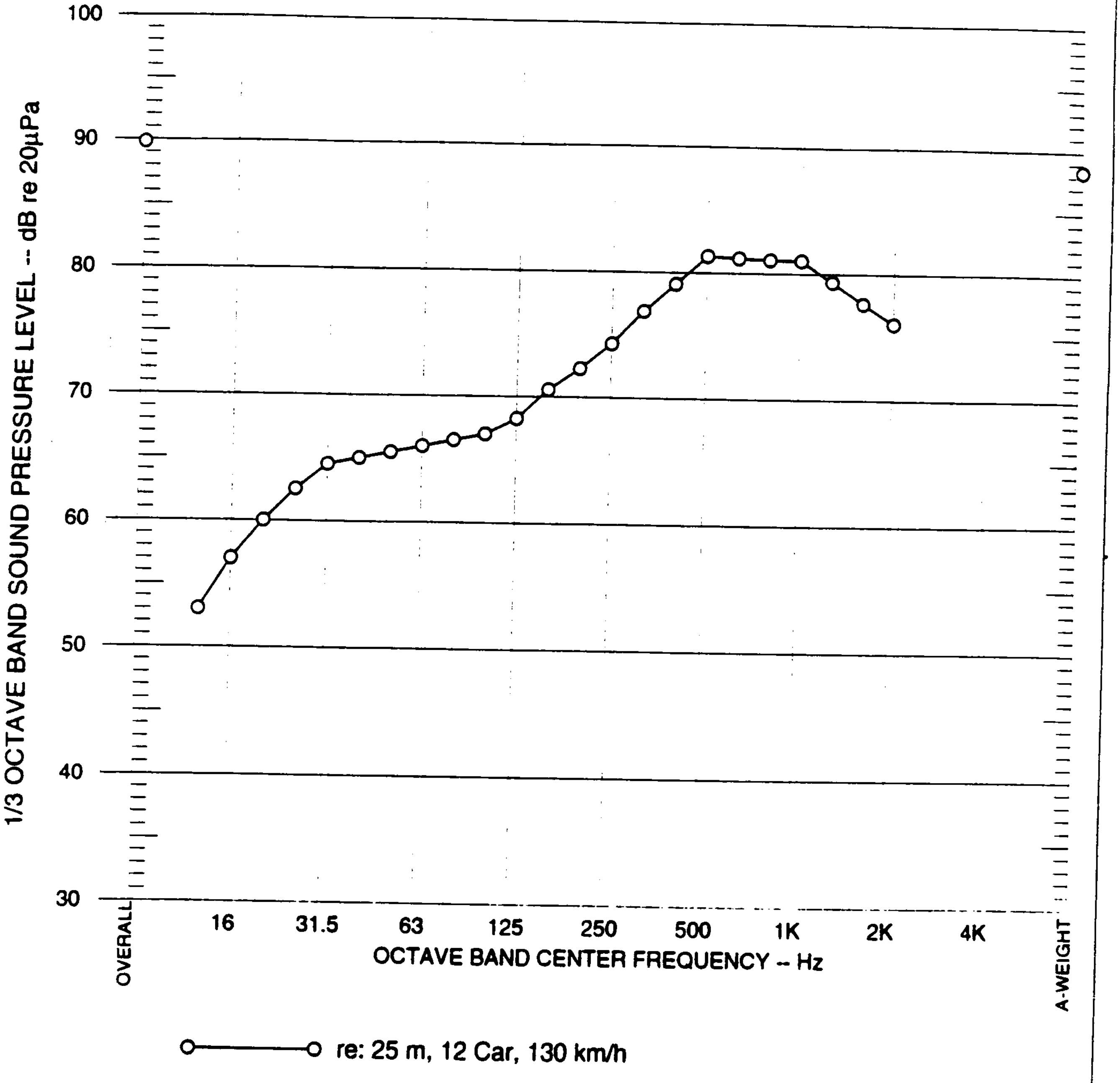
FIGURE 22

Contract/C1588/C1588_52

ERM

KOWLOON - CANTON RAILWAY CORPORATION

WEST RAIL: TS900 EIA STUDY



NOT TO SCALE

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REFERENCE TRAIN NOISE SPECTRUM WITH STRUCTURE RADIATED NOISE REMOVED

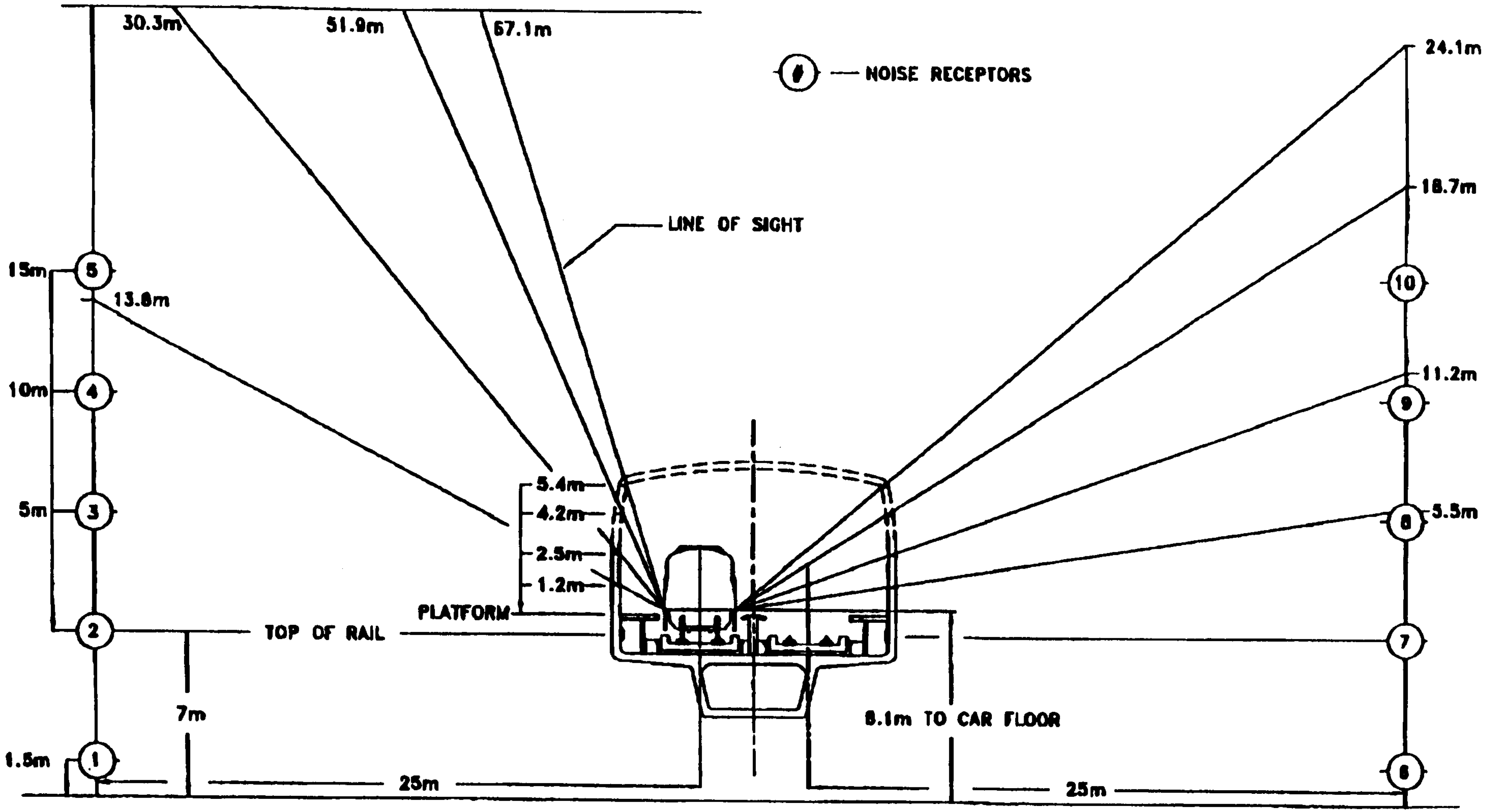
FIGURE 23

Contract/C1588/C1588_53

ERM

KOWLOON - CANTON RAILWAY CORPORATION

WEST RAIL: TS900 EIA STUDY



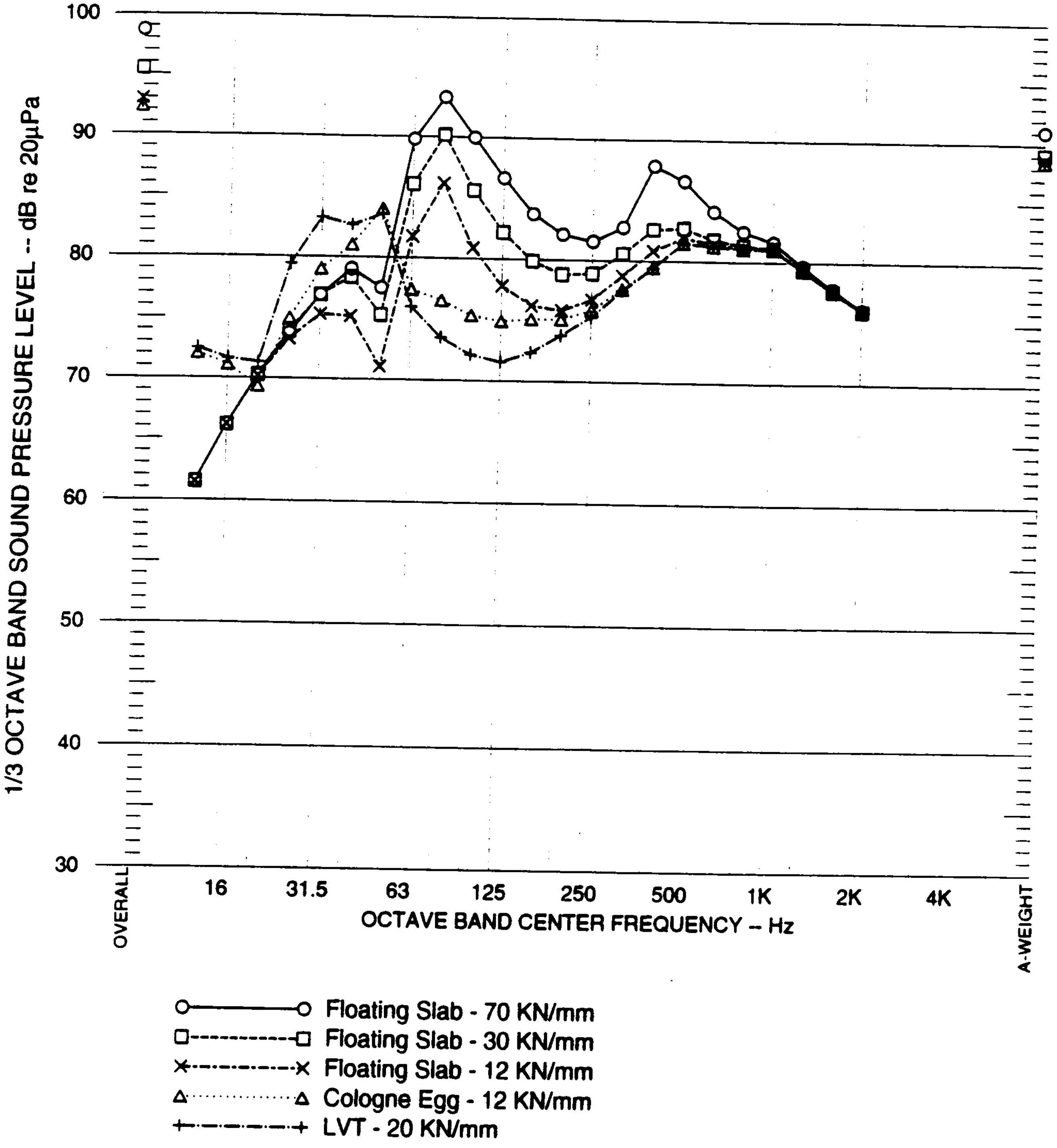
CROSS-SECTION OF KCRC WEST RAIL VIADUCT SHOWING NOISE RECEPTOR LOCATIONS, SOUND BARRIERS OF DIFFERENT HEIGHTS AND LINE-OF-SIGHT

FIGURE
24

Contract/C1588/C1588_54

ERM

KOWLOON - CANTON
RAILWAY CORPORATION
WEST RAIL: TS900 EIA STUDY



NOT TO SCALE

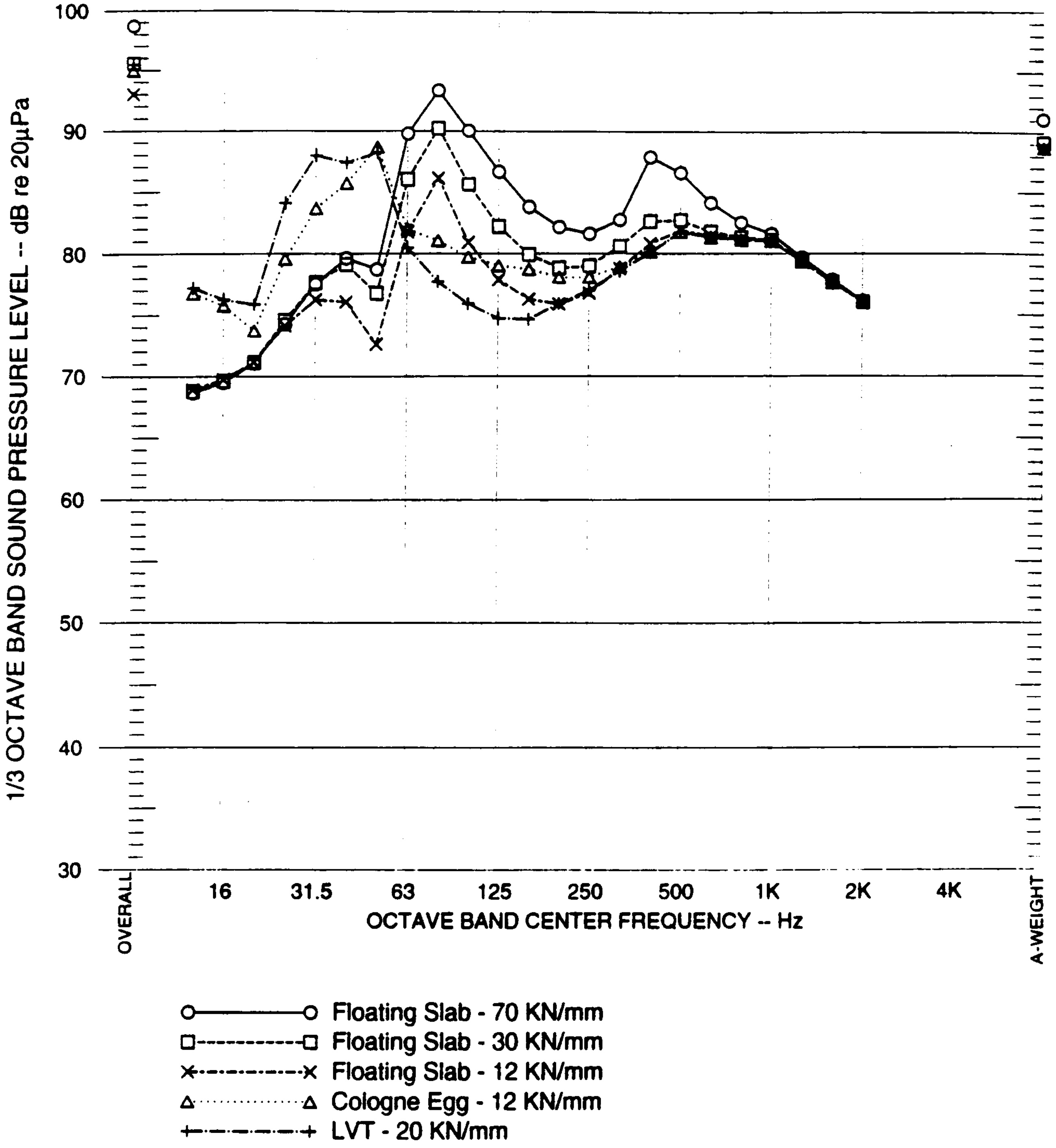
ESTIMATED NOISE FROM THE TRAIN AND FROM THE DECK (FLOATING SLAB) UNDER THE TRAIN - re: 12 CAR, 130 kmh, 25m DISTANCE WITH NO MITIGATION APPLIED

FIGURE 25

Contract/C1588/C1588_55

KOWLOON - CANTON RAILWAY CORPORATION

WEST RAIL: TS900 EIA STUDY



NOT TO SCALE

W I A

ESTIMATED TOTAL NOISE FROM THE TRAIN AND VIADUCT WITH NO MITIGATION OF THE DIRECT NOISE - re: 12 CAR, 130 kmh, 25m DISTANCE

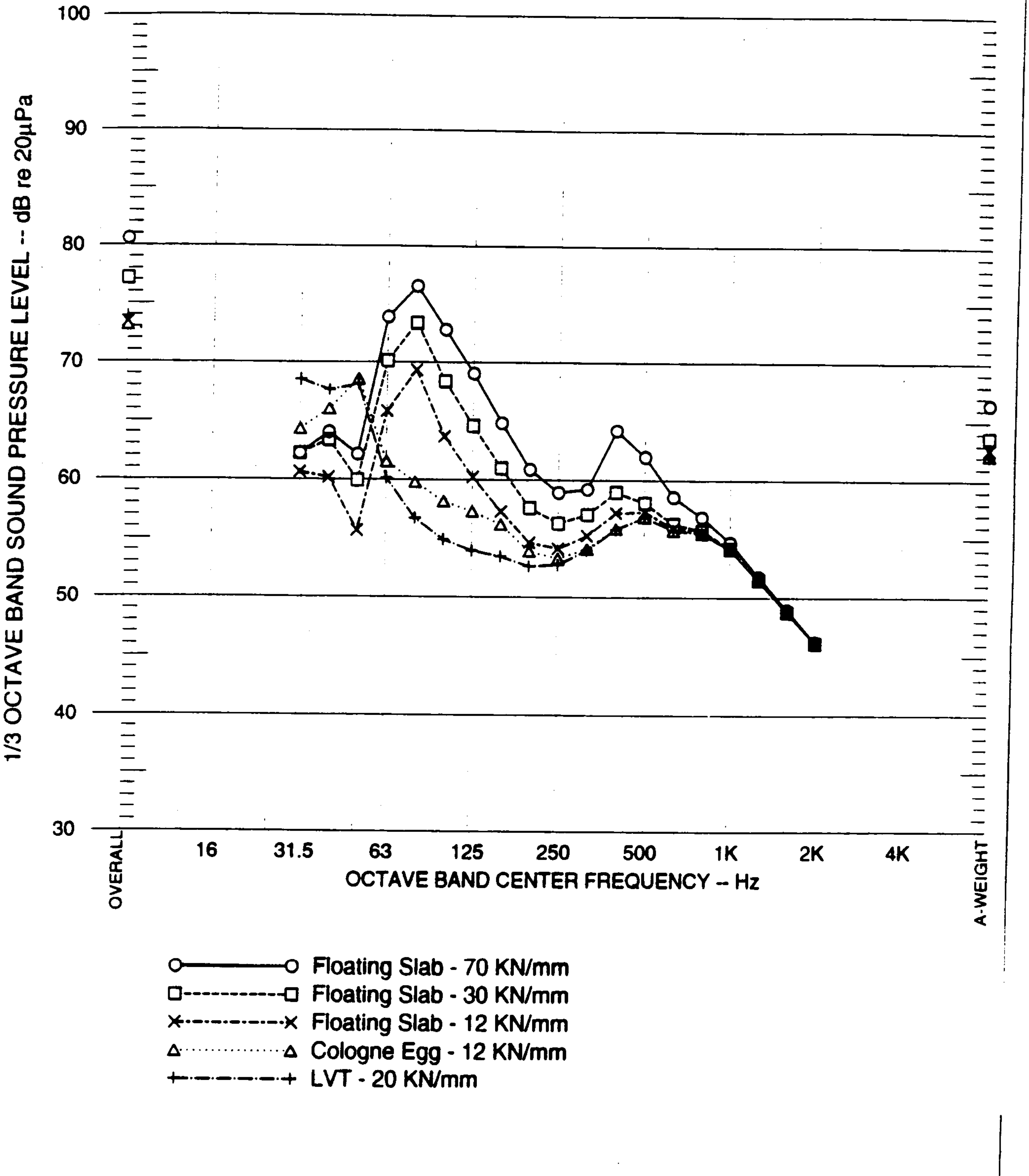
FIGURE 26

Contract/C1588/C1588_56

ERM

KOWLOON - CANTON RAILWAY CORPORATION

WEST RAIL: TS900 EIA STUDY



NOT TO SCALE

W I A

ESTIMATED TOTAL NOISE FROM THE TRAIN AND FROM THE DECK (FLOATING SLAB) UNDER THE TRAIN AT LOCATION 7 WITH MAXIMUM MITIGATION APPLIED (1.2m EDGE WALL AND DOUBLE PLENUM SYSTEM)

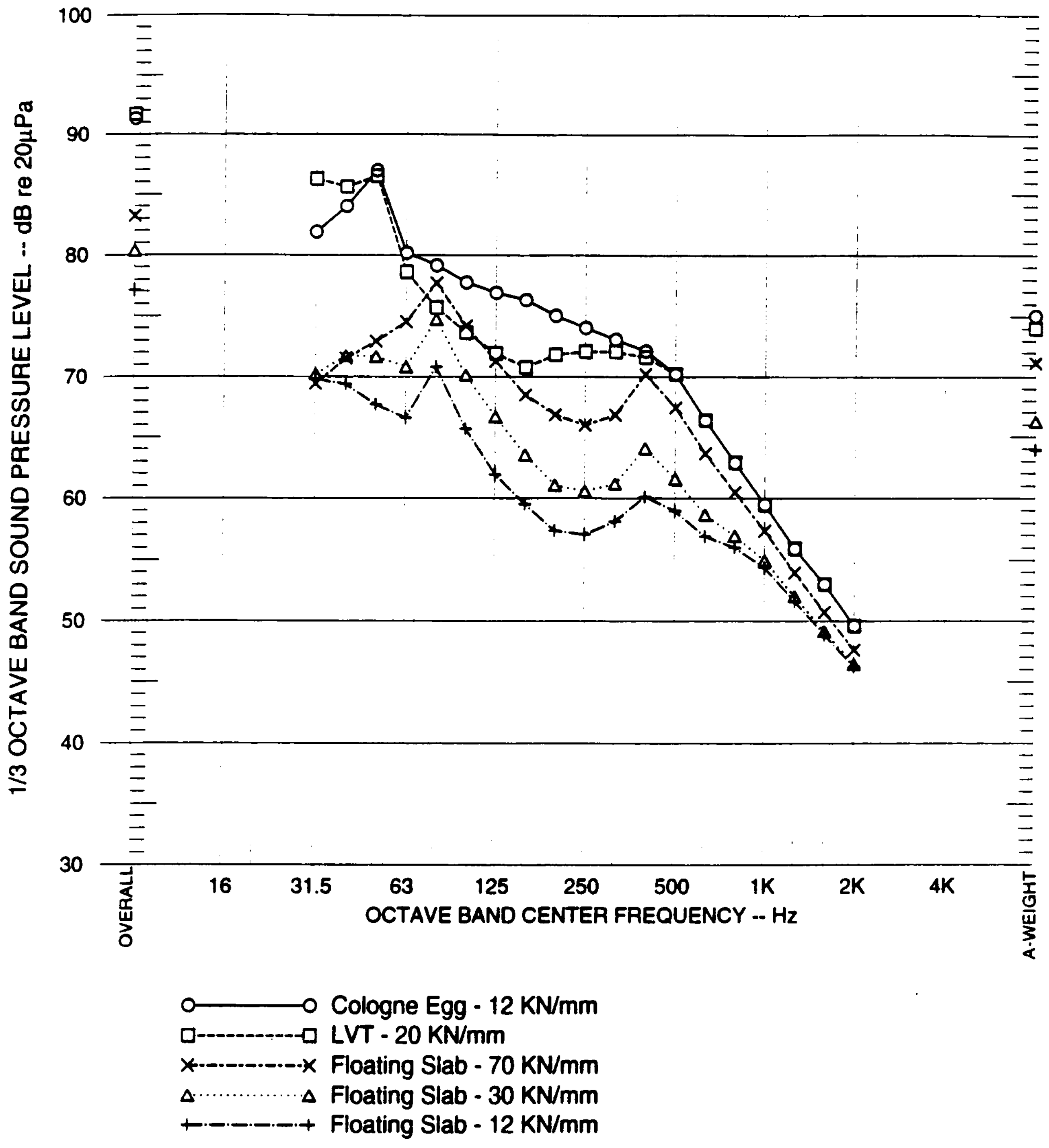
FIGURE 27

Contract/C1588/C1588_57

ERM

KOWLOON - CANTON RAILWAY CORPORATION

WEST RAIL: TS900 EIA STUDY



NOT TO SCALE

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ESTIMATED TOTAL NOISE FROM THE TRAIN VAIDUCT AT LOCATION 7 WITH MAXIMUM MITIGATION OF THE DIRECT NOISE (1.2m EDGE WALL AND DOUBLE PLENUM SYSTEM)

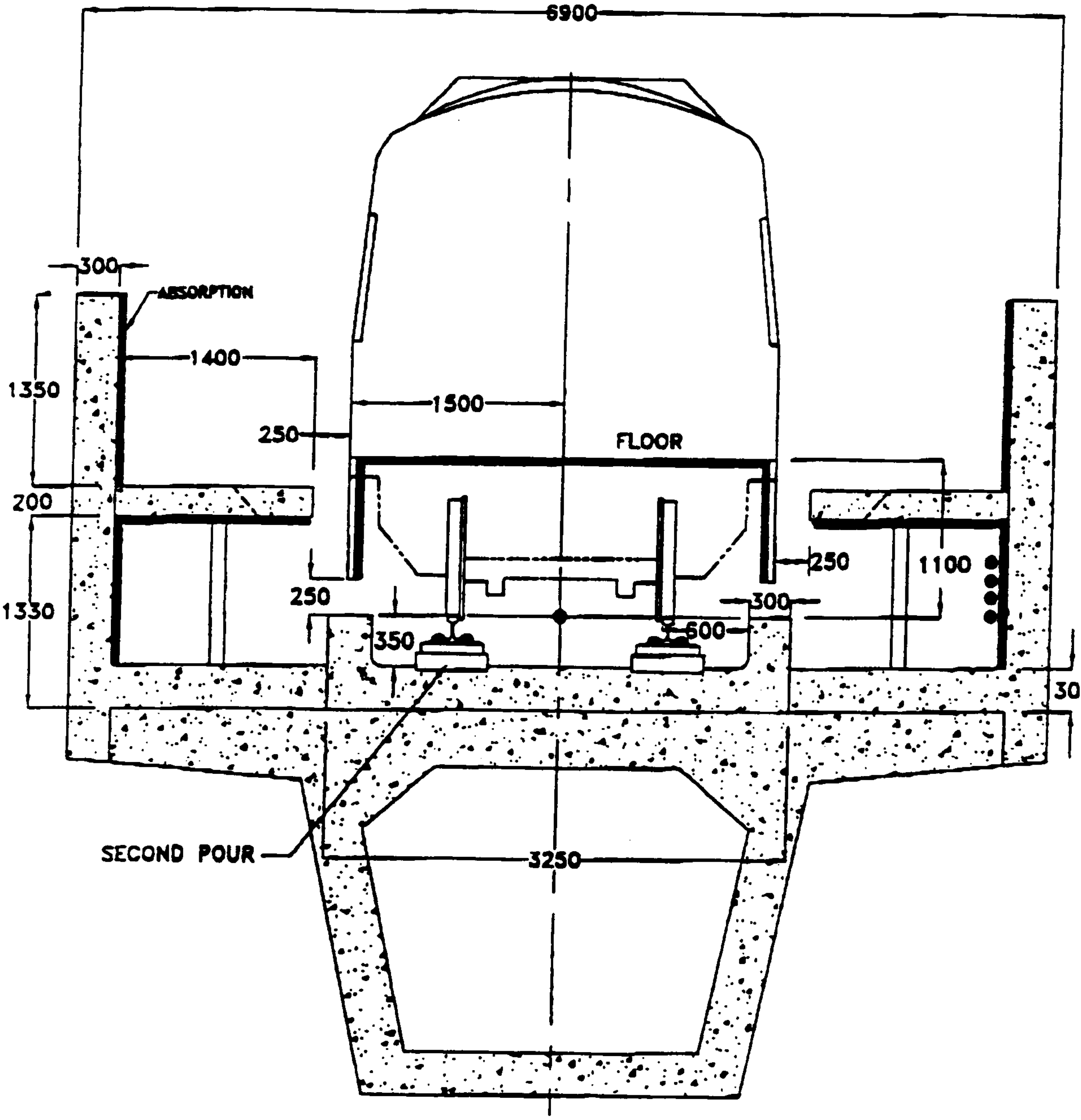
FIGURE 28

Contract/C1588/C1588_58

ERM

KOWLOON - CANTON RAILWAY CORPORATION

WEST RAIL: TS900 EIA STUDY



CROSS-SECTION OF THE KCRC WEST RAIL SINGLE TRACK VIADUCT DESIGN - WITH DIRECT FIXATION RAIL FASTENERS

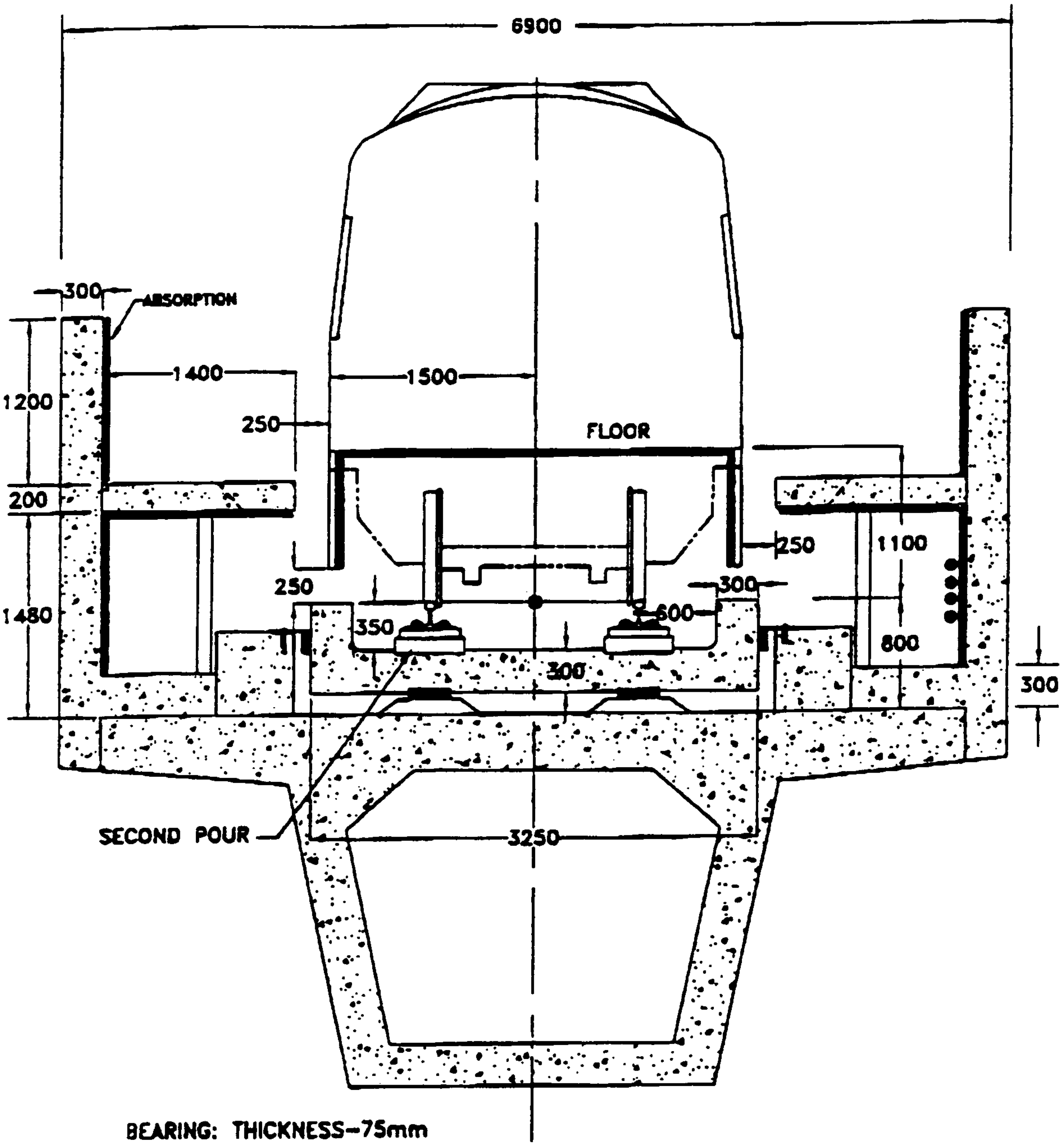
FIGURE 29

Contract/C1588/C1588_59

ERM

KOWLOON - CANTON RAILWAY CORPORATION

WEST RAIL: TS900 EIA STUDY



BEARING: THICKNESS–75mm
DIAMETER–300mm

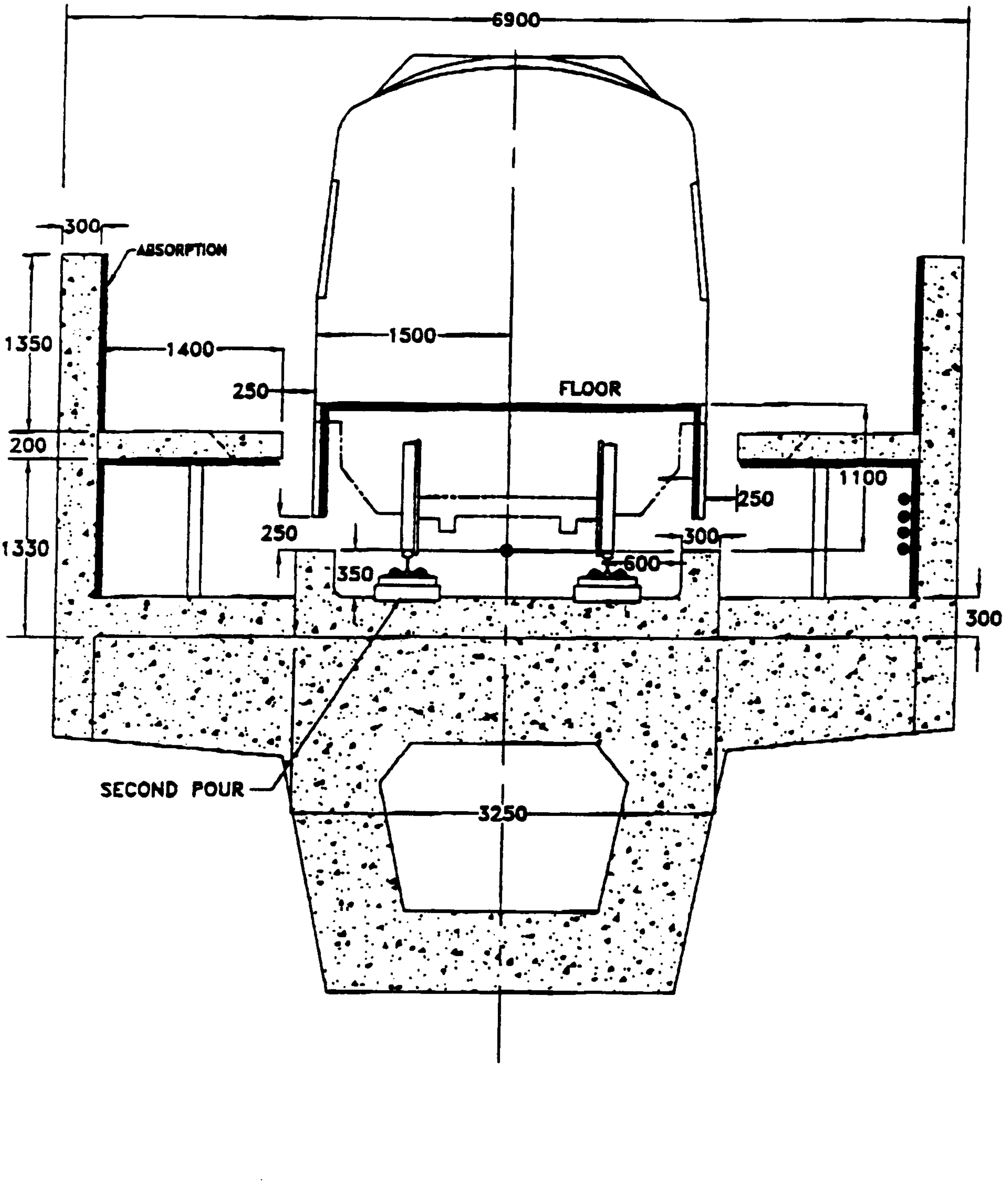
CROSS-SECTION OF THE KCRC WEST RAIL SINGLE TRACK VIADUCT DESIGN - WITH FLOATING SLAB

FIGURE 30

Contract/C1586/C1586_60

KOWLOON - CANTON RAILWAY CORPORATION

WEST RAIL: TS900 EIA STUDY



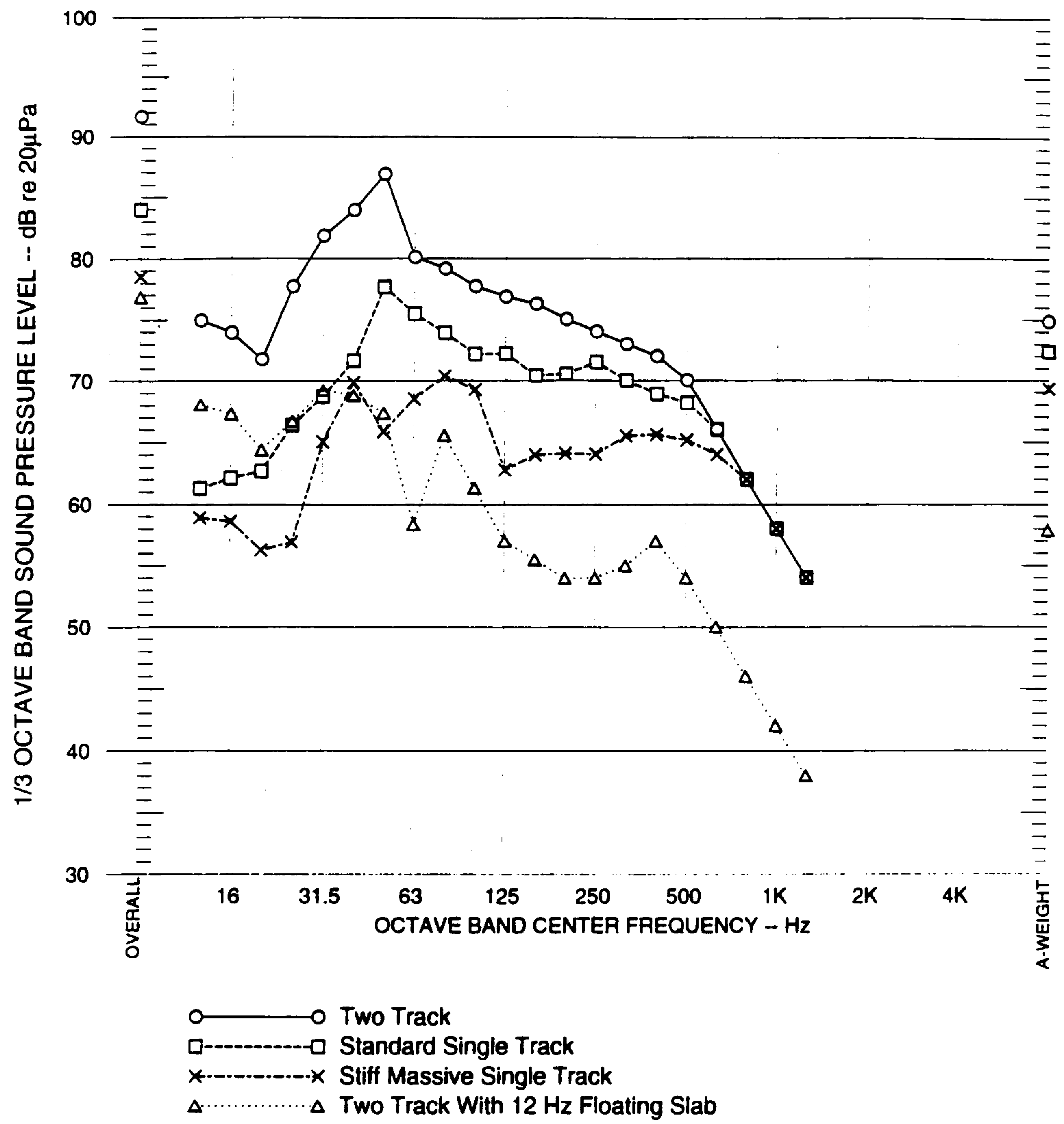
CROSS-SECTION OF THE KCRC WEST RAIL
SINGLE TRACK VIADUCT DESIGN -
WITH MASSIVE SUPPORT CELL AND DECK

FIGURE
31

Contract/C1588/C1588_61

ERM

KOWLOON - CANTON
RAILWAY CORPORATION
WEST RAIL: TS900 EIA STUDY



NOT TO SCALE

W I A

ESTIMATED STRUCTURE RADIATED NOISE FOR DIFFERENT VIADUCT DESIGNS - re: 12 CAR 130 kmh, 25m DISTANCE (BASEPLATES STIFFNESS: 12 Kn/mm)

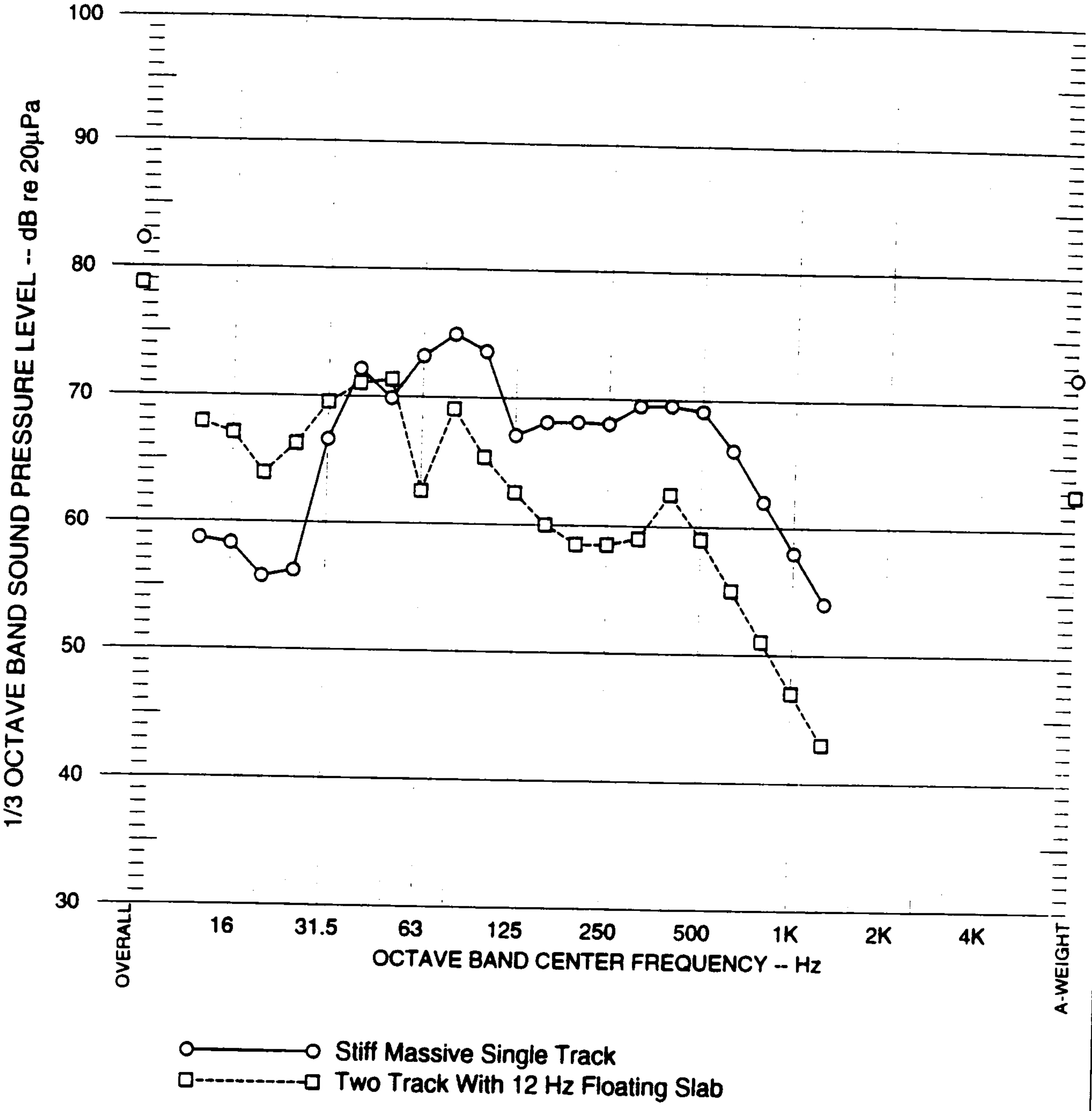
FIGURE 32

Contract/C1588/C1588_62

ERM

KOWLOON - CANTON RAILWAY CORPORATION

WEST RAIL: TS900 EIA STUDY



NOT TO SCALE

ESTIMATED STRUCTURE RADIATED NOISE FOR DIFFERENT VIADUCT DESIGNS - re: 12 CAR 130 kmh, 25m DISTANCE (BASEPLATES STIFFNESS: 30 Kn/mm)

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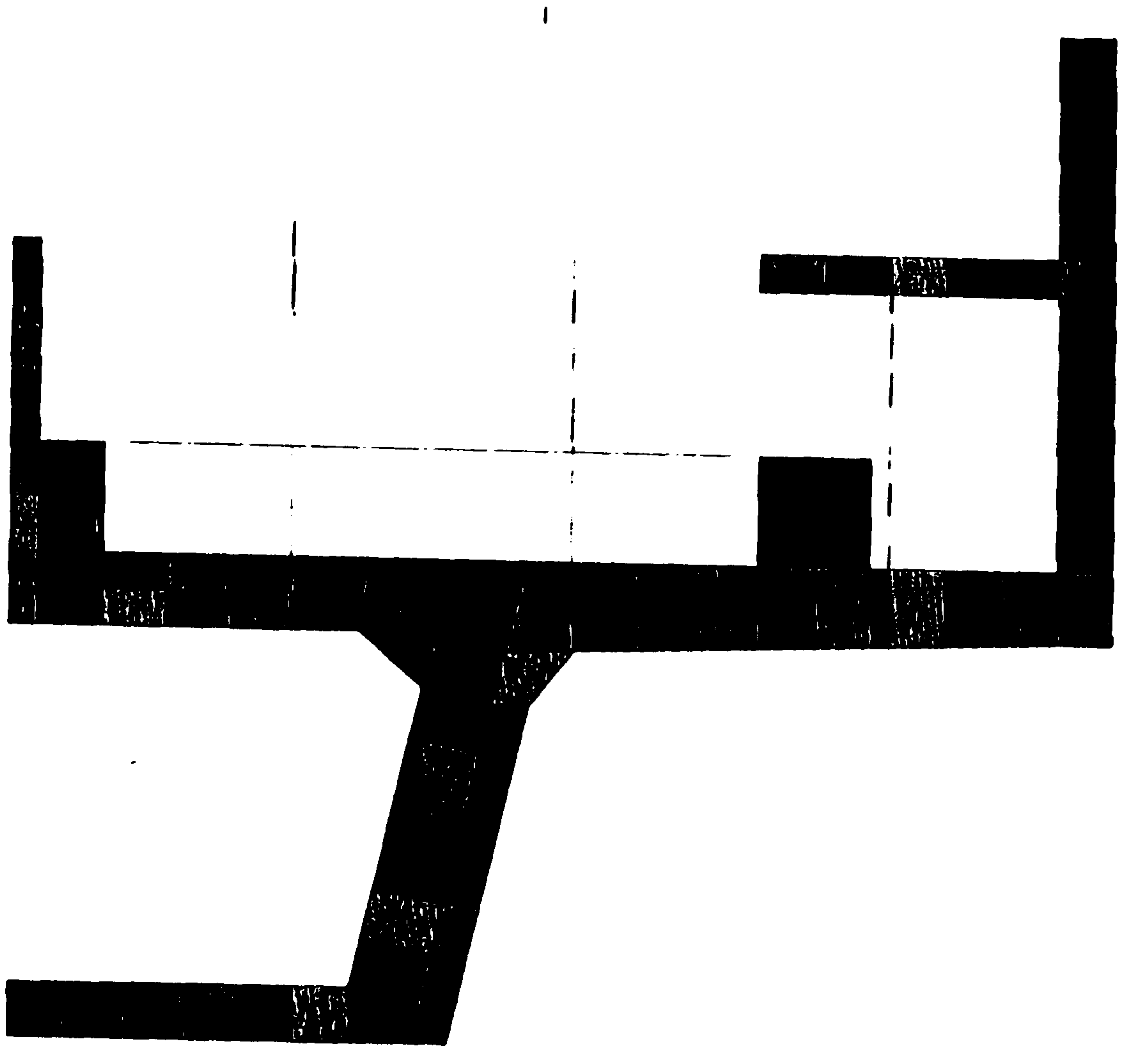
FIGURE
33

Contract/C1588/C1588_63

ERM

KOWLOON - CANTON
RAILWAY CORPORATION
WEST RAIL: TS900 EIA STUDY



FINITE ELEMENT MODEL OF TWO-TRACK VIADUCT CROSS-SECTION WITH STRENGTHENED CELL

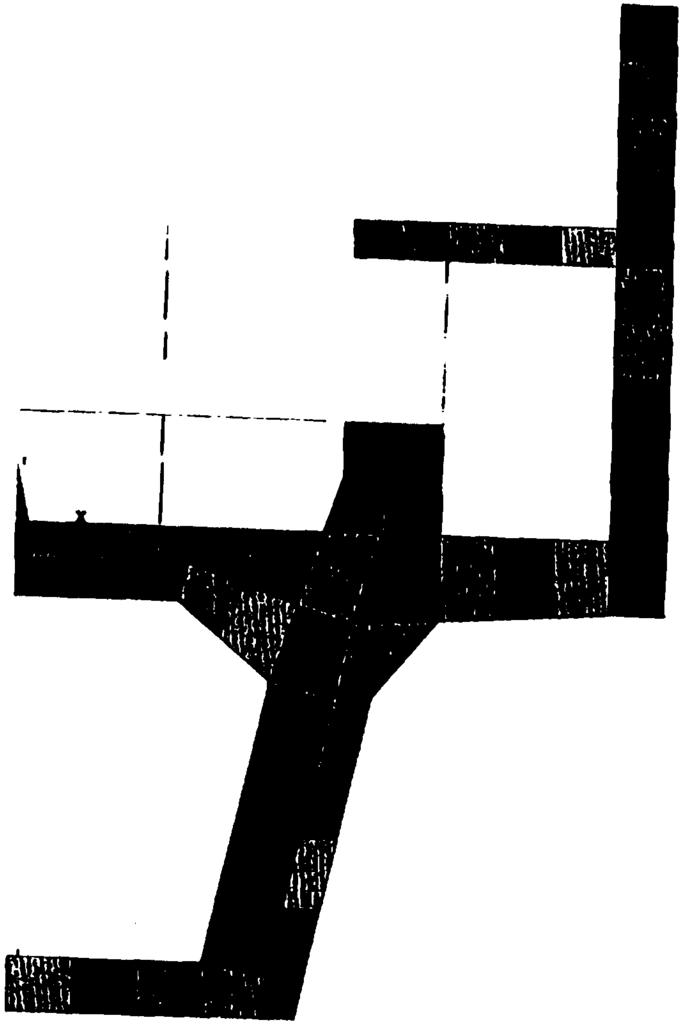
FIGURE 34

Contract/C1588/C1588_64

ERM

KOWLOON - CANTON RAILWAY CORPORATION

WEST RAIL: TS900 EIA STUDY



FINITE ELEMENT MODEL OF SINGLE TRACK VIADUCT WITH STRENGTHENED CELL

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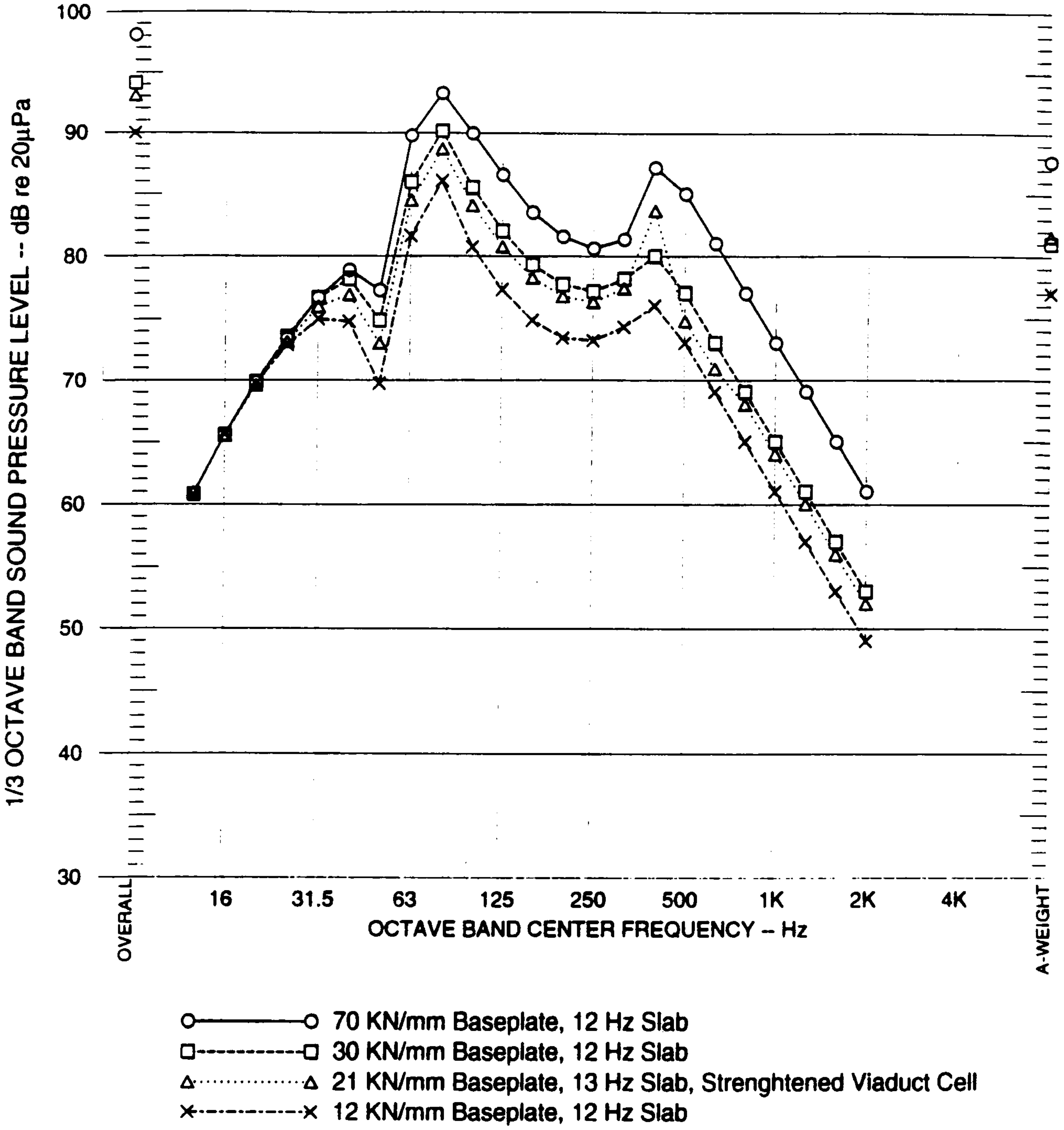
FIGURE
35

Contract/C1588/C1588_65

ERM

KOWLOON - CANTON
RAILWAY CORPORATION

WEST RAIL: TS900 EIA STUDY



NOT TO SCALE

ESTIMATED RADIATED NOISE FROM THE FLOATING SLAB - re: 12 TRANSIT CAR 130 kmh, 25m DISTANCE

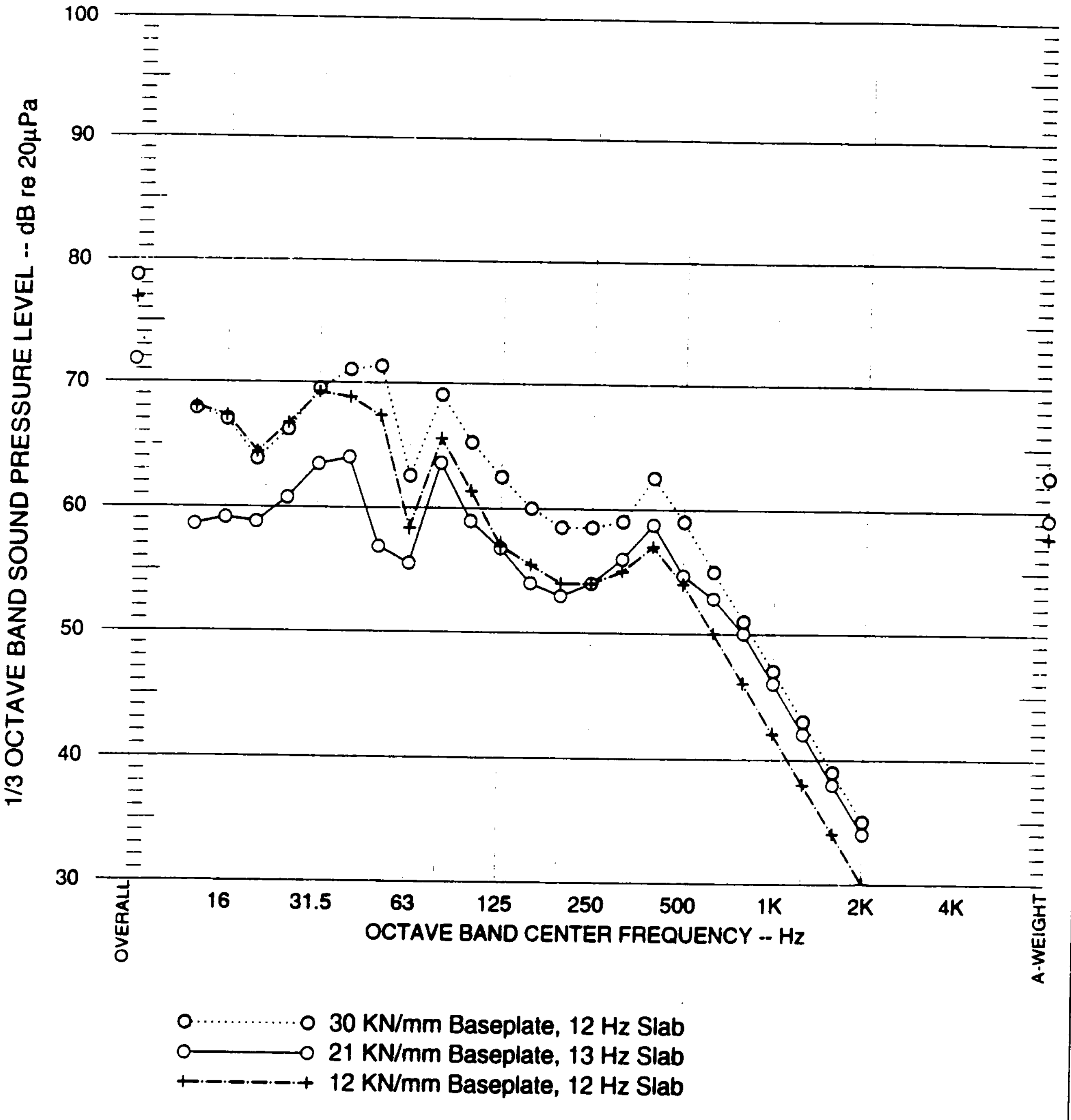
FIGURE 36

Contract/C1588/C1588_66

ERM

KOWLOON - CANTON RAILWAY CORPORATION

WEST RAIL: TS900 EIA STUDY



NOT TO SCALE

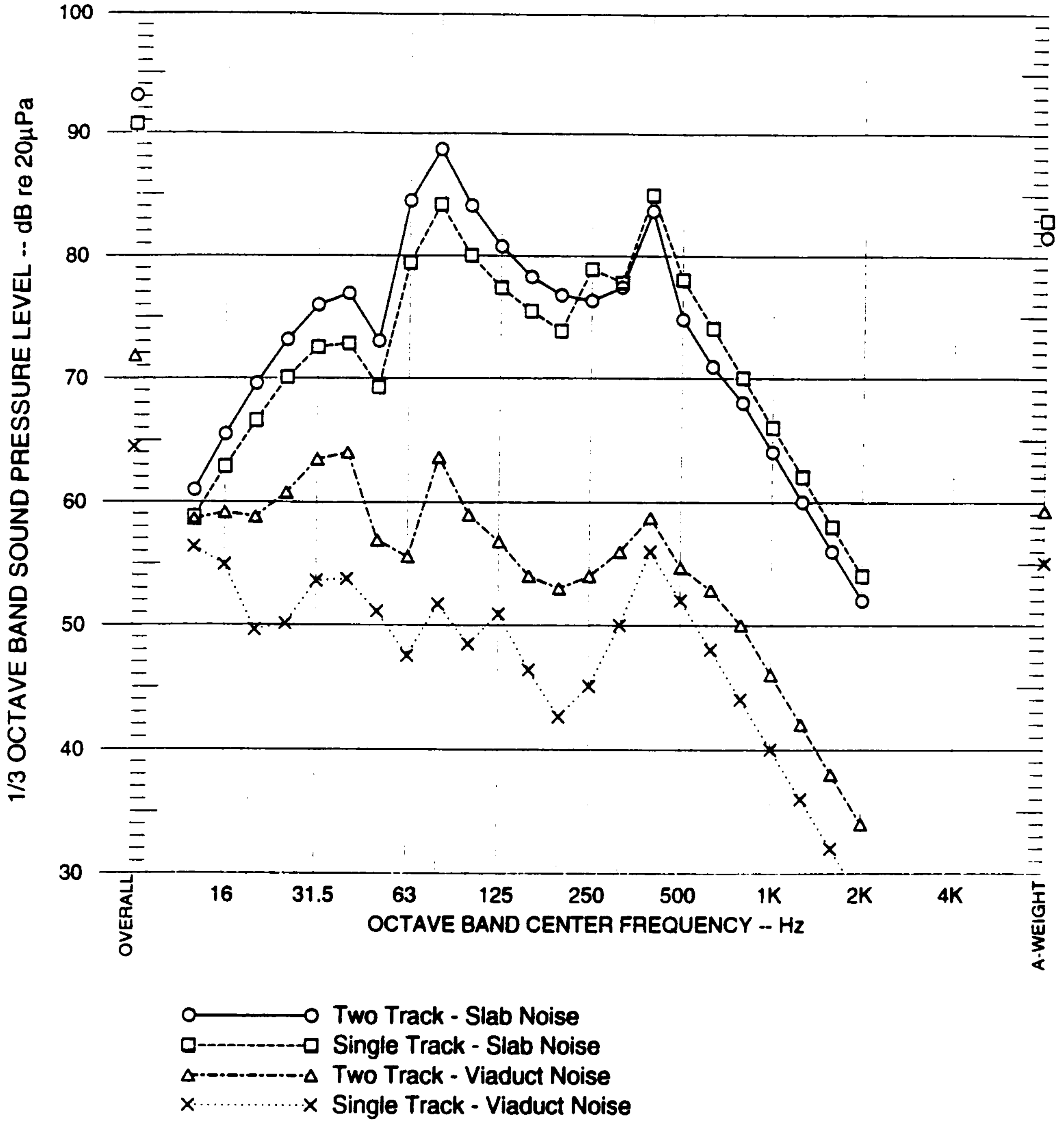
ESTIMATED RADIATED NOISE FROM THE TWO TRACK VIADUCT - re: 12 TRANSIT CAR 130 kmh, 25m DISTANCE

FIGURE 37

Contract/C1588/C1588_67

KOWLOON - CANTON RAILWAY CORPORATION

WEST RAIL: TS900 EIA STUDY



NOT TO SCALE

W I A

ESTIMATED STRUCTURE RADIATED NOISE FROM THE KCR VIADUCT - re: 12 TRANSIT CAR 130 kmh, 25m DISTANCE

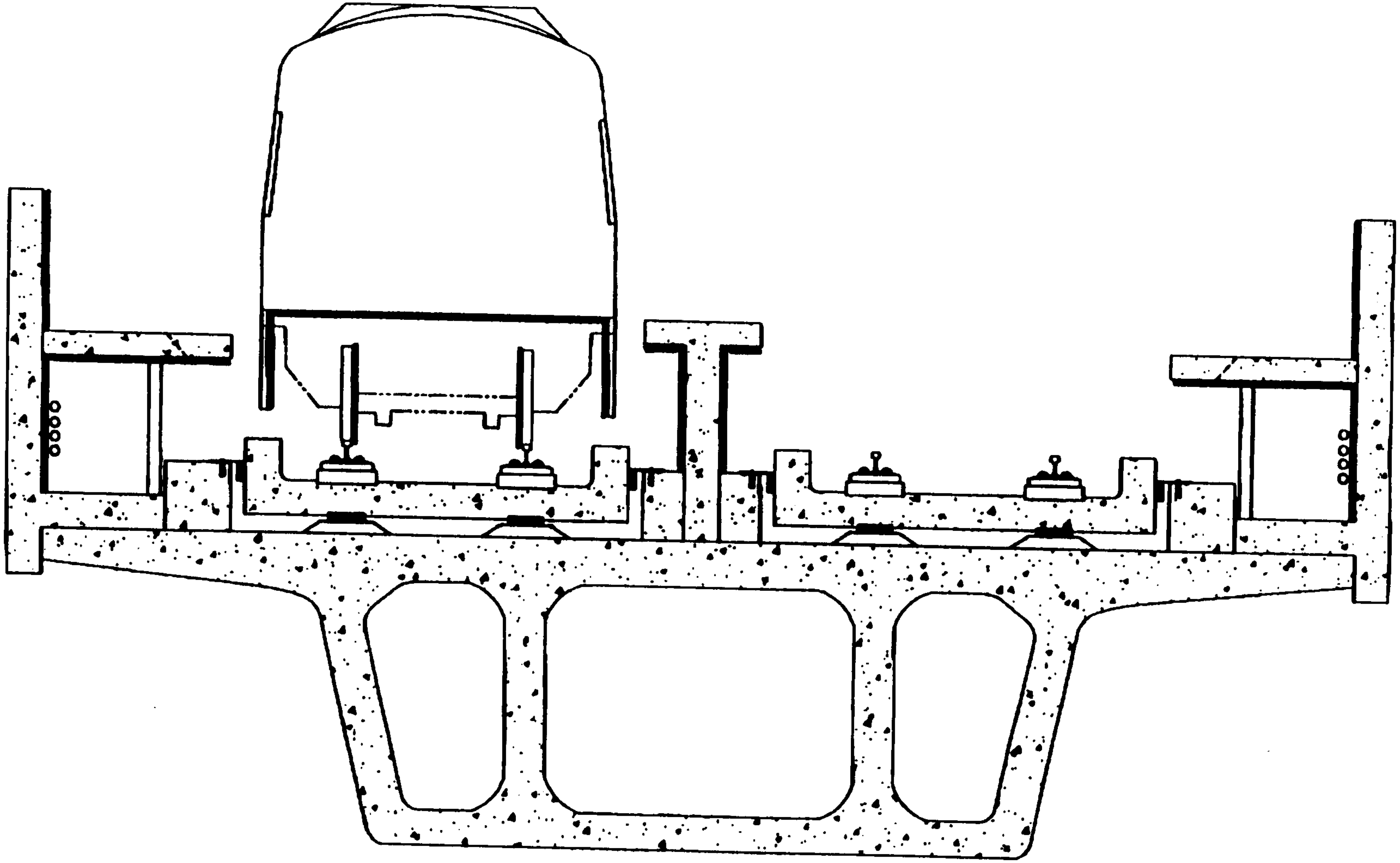
FIGURE 38

Contract/C1588/C1588_68

ERM

KOWLOON - CANTON RAILWAY CORPORATION

WEST RAIL: TS900 EIA STUDY



STRENGTHENED THREE-CELL CROSS-SECTION
WITH CELL WALLS UNDER TRACKFORM MODEL

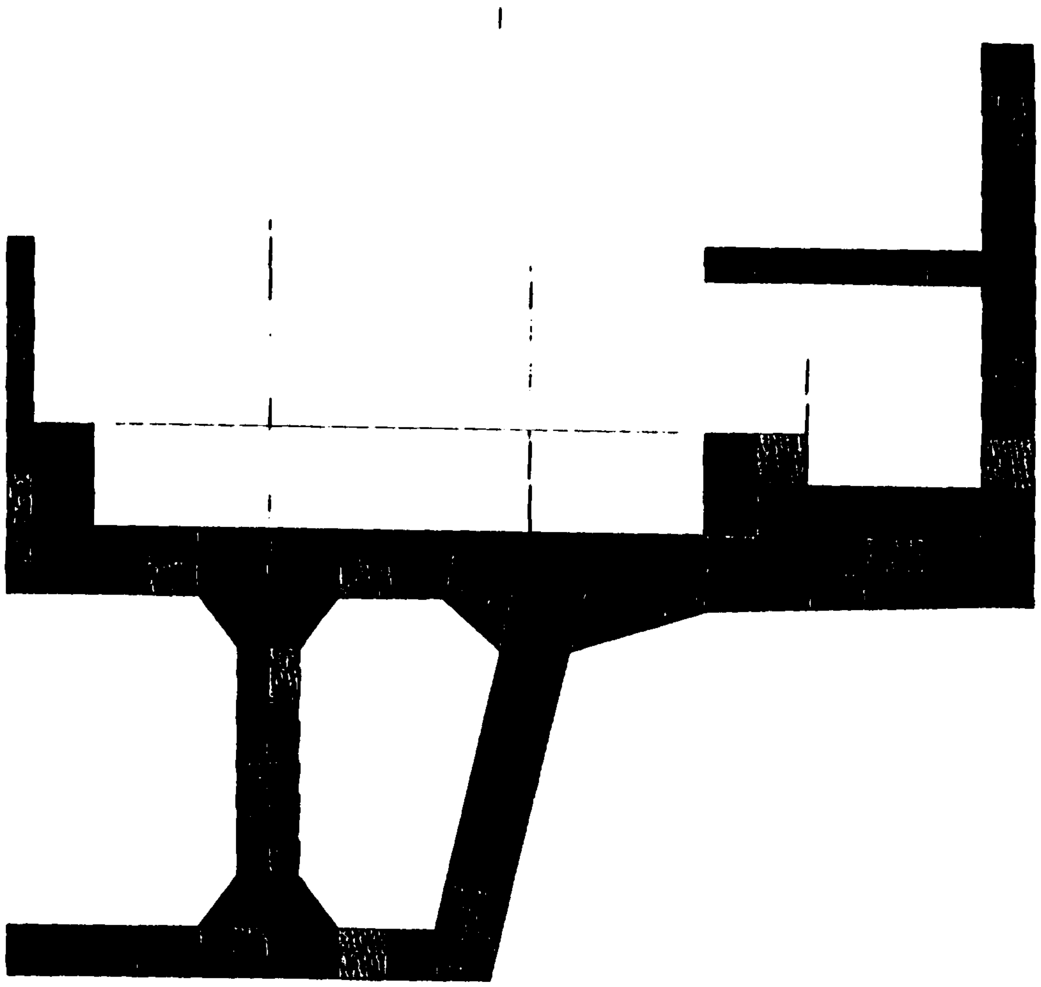
FIGURE
39

Contract/C1588/C1588_69

ERM

KOWLOON - CANTON
RAILWAY CORPORATION

WEST RAIL: TS900 EIA STUDY



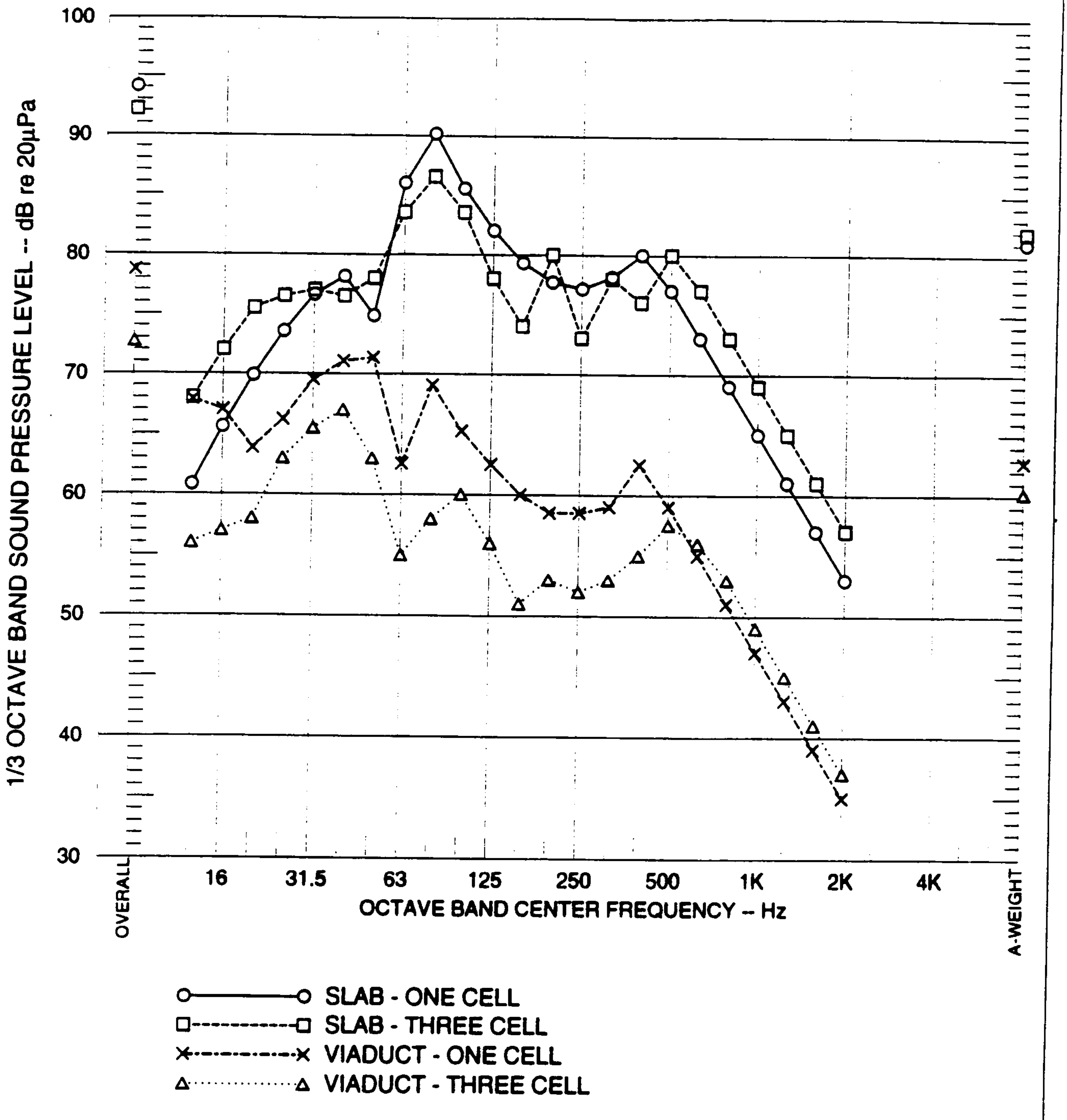
FINITE ELEMENT MODEL CROSS-SECTION OF THE THREE-CELL VIADUCT

FIGURE
40

Contract/C1588/C1588_70

ERM

KOWLOON - CANTON
RAILWAY CORPORATION
WEST RAIL: TS900 EIA STUDY



NOT TO SCALE

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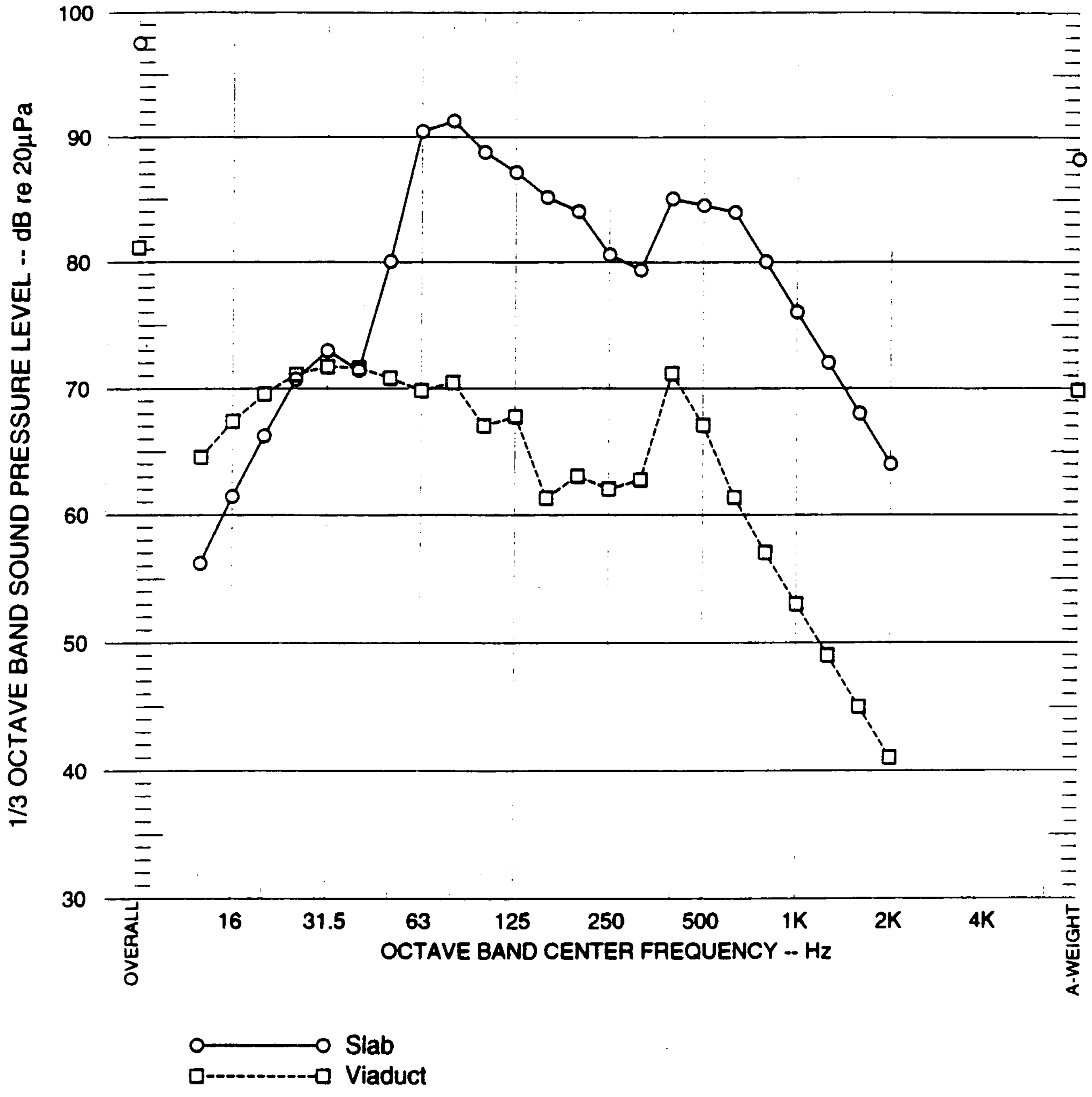
COMPARISON OF RE-RADIATED NOISE FOR ONE VS THREE-CELL VIADUCT STRUCTURE - 12 Hz SLAB, 30 kN/mm BASEPLATE (DYNAMIC)

FIGURE
41

Contract/C1588/C1588_71

ERM

KOWLOON - CANTON
RAILWAY CORPORATION
WEST RAIL: TS900 EIA STUDY



NOT TO SCALE

W I A

RE-RADIATED (32T FREIGHT) NOISE FROM TWO TRACK VIADUCTS - 20.5Hz, 2844kg/m FLOATING SLAB: ACOUSTIC LOADMASTER

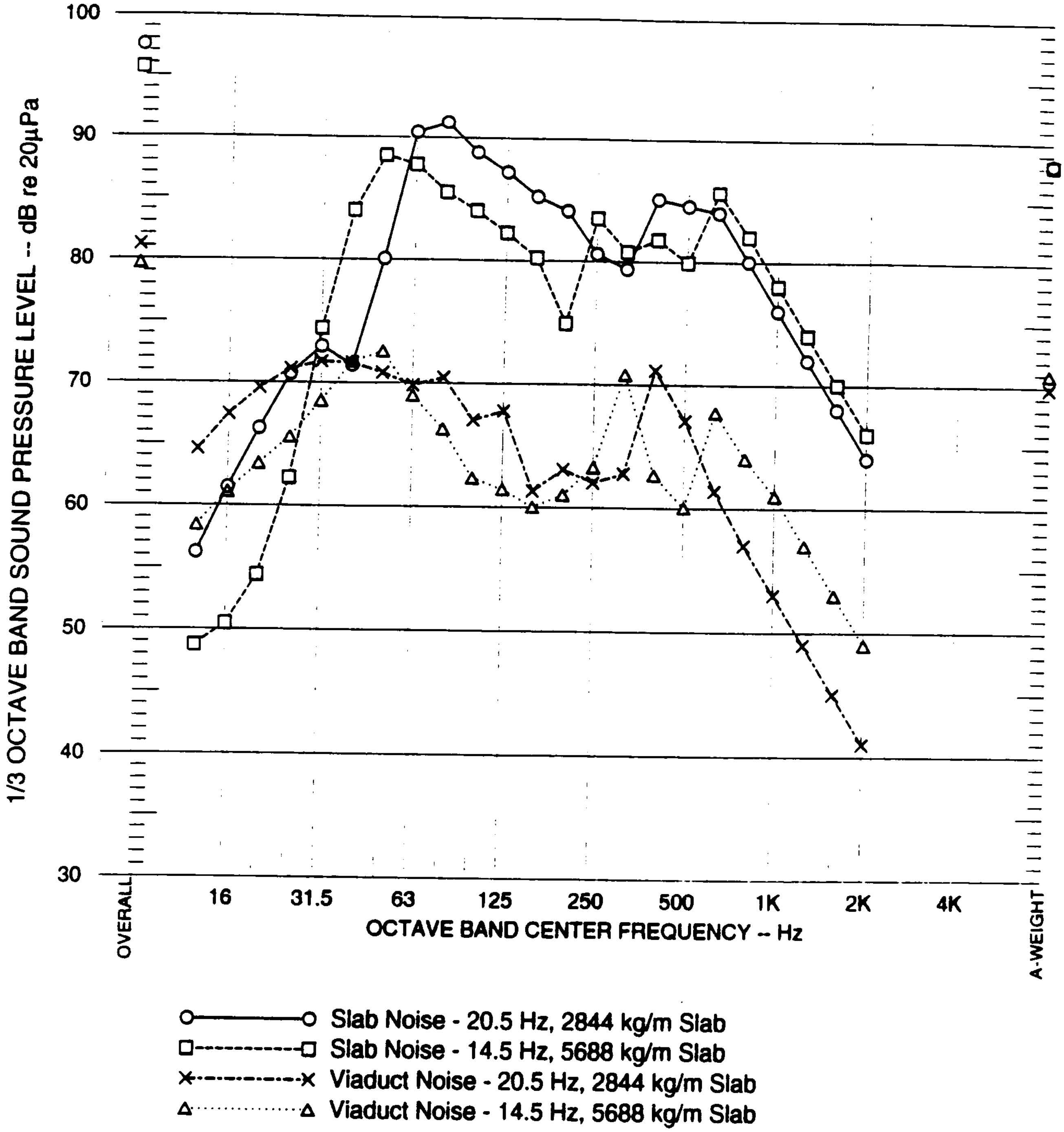
FIGURE 42

Contract/C1588/C1588_72

ERM

KOWLOON - CANTON RAILWAY CORPORATION

WEST RAIL: TS900 EIA STUDY



NOT TO SCALE

WIA

COMPARISON OF RE-RADIATED (32T FRIEGHT) NOISE ON A TWO TRACK VAIDUCT FOR DIFFERENT MASS FLOATING SLAB: ACOUSTIC LOADMASTER BASEPLATE

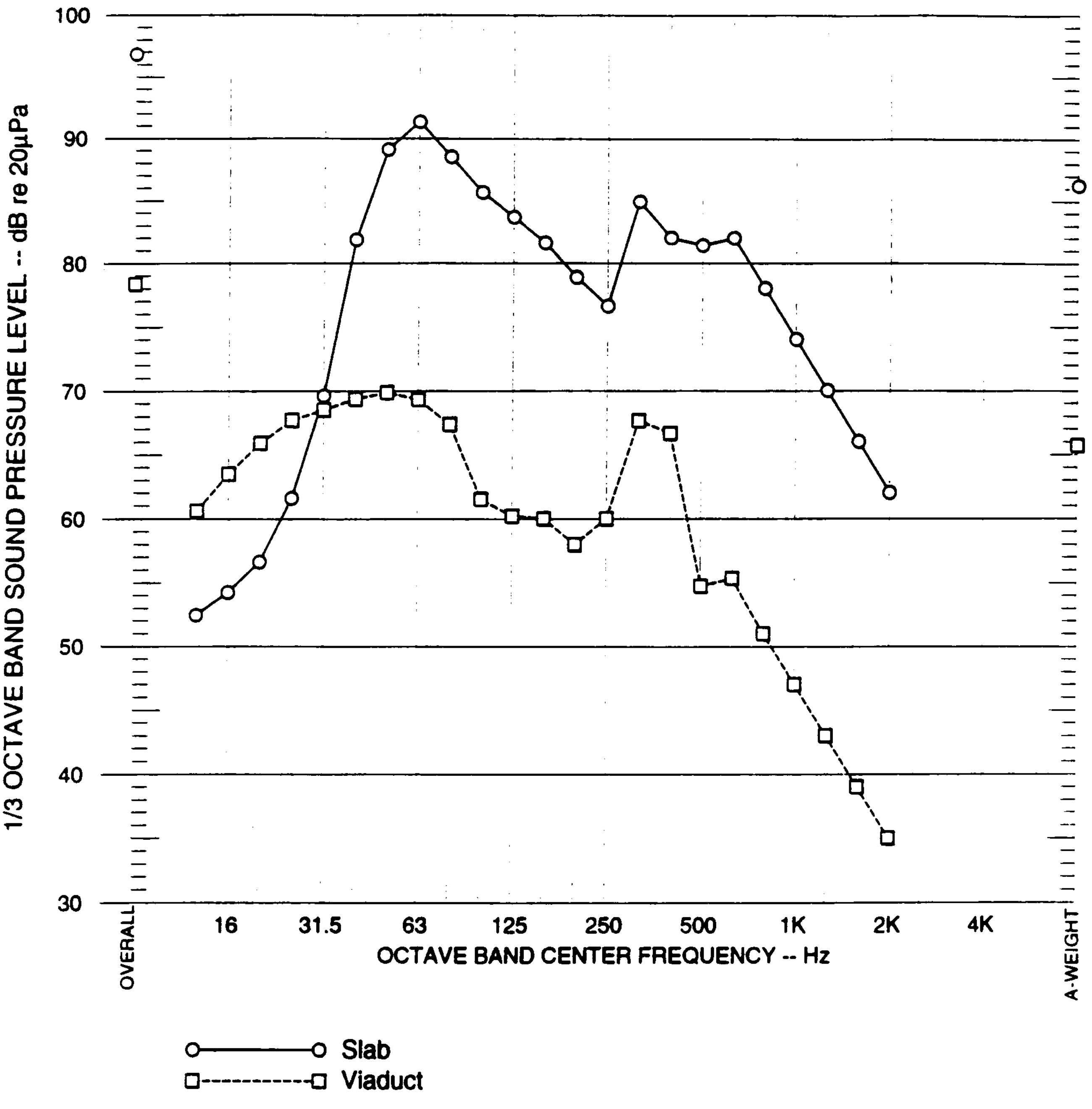
FIGURE 43

Contract/C1588/C1588_73

ERM

KOWLOON - CANTON RAILWAY CORPORATION

WEST RAIL: TS900 EIA STUDY



NOT TO SCALE

RE-RADIATED (22T FRIEGHT) NOISE FROM TWO TRACK VAIDUCTS - 13.2Hz, 4266 kg/m Floating Slab - ACOUSTIC LOADMASTER

WIA

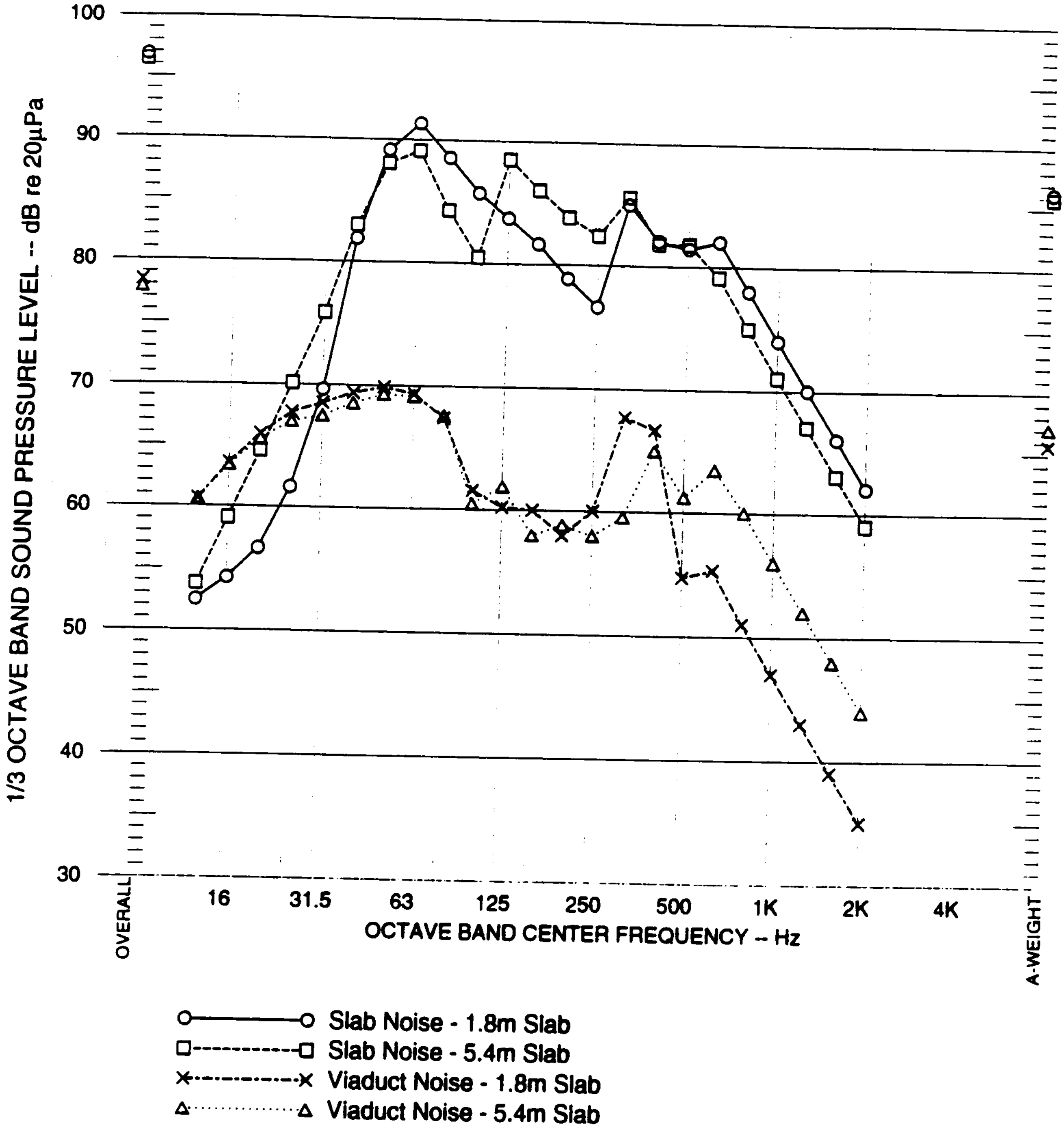
FIGURE 44

Contract/C1588/C1588_74

ERM

KOWLOON - CANTON RAILWAY CORPORATION

WEST RAIL: TS900 EIA STUDY



NOT TO SCALE

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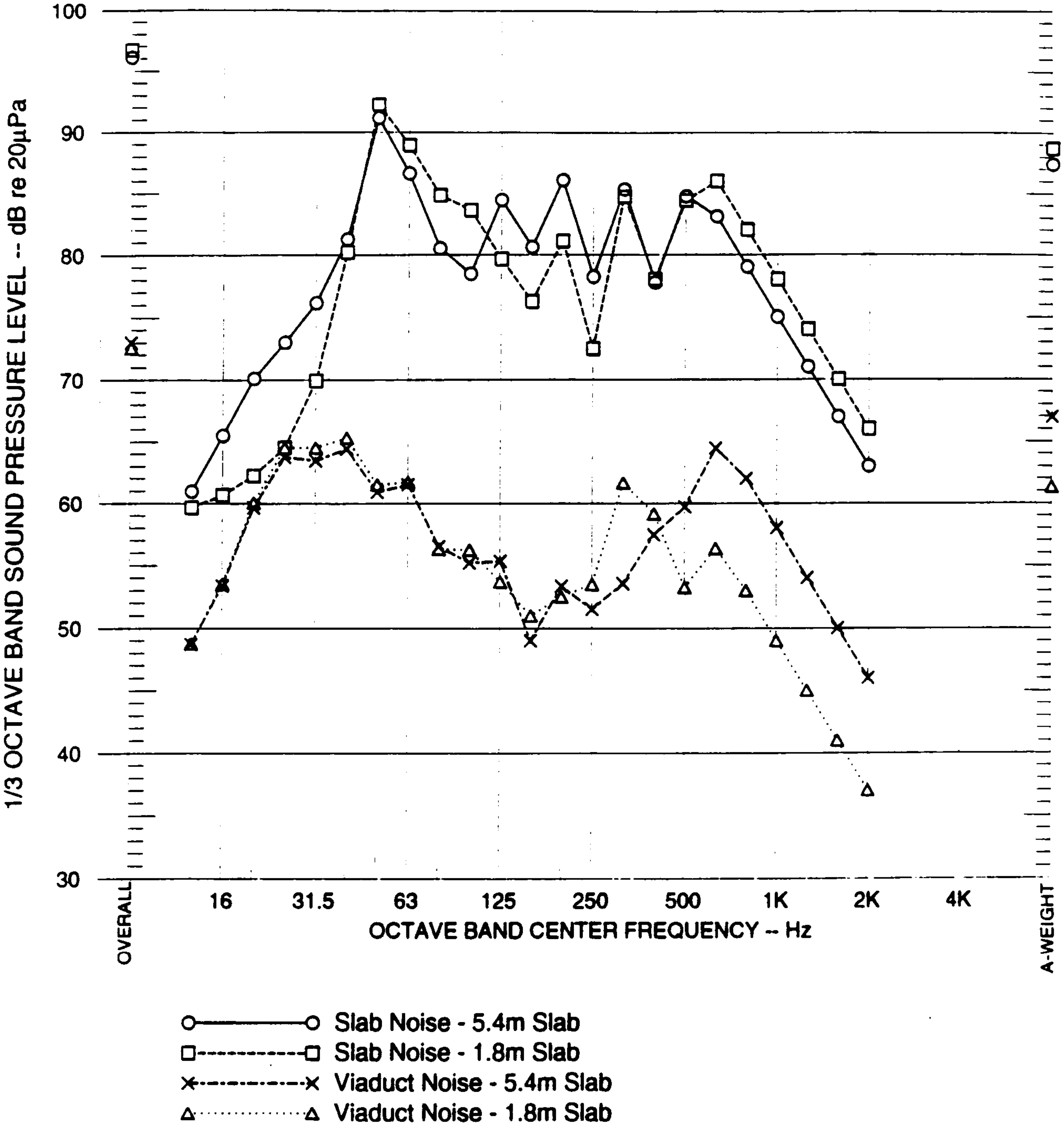
COMPARISON OF RE-RADIATED (22T FRIEGHT):
1.8m VS 5.4m SLAB LENGTH - 13.2Hz, 4266 kg/m
FLOATING SLAB, - ACOUSTIC LOADMASTER
BASEPLATE

FIGURE
45

Contract/C1588/C1588_75

ERM

KOWLOON - CANTON
RAILWAY CORPORATION
WEST RAIL: TS900 EIA STUDY



NOT TO SCALE

W
I
A

RE-RADIATED NOISE FOR 22T AXLE FREIGHT
ON A STRENGTHENED THREE CELL VIADUCT -
13.2 Hz, 4266 kg/m FLOATING SLAB WITH
ACOUSTIC LOADMASTER BASEPLATE

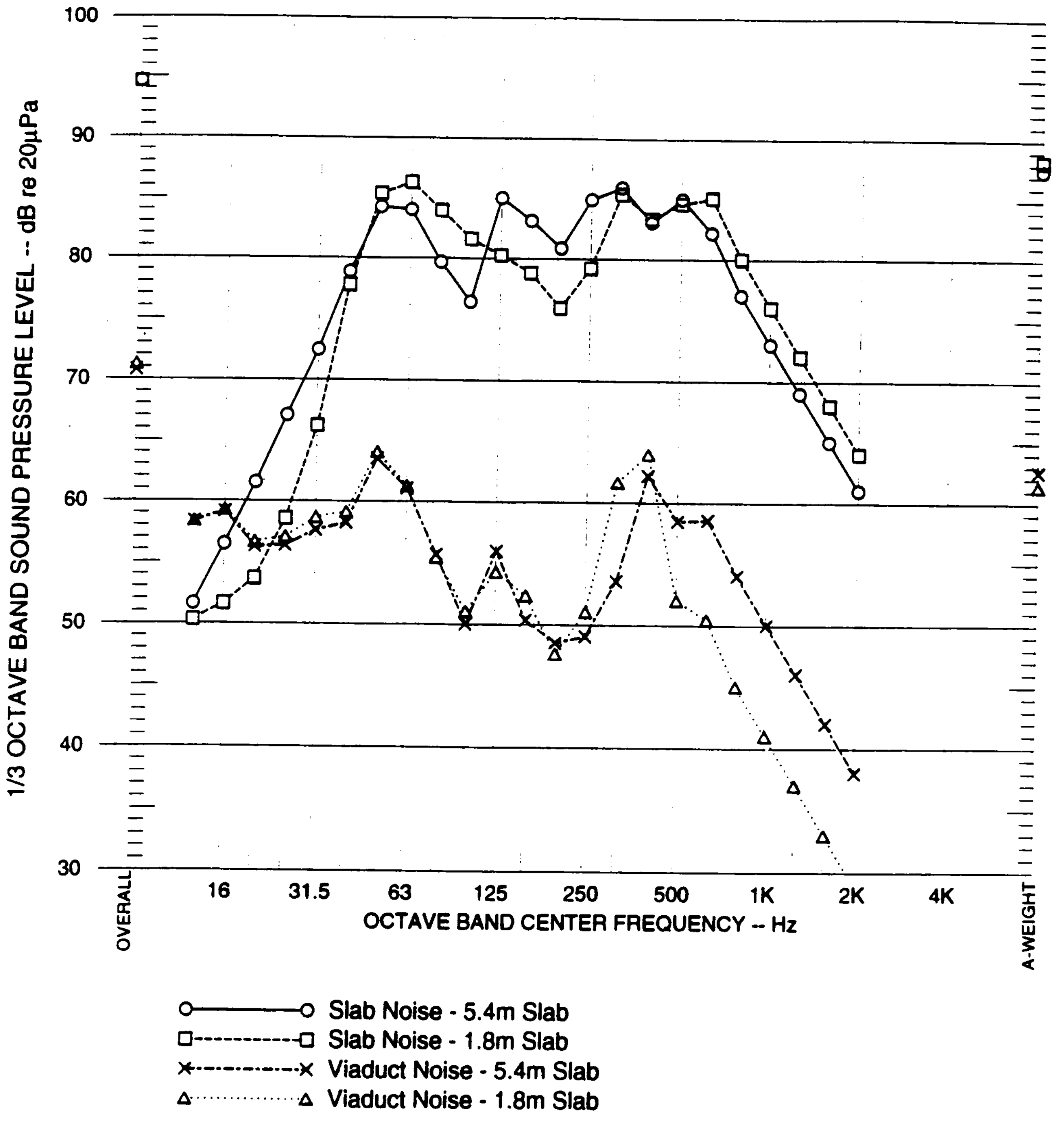
FIGURE
46

Contract/C1586/C1586_76

ERM

KOWLOON - CANTON
RAILWAY CORPORATION

WEST RAIL: TS900 EIA STUDY



NOT TO SCALE

W
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RE-RADIATED NOISE FOR A SINGLE TRACK VIADUCT FOR 22T FREIGHT - 13.2 Hz, 4266 kg/m FLOATING SLAB WITH ACOUSTIC LOADMASTER BASEPLATE

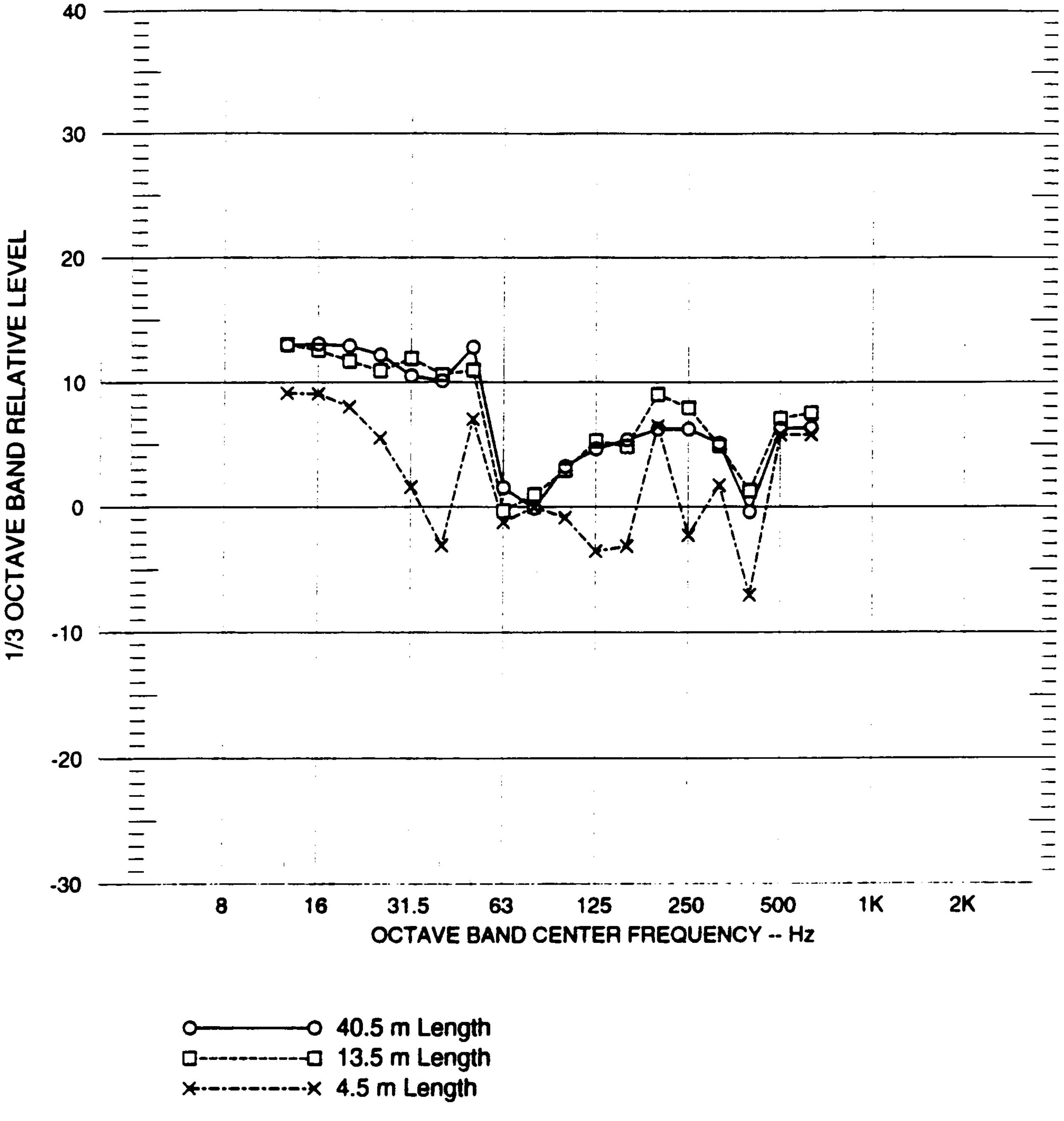
FIGURE 47

Contract/C1586/C1586_77

ERM

KOWLOON - CANTON RAILWAY CORPORATION

WEST RAIL: TS900 EIA STUDY



NOT TO SCALE

W
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NOISE RADIATED FROM 12 Hz FLOATING SLABS OF DIFFERENT LENGTHS - RELATIVE TO THE 1.5m MINI-SLAB MODULE (BASEPLATE STIFFNESS: 30 kN/mm)

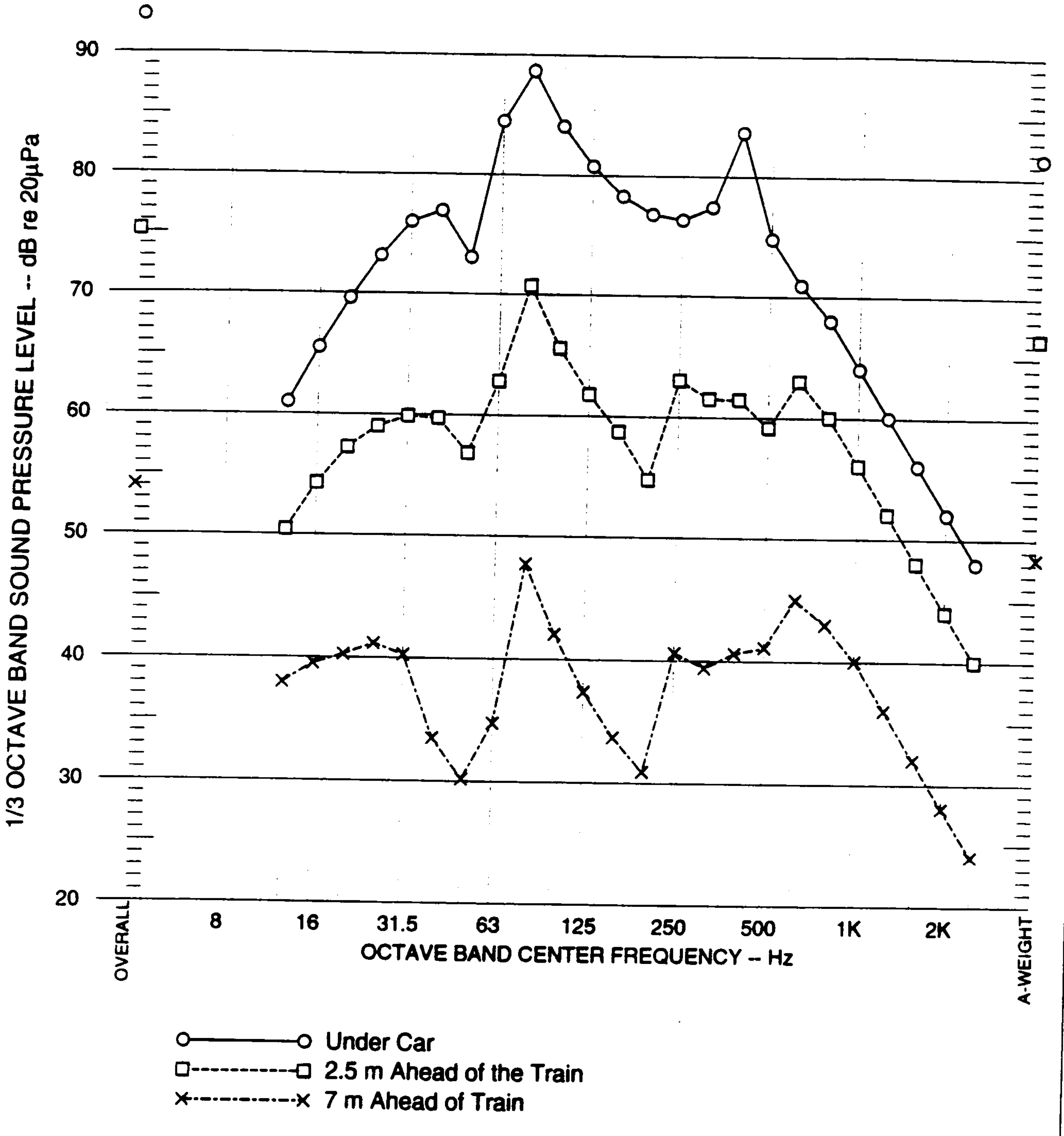
FIGURE
48

Contract/C1588/C1588_78

ERM

KOWLOON - CANTON
RAILWAY CORPORATION

WEST RAIL: TS900 EIA STUDY



NOT TO SCALE

ESTIMATED NOISE RADIATED FROM THE FLOATING SLAB - 13 Hz RESONANCE FREQUENCY WITH 21 kN/mm BASEPLATES

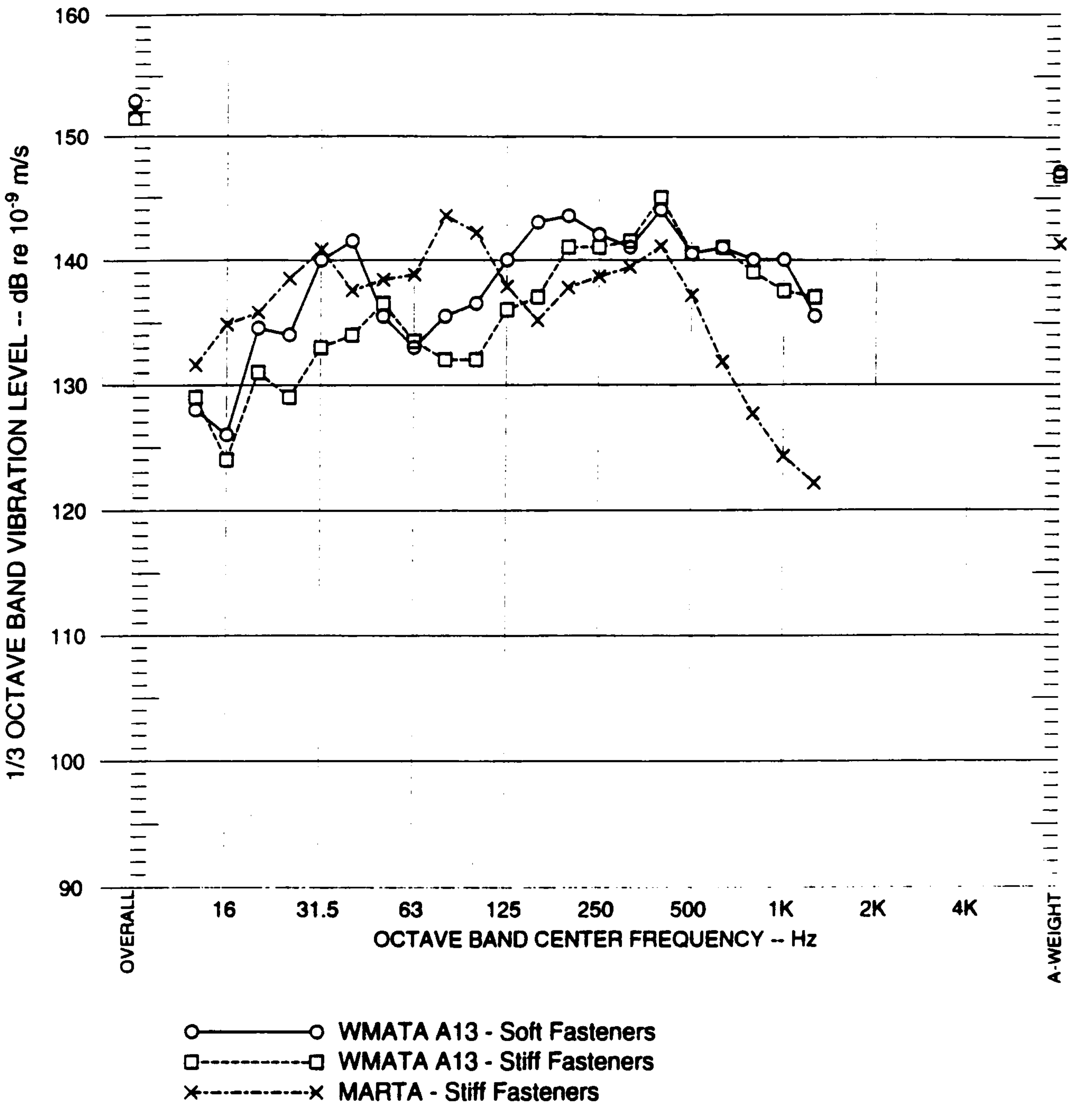
FIGURE 49

Contract/C1588/C1588_79

ERM

KOWLOON - CANTON RAILWAY CORPORATION

WEST RAIL: TS900 EIA STUDY



NOT TO SCALE

W
I
A

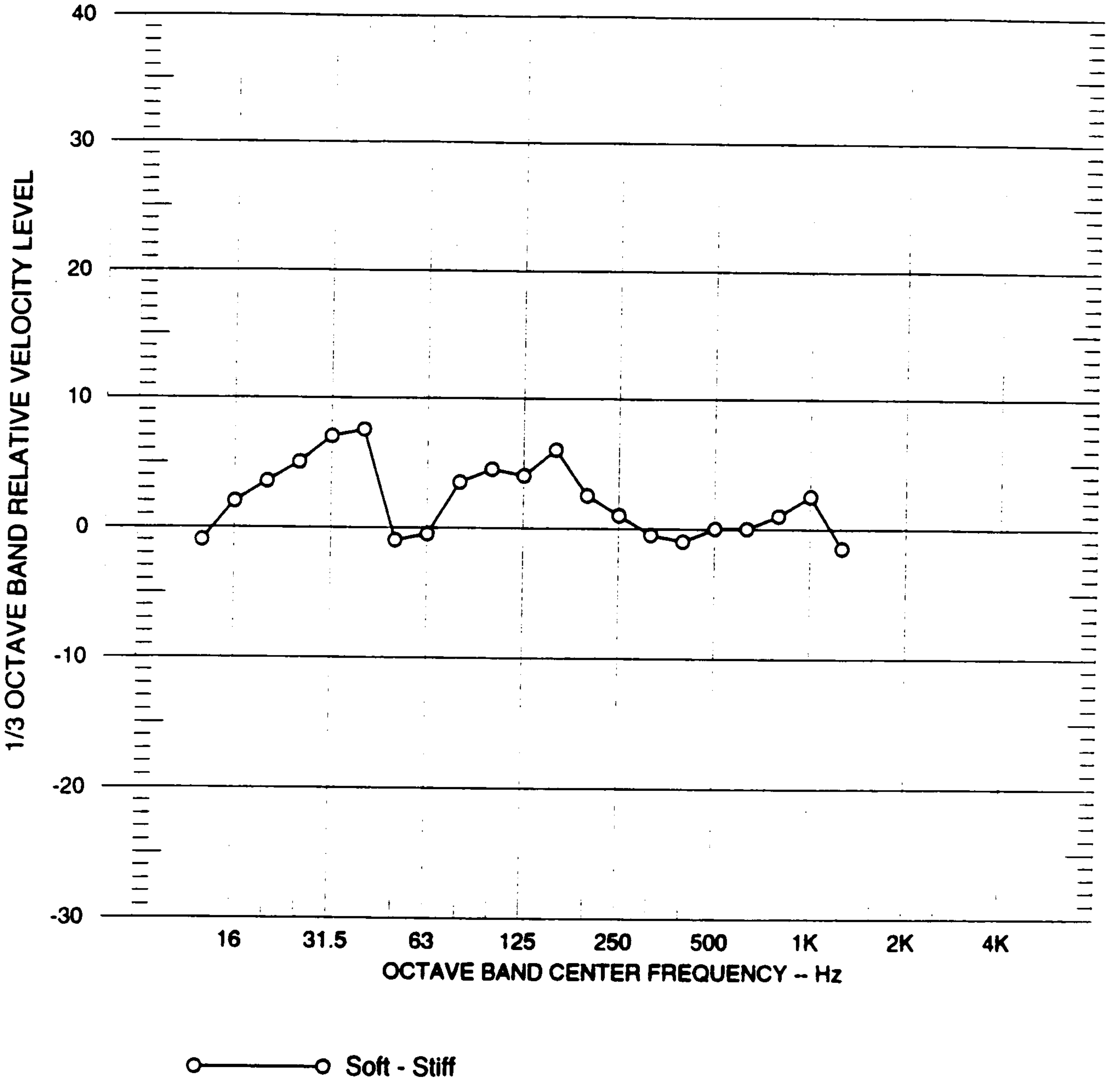
RAIL VIBRATION MEASUREMENT DATA TAKEN ON VIADUCTS AND ADJUSTED TO 130 kmh

FIGURE
50

Contract/C1588/C1588_80

ERM

KOWLOON - CANTON
RAILWAY CORPORATION
WEST RAIL: TS900 EIA STUDY



NOT TO SCALE

WIA

RELATIVE RAIL VIBRATION - SOFT VS STIFF BASEPLATES

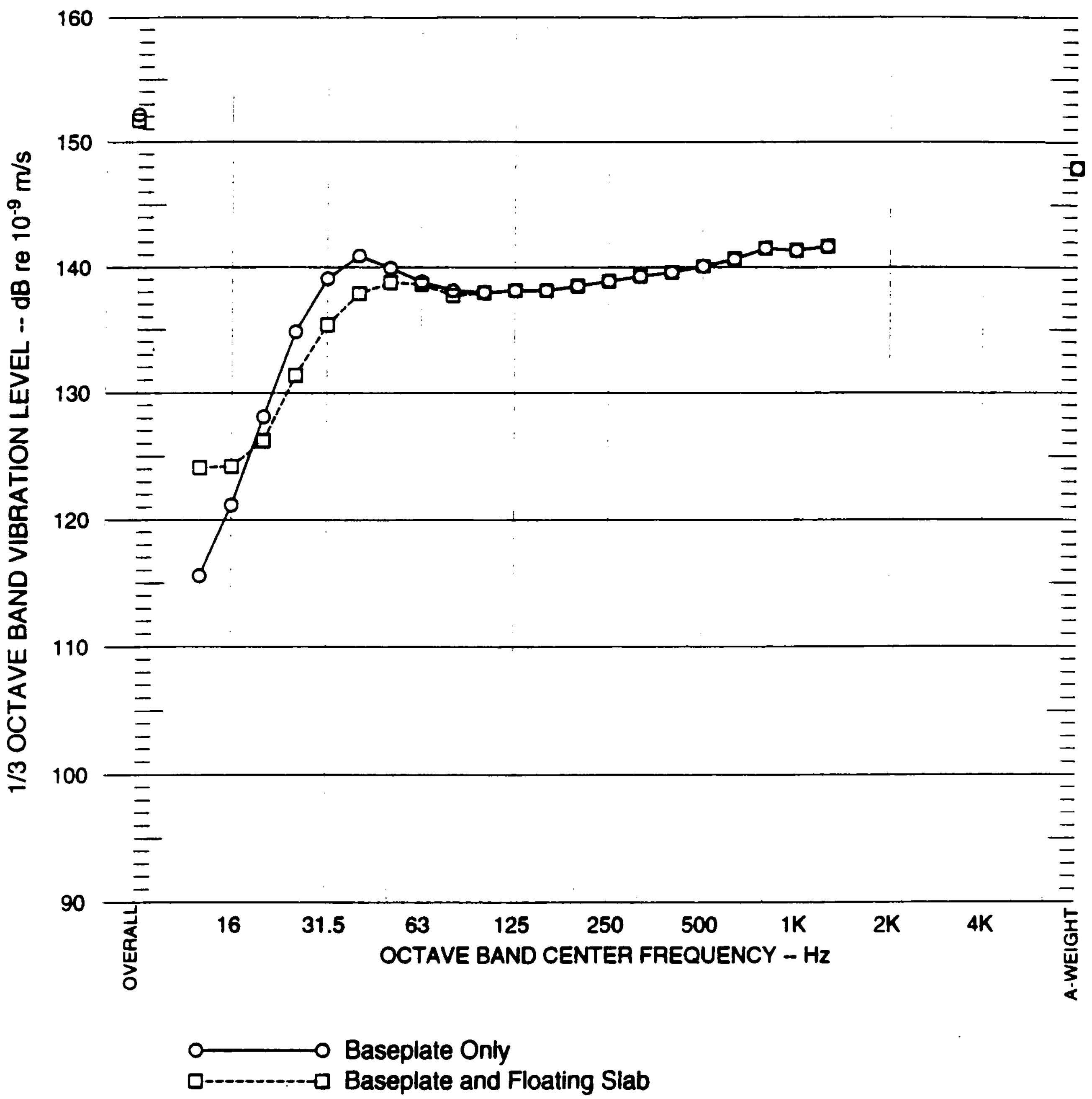
FIGURE 51

Contract/C1588/C1588_81

ERM

KOWLOON - CANTON RAILWAY CORPORATION

WEST RAIL: TS900 EIA STUDY



NOT TO SCALE

W I A

CALCULATED RAIL VIBRATION WITH AND WITHOUT FLOATING SLAB

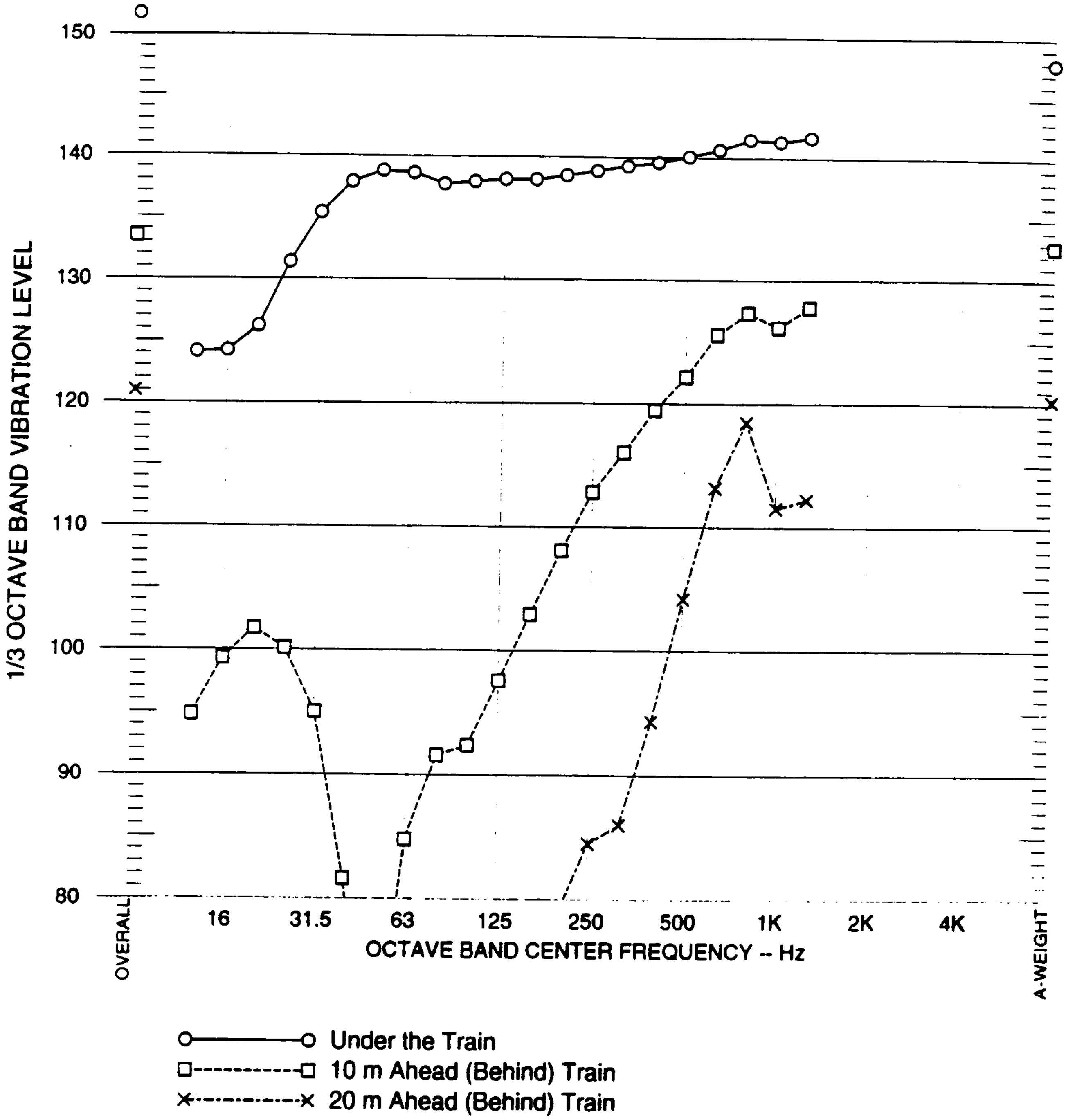
FIGURE 52

Contract/C1588/C1588_82

ERM

KOWLOON - CANTON RAILWAY CORPORATION

WEST RAIL: TS900 EIA STUDY



NOT TO SCALE

W I A

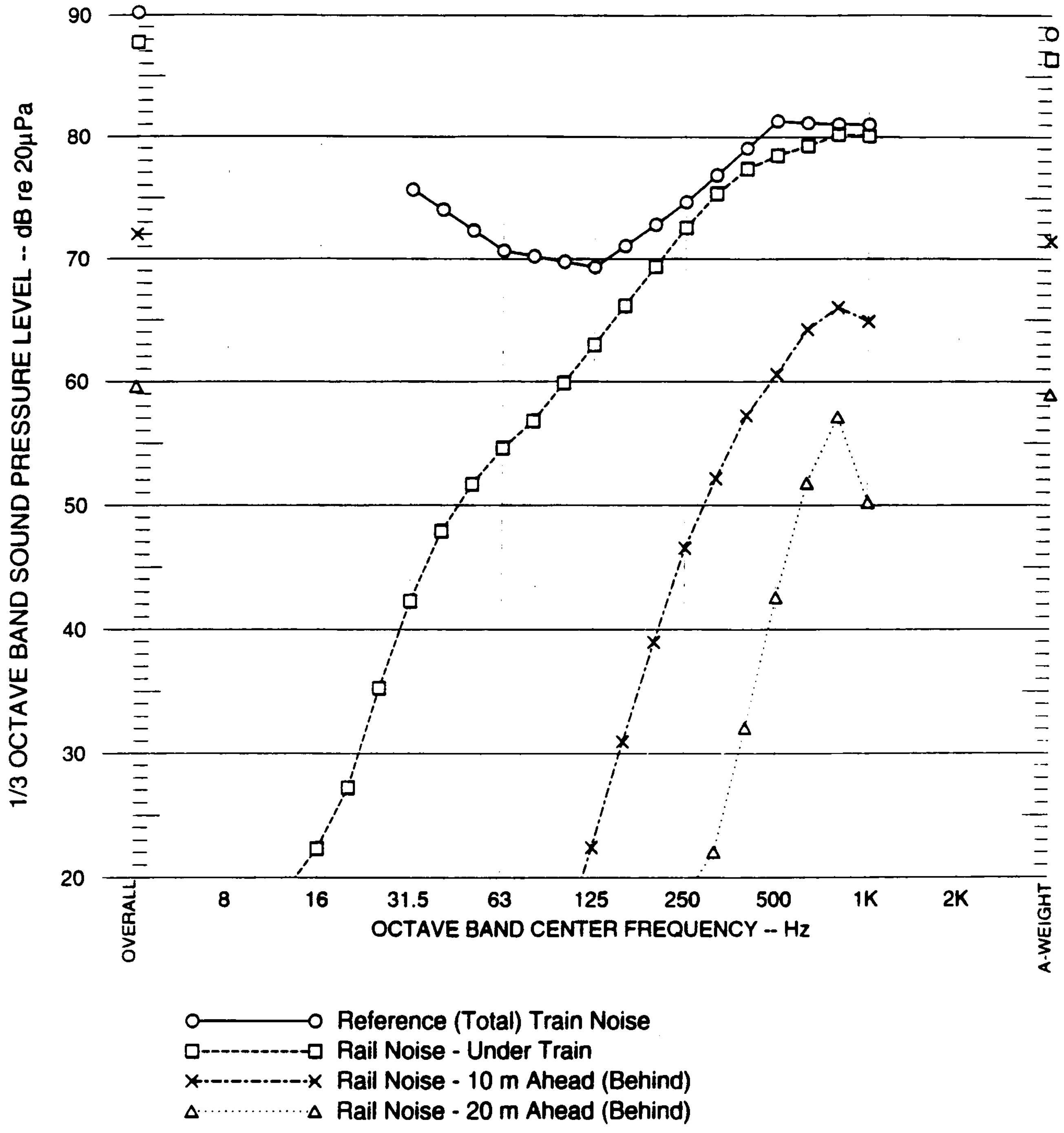
COMPARISON OF RAIL VIBRATION UNDER AND IN FRONT (BACK) OF THE TRAIN

FIGURE
53

Contract/C1588/C1588_83

ERM

KOWLOON - CANTON
RAILWAY CORPORATION
WEST RAIL: TS900 EIA STUDY



NOT TO SCALE

W
I
A

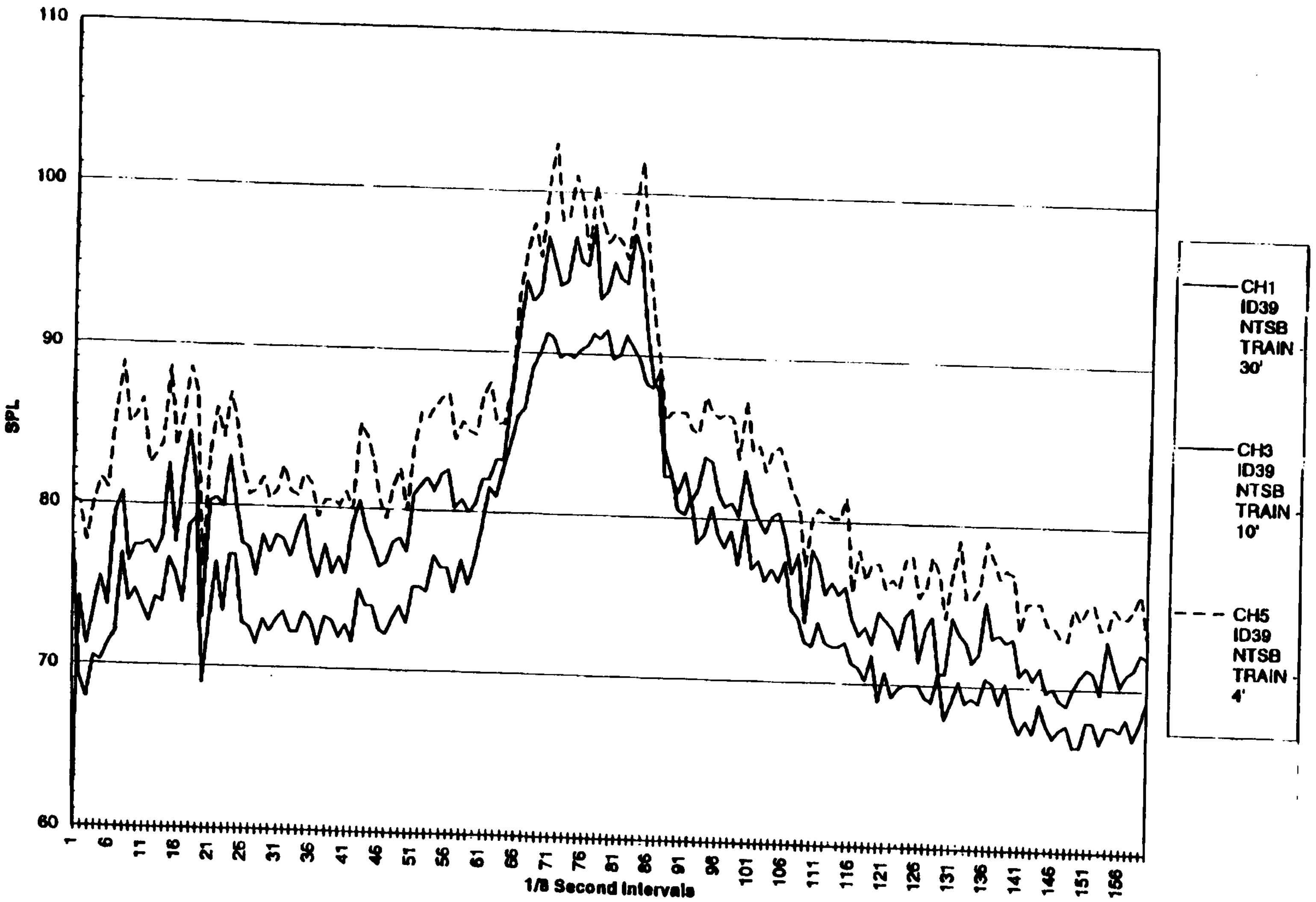
COMPARISON OF NOISE RADIATED FROM
THE RAIL UNDER AND AHEAD OF (BEHIND)
THE TRAIN - re 12 CAR, 130 kmh,
25m DISTANCE

FIGURE
54

Contract/C1588/C1588_84

ERM

KOWLOON - CANTON
RAILWAY CORPORATION
WEST RAIL: TS900 EIA STUDY



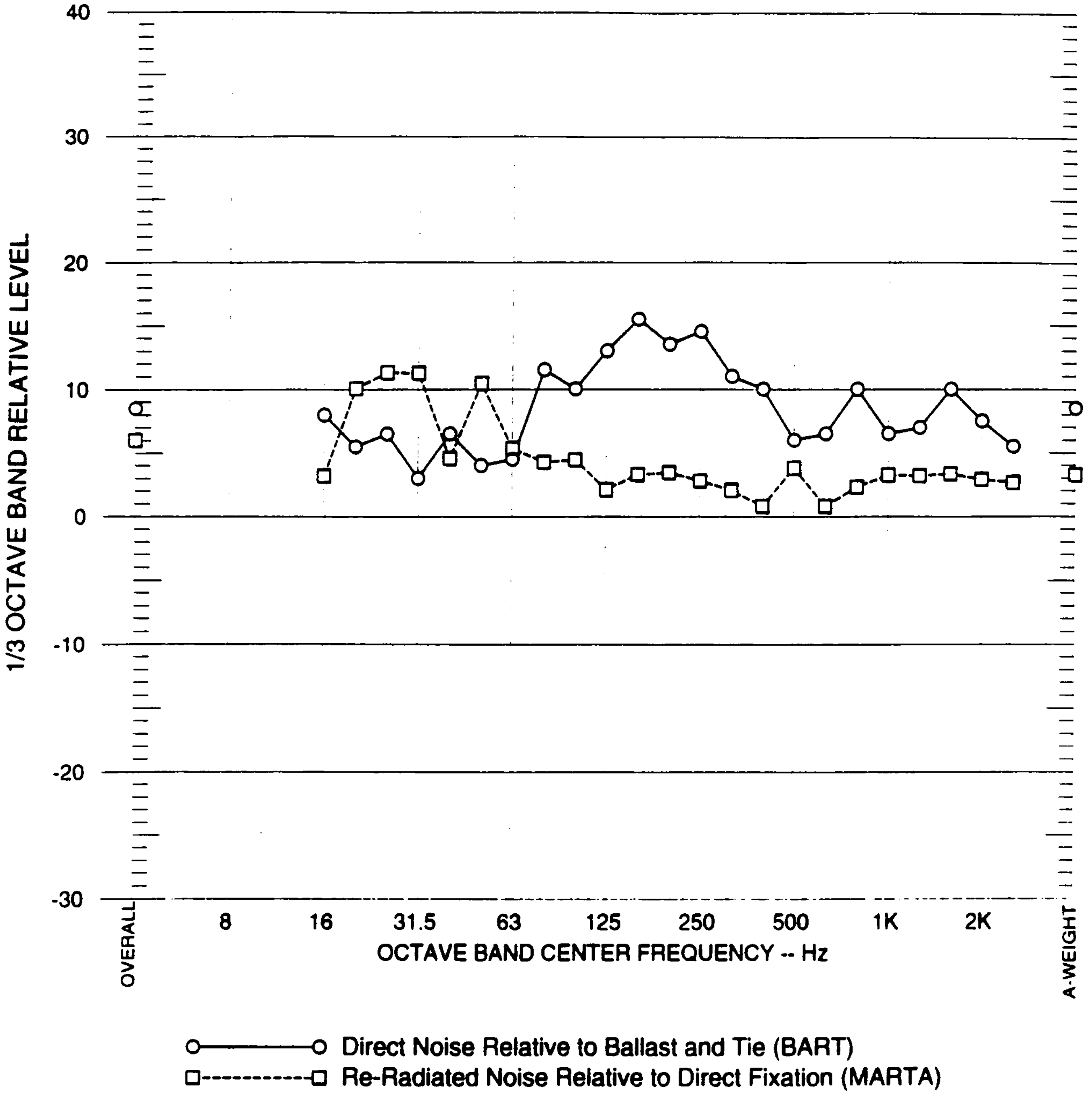
"A" WEIGHTED NOISE LEVELS MEASURED AT 3 DISTANCES
FROM THE NEAREST RAIL

FIGURE
55

Contract/C1588/C1588_85

ERM

KOWLOON - CANTON
RAILWAY CORPORATION
WEST RAIL: TS900 EIA STUDY



NOT TO SCALE

INCREASE IN NOISE DUE TO CROSSOVERS AND TURNOUTS

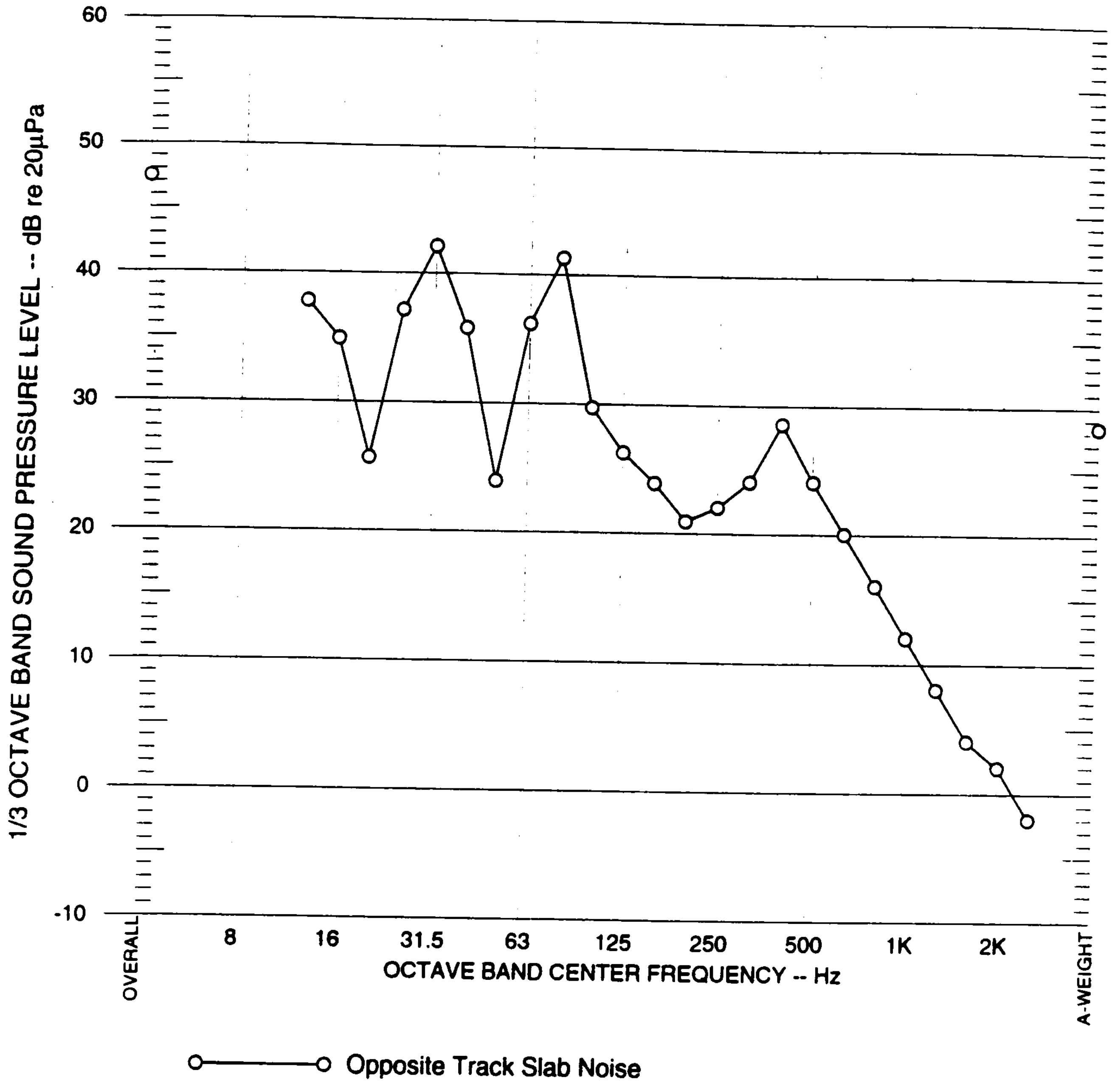
FIGURE 56

Contract/C1588/C1588_86

ERM

KOWLOON - CANTON RAILWAY CORPORATION

WEST RAIL: TS900 EIA STUDY



NOT TO SCALE

W I A

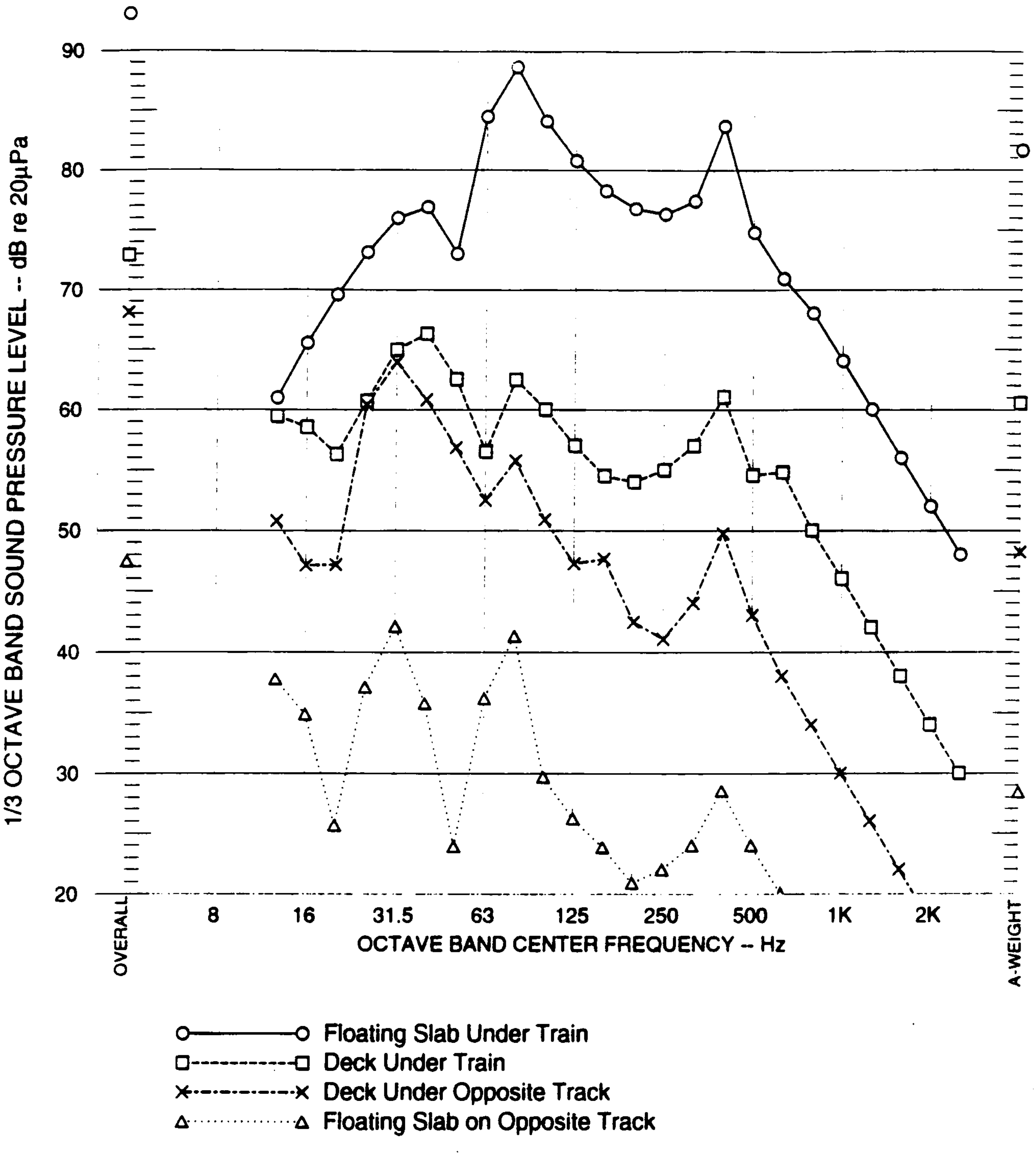
NOISE RADIATED FROM THE OPPOSITE TRACK
FLOATING SLAB - 13 Hz SLAB, 21 kN/mm
BASEPLATE, 130 kmh

FIGURE
57

Contract/C1588/C1588_87

ERM

KOWLOON - CANTON
RAILWAY CORPORATION
WEST RAIL: TS900 EIA STUDY



NOT TO SCALE

<u>COMPARISON OF THE STRUCTURE RADIATED NOISE LEVELS - 13 Hz SLAB, 21 kN/mm BASEPLATE, 130 kmh TRAIN SPEED</u>

FIGURE 58

Contract/C1588/C1588_88

ERM

KOWLOON - CANTON RAILWAY CORPORATION

WEST RAIL: TS900 EIA STUDY

Tai Wai to Ma On Shan Rail
Revenue Trains - Down

NSR No.	Description Location / Address	Airborne Outboard Leq (dB)	Airborne Inboard Leq (dB)	Structural Noise Leq (dB)	Distance (m)	Airborne Enclosure Portal Leq (dB)	Airborne Aircon. Units Leq (dB)	Total Airborne Leq (dB)	Total Structureborne Leq (dB)	Total Leq (dB)	Criterion (dB)	Exceedance (dB)
3	Keng Hau Rd 29	39.3	41.0	<20	196.8	<20	35.9	44.0	<20	44	45	-1
4	Keng Hau Rd 27	37.9	40.7	<20	187.4	<20	34.8	43.2	<20	43	45	-2
5	Keng Hau Rd 25	36.1	39.4	<20	163.8	<20	34.2	41.9	<20	42	45	-3
6	Keng Hau Rd 24	36.3	39.6	<20	148.6	<20	34.8	42.2	<20	42	45	-3
7	Keng Hau Rd 22	36.6	40.2	<20	133.8	<20	35.7	42.8	<20	43	50	-7
8	Keng Hau Rd 18	36.3	40.5	<20	147.3	<20	35.3	42.8	<20	43	50	-7
9	Keng Hau Rd13-15	36.2	40.6	<20	155.8	<20	35.0	42.7	<20	43	50	-7
11	Keng Hau Rd 11	36.0	40.7	<20	166.6	<20	34.4	42.7	<20	43	50	-7
12	Keng Hau Rd 9	36.0	41.0	<20	188.1	<20	34.2	42.8	<20	43	50	-7
17	Shatin Heights	40.5	49.2	22.6	138.3	<20	41.3	50.3	22.6	50	55	-5
24	Christian Alliance School (Daytime)	53.0	53.1	33.9	61.6	<20	45.4	56.4	33.9	56	60	-4
27	Grandway Garden Block 2	44.3	46.9	33.6	122.6	<20	41.1	49.5	33.6	50	55	-5
27.1		44.3	46.9	33.8	122.6	<20	41.2	49.5	33.8	50	55	-5
27.2		43.9	47.1	34.1	122.6	<20	41.3	49.5	34.1	50	55	-5
27.3		43.6	44.8	34.2	122.6	<20	41.4	48.3	34.2	48	55	-7
28	Grandway Garden Block 3	43.6	45.9	33.1	117.9	<20	41.1	48.7	33.1	49	55	-6
28.1		43.5	46.0	33.3	117.9	<20	41.1	48.7	33.3	49	55	-6
28.2		43.0	46.1	33.5	117.9	<20	41.3	48.7	33.5	49	55	-6
28.3		42.7	44.1	33.7	117.9	<20	41.3	47.6	33.7	48	55	-7
30	Tai On Building	38.6	39.8	34.0	94.5	<20	41.8	45.1	34.0	45	50	-5
32a	Sin Chu Wan Primary School	36.3	36.3	32.1	177.5	<20	40.4	42.9	32.1	43	50	-7
35	Kam Cheong Building	38.6	39.7	34.3	97.1	<20	42.4	45.3	34.3	46	50	-4
38	Wing Fu Bldg	38.6	39.7	34.4	99.2	<20	42.6	45.4	34.4	46	50	-4
40	Moon Wah Bldg	40.1	39.6	34.4	103.5	<20	42.6	45.7	34.4	46	50	-4
41	Lai Sing Mansion	40.3	39.7	34.4	104.7	<20	42.6	45.8	34.4	46	50	-4
42	Man Lai Court Block 1	47.1	48.8	36.6	58.1	<20	44.6	51.9	36.6	52	55	-3
42.1		44.6	49.3	37.4	58.1	<20	45.1	51.6	37.4	52	55	-3
42.2		42.9	49.6	38.1	58.1	<20	45.5	51.7	38.1	52	55	-3
43	Man Lai Court Block 2	47.0	48.8	36.8	54.5	<20	44.8	51.9	36.8	52	55	-3
43.1		45.3	49.3	37.7	54.5	<20	45.4	51.9	37.7	52	55	-3
43.2		44.2	49.8	38.4	54.5	<20	45.8	52.0	38.4	52	55	-3
44	Man Lai Court Block 3	46.6	48.3	36.4	64.2	<20	44.7	51.5	36.4	52	55	-3
44.1		44.4	48.7	37.1	64.2	<20	45.2	51.3	37.1	51	55	-4
44.2		43.5	49.0	37.7	64.2	<20	45.5	51.4	37.7	52	55	-3
44a	Immaculate Heart of Mary School (secondary building)	35.4	38.1	34.3	111.5	<20	45.4	46.5	34.3	47	55	-8
47	Man Lai Court Block 4	44.4	47.7	35.8	78.4	<20	44.5	50.6	35.8	51	60	-9

NSR	Description	Airborne		Structural	Distance	Airborne	Airborne	Total	Total	Total	Criterion	Exceedance
No.	Location / Address	Outboard Leq (dB)	Inboard Leq (dB)	Noise Leq (dB)	(m)	Enclosure Portal Leq (dB)	Aircon. Units Leq (dB)	Airborne Leq (dB)	Structureborne Leq (dB)	Leq (dB)	(dB)	(dB)
47.1		43.6	48.0	36.3	78.4	<20	44.8	50.6	36.3	51	60	-9
47.2		41.6	48.2	36.7	78.4	<20	45.1	50.5	36.7	51	60	-9
47b	Regional Council Heritage Museum	39.4	41.3	30.7	220.8	<20	43.9	46.7	30.7	47	55	-8
49	Lok Sin Tong Chan Cho Chak Primary School*	41.2	53.8	40.4	40.7	22.6	46.7	54.8	40.4	55	55	0
50	Immaculate Heart of Mary School	40.2	44.1	35.0	102.5	<20	45.0	48.3	35.0	49	55	-6
51	Immaculate Heart of Mary College	41.4	53.3	40.5	33.1	23.1	47.7	54.6	40.5	55	55	0
52	Caritas Lok Jun School	40.5	45.1	35.9	91.9	<20	44.9	48.7	35.9	49	55	-6
54	Sha Tin Government Secondary School	40.4	42.7	32.8	141.1	<20	45.5	48.1	32.8	48	55	-7
55	Ming Yan Lau	45.0	48.9	34.5	39.3	25.2	46.5	51.9	34.5	52	55	-3
55.1		45.4	49.3	34.8	39.3	25.0	46.8	52.3	34.8	52	55	-3
55.2		46.4	50.1	35.6	39.3	24.6	47.5	53.1	35.6	53	55	-2
55.3		42.1	50.9	36.5	39.3	24.2	48.2	53.1	36.5	53	55	-2
55.4		38.6	50.6	37.1	39.3	23.8	48.6	52.9	37.1	53	55	-2
57	Ecclesia Bible College	38.5	41.4	32.4	185.9	<20	43.6	46.4	32.4	47	60	-13
58a	Jat Min Chuen, Ming Shun Lau	39.7	48.0	34.1	134.4	23.1	43.0	49.6	34.1	50	55	-5
58a.1		38.9	48.3	34.4	134.4	22.8	43.1	49.8	34.4	50	55	-5
58a.2		38.0	48.5	34.7	134.4	22.5	43.3	50.0	34.7	50	55	-5
58a.3		37.5	45.5	34.9	134.4	22.2	43.4	48.0	34.9	48	55	-7
58a.4		34.2	40.8	35.0	134.4	22.0	43.4	45.6	35.0	46	55	-9
59	Osprey House Sha Kok Estate	37.5	46.0	32.8	88.5	25.0	48.7	50.8	32.8	51	55	-4
59.1		37.0	46.0	33.0	88.5	24.7	49.0	50.9	33.0	51	55	-4
59.2		36.3	44.3	33.1	88.5	24.3	49.1	50.5	33.1	51	55	-4
59a	Jat Min Estate, Ming Yiu Lau	37.3	46.0	32.1	186.5	23.6	42.7	48.1	32.1	48	55	-7
59a.1		36.9	46.2	32.3	186.5	23.3	42.8	48.2	32.3	48	55	-7
59a.2		36.6	45.7	32.4	186.5	23.0	42.9	47.9	32.4	48	55	-7
59a.3		36.1	43.3	32.5	186.5	22.7	43.0	46.6	32.5	47	55	-8
59a.4		32.7	38.8	32.6	186.5	22.4	43.0	44.7	32.6	45	55	-10
61	Sand Martin House Sha Kok Estate	38.8	45.4	33.4	66.1	26.1	49.8	51.4	33.4	51	55	-4
61.1		38.0	45.2	33.6	66.1	25.8	50.1	51.5	33.6	52	55	-3
61.2		37.0	43.7	33.9	66.1	25.3	50.4	51.4	33.9	51	55	-4
63	Oriole House Sha Kok Estate	43.5	46.4	34.5	49.3	26.7	48.8	51.5	34.5	52	60	-8
63.1		40.3	46.1	34.9	49.3	26.4	49.2	51.3	34.9	51	60	-9
63.2		38.5	44.5	35.3	49.3	25.9	49.5	50.9	35.3	51	60	-9
64	Avon Garden Shatin Park	46.9	51.0	37.4	34.0	28.6	46.2	53.4	37.4	53	60	-7
64.1		48.1	52.0	38.6	34.0	28.1	47.1	54.4	38.6	54	60	-6
64.2		44.0	52.8	39.8	34.0	27.5	47.9	54.4	39.8	55	60	-5
65	Ashley Garden Shatin Park	47.9	51.9	38.2	14.9	29.1	46.5	54.2	38.2	54	60	-6
65.1		49.6	53.4	39.9	14.9	28.5	47.8	55.7	39.9	56	60	-4
65.2		51.9	55.3	42.2	14.9	27.9	49.8	57.7	42.2	58	60	-2

NSR No.	Description Location / Address	Airborne		Structural Noise Leq (dB)	Distance (m)	Airborne Enclosure Portal Leq (dB)	Airborne Aircon. Units Leq (dB)	Total Airborne Leq (dB)	Total Structureborne Leq (dB)	Total Leq (dB)	Criterion (dB)	Exceedance (dB)
		Outboard Leq (dB)	Inboard Leq (dB)									
66	Escort Garden Shatin Park	47.5	51.5	37.6	41.3	29.0	45.5	53.6	37.6	54	60	-6
66.1		48.4	52.3	38.7	41.3	28.4	46.3	54.5	38.7	55	60	-5
66.2		43.1	53.0	39.6	41.3	27.8	46.9	54.3	39.6	54	60	-6
67	Greenwood Garden Block A	40.7	47.4	34.0	109.7	28.0	44.1	49.7	34.0	50	60	-10
67.1		40.0	47.6	34.4	109.7	27.5	44.3	49.8	34.4	50	60	-10
67.2		37.5	47.7	34.7	109.7	27.0	44.5	49.7	34.7	50	60	-10
67.3		36.3	45.4	34.9	109.7	26.5	44.6	48.3	34.9	49	60	-11
68	Artland Garden Shatin Park	49.1	53.1	38.9	18.4	29.9	45.8	55.1	38.9	55	60	-5
68.1		50.8	54.6	40.5	18.4	29.3	47.1	56.6	40.5	57	60	-3
68.2		52.9	56.4	42.5	18.4	28.6	48.7	58.5	42.5	59	60	-1
68a	Tin Ka Ping Kindergarden	33.6	39.1	34.9	72.3	23.5	47.3	48.1	34.9	48	60	-12
69	Iris Garden Shatin Park	48.1	52.1	38.0	40.0	29.4	45.3	54.1	38.0	54	60	-6
69.1		49.0	53.0	39.1	40.0	28.8	46.1	55.1	39.1	55	60	-5
69.2		43.5	53.8	40.1	40.0	28.2	46.7	54.9	40.1	55	60	-5
76	Green Leave Garden Block A	51.8	55.6	40.1	43.1	31.8	45.4	57.4	40.1	58	60	-2
76.1		52.4	56.3	40.7	43.1	31.4	45.8	58.1	40.7	58	60	-2
76.2		51.8	57.2	41.7	43.1	30.6	46.3	58.6	41.7	59	60	-1
76a	Sha Kok Estate Food Stalls	31.2	35.9	35.4	46.0	24.2	51.1	51.3	35.4	51	60	-9
77	Toi Shan Association College	38.2	47.1	36.7	106.2	28.3	43.5	49.1	36.7	49	60	-11
78	Green Leave Block B	49.8	53.7	38.1	45.4	33.4	44.3	55.5	38.1	56	60	-4
78.1		51.2	55.1	39.5	45.4	32.7	45.2	56.9	39.5	57	60	-3
78.2		51.8	56.1	40.6	45.4	31.9	45.8	57.8	40.6	58	60	-2
78.3		50.5	56.8	41.4	45.4	31.1	46.3	58.0	41.4	58	60	-2
79	Pamela Youde Child Assessment Centre and School Dental Clinic	41.0	47.4	40.3	21.7	34.1	50.3	52.4	40.3	53	55	-2
80	Pamela Youde Child Assessment Centre and School Dental Clinic	40.3	45.4	39.8	15.8	34.9	51.8	53.0	39.8	53	55	-2
81	Yue Sui House Yue Tin Court	44.7	48.8	34.4	30.9	42.7	48.6	52.5	34.4	53	55	-2
81.1		45.0	49.3	35.1	30.9	42.7	49.7	53.2	35.1	54	55	-1
81.2		45.4	48.5	35.8	30.9	37.7	50.8	53.5	35.8	54	55	-1
81.3		41.0	47.8	36.7	30.9	36.4	51.7	53.4	36.7	54	55	-1
82	Yue Kwan House Yue Tin Court	43.4	47.4	33.5	36.2	43.4	48.4	51.7	33.5	52	55	-3
82.1		43.4	47.8	34.0	36.2	43.5	49.6	52.4	34.0	53	55	-2
82.2		43.7	47.9	34.6	36.2	43.5	50.7	53.1	34.6	54	55	-1
82.3		43.9	47.3	35.2	36.2	38.4	52.0	53.7	35.2	54	55	-1
82.4		39.5	46.7	36.0	36.2	37.0	53.0	54.1	36.0	54	55	-1
83	Yue Yuet House Yue Tin Court	41.8	46.1	32.9	77.5	44.3	47.7	50.6	32.9	52	55	-3
83.1		41.8	45.9	33.2	77.5	39.6	48.5	51.0	33.2	51	55	-4
83.2		40.7	45.7	33.5	77.5	39.0	49.3	51.2	33.5	52	55	-3
83.3		38.0	45.3	33.8	77.5	37.8	49.9	51.4	33.8	52	55	-3

NSR No.	Description Location / Address	Airborne Outboard Leq (dB)	Airborne Inboard Leq (dB)	Structural Noise Leq (dB)	Distance (m)	Airborne Enclosure Portal Leq (dB)	Airborne Aircon. Units Leq (dB)	Total Airborne Leq (dB)	Total Structureborne Leq (dB)	Total Leq (dB)	Criterion (dB)	Exceedance (dB)
83.4		35.5	44.7	34.0	77.5	36.5	50.3	51.5	34.0	52	55	-3
84	Yue Yat House Yue Tin Court	41.4	45.6	32.9	85.6	45.2	47.4	50.3	32.9	51	55	-4
84.1		41.2	45.1	33.2	85.6	40.5	48.2	50.5	33.2	51	55	-4
84.2		39.8	45.0	33.5	85.6	39.7	48.8	50.7	33.5	51	55	-4
84.3		37.5	44.6	33.7	85.6	38.5	49.3	50.8	33.7	51	55	-4
84.4		35.3	43.6	33.9	85.6	37.1	49.7	50.8	33.9	51	55	-4
85	Yow Kam Yuen Prevocational School	41.7	45.2	37.8	24.7	41.9	52.1	53.3	37.8	54	60	-6
85a	Greenwood Garden	43.3	48.2	34.6	97.0	28.4	44.1	50.5	34.6	51	60	-9
85a.1		41.4	48.5	35.0	97.0	27.9	44.4	50.5	35.0	51	60	-9
85a.2		38.6	48.7	35.4	97.0	27.4	44.6	50.4	35.4	51	60	-9
85a.3		37.2	47.0	35.7	97.0	26.9	44.7	49.3	35.7	50	60	-10
85a.4		33.5	40.3	35.8	97.0	26.4	44.8	46.3	35.8	47	60	-13
86	Yue Chak House Yue Tin Court	40.5	44.5	32.7	121.4	40.7	46.1	49.1	32.7	50	55	-5
86.1		39.2	44.4	32.9	121.4	40.0	46.6	49.1	32.9	50	55	-5
86.2		37.3	44.3	33.1	121.4	38.9	47.0	49.2	33.1	50	55	-5
86.3		36.6	43.7	33.2	121.4	37.7	47.2	49.1	33.2	49	55	-6
86.4		34.6	41.0	33.3	121.4	36.5	47.4	48.5	33.3	49	55	-6
87	Lam Kau Mow Secondary School	41.0	46.9	39.0	32.6	44.7	49.2	51.7	39.0	53	60	-7
87a	Chuen Fai Centre	41.6	49.6	35.7	98.3	28.4	43.7	51.1	35.7	51	60	-9
87a.1		39.6	49.8	36.0	98.3	27.9	43.9	51.1	36.0	51	60	-9
87a.2		38.6	45.7	36.3	98.3	27.4	44.0	48.4	36.3	49	60	-11
87a.3		34.5	40.0	36.3	98.3	26.8	44.0	45.8	36.3	46	60	-14
88	City One Sha Tin Block 45	42.3	45.9	35.4	86.8	50.8	45.2	49.6	35.4	53	55	-2
88.1		42.4	45.1	35.8	86.8	46.2	45.5	49.4	35.8	51	55	-4
88.2		39.6	44.9	36.2	86.8	45.2	45.8	49.1	36.2	51	55	-4
88.3		38.5	44.7	36.5	86.8	43.4	46.1	49.0	36.5	50	55	-5
88.4		36.9	42.9	36.7	86.8	41.7	46.2	48.4	36.7	49	55	-6
89	City One Sha Tin Block 37	41.4	44.6	34.6	109.1	44.7	45.0	48.8	34.6	50	55	-5
89.1		39.1	44.4	34.8	109.1	44.1	45.3	48.5	34.8	50	55	-5
89.2		38.4	44.0	35.1	109.1	42.8	45.5	48.5	35.1	50	55	-5
89.3		37.3	43.8	35.3	109.1	41.3	45.7	48.4	35.3	49	55	-6
89.4		36.2	40.6	35.5	109.1	39.9	45.8	47.5	35.5	48	55	-7
90	City One Sha Tin Block 36	43.0	46.3	36.7	69.0	52.8	45.0	49.9	36.7	55	55	0
90.1		43.4	46.6	37.2	69.0	53.3	45.4	50.2	37.2	55	55	0
90.2		43.1	46.0	37.8	69.0	48.6	45.7	50.1	37.8	52	55	-3
90.3		39.8	46.0	38.4	69.0	46.6	46.1	49.8	38.4	52	55	-3
90.4		38.0	45.3	38.7	69.0	44.4	46.3	49.5	38.7	51	55	-4
90a	Caritus H W.Lee Care & Attension Centre	40.5	44.1	41.0	45.0	28.8	45.9	48.8	41.0	50	55	-5
91	City One Sha Tin Block 34	42.0	45.2	36.6	102.2	52.8	44.1	48.9	36.6	54	55	-1
91.1		39.9	44.9	37.0	102.2	48.0	44.3	48.5	37.0	51	55	-4

NSR No.	Description Location / Address	Airborne		Structural Noise Leq (dB)	Distance (m)	Airborne Enclosure Portal Leq (dB)	Airborne Aircon. Units Leq (dB)	Total Airborne Leq (dB)	Total Structureborne Leq (dB)	Total Leq (dB)	Criterion (dB)	Exceedance (dB)
		Outboard Leq (dB)	Inboard Leq (dB)									
91.2		39.3	44.7	37.5	102.2	46.7	44.5	48.5	37.5	51	55	-4
91.3		38.4	44.5	37.9	102.2	44.8	44.6	48.4	37.9	50	55	-5
91.4		37.5	41.9	38.2	102.2	43.1	44.7	47.5	38.2	49	55	-6
91a	Springfield Garden	45.4	51.5	36.6	108.2	30.6	43.3	53.0	36.6	53	55	-2
91a.1		44.2	51.8	37.0	108.2	29.9	43.4	53.0	37.0	53	55	-2
91a.2		43.9	49.1	37.2	108.2	29.3	43.5	51.1	37.2	51	55	-4
91a.3		38.2	42.4	37.2	108.2	28.7	43.5	46.7	37.2	47	55	-8
92	City One Sha Tin Block 32	42.2	45.4	39.0	88.0	50.7	44.4	49.1	39.0	53	55	-2
92.1		40.2	45.1	39.7	88.0	49.7	44.5	48.6	39.7	52	55	-3
92.2		39.2	44.8	40.4	88.0	47.0	44.7	48.4	40.4	51	55	-4
92.3		38.2	42.0	40.9	88.0	44.1	44.7	47.2	40.9	50	55	-5
93	City One Sha Tin Block 33	43.3	46.2	40.4	67.2	56.8	44.8	49.7	40.4	58	60	-2
93.1		43.5	46.2	41.7	67.2	57.9	45.0	49.8	41.7	59	60	-1
93.2		40.7	45.1	43.0	67.2	51.0	45.2	48.9	43.0	54	60	-6
93.3		39.5	43.6	43.9	67.2	46.9	45.3	48.2	43.9	51	60	-9
94	City One Sha Tin Block 28	43.8	46.6	39.8	43.4	55.0	45.6	50.6	39.8	56	60	-4
94.1		44.3	46.9	41.0	43.4	55.7	46.0	51.1	41.0	57	60	-3
94.2		41.8	45.6	42.2	43.4	50.0	46.5	50.7	42.2	53	60	-7
94.3		40.0	45.0	43.1	43.4	47.7	46.7	50.6	43.1	52	60	-8
95	City One Sha Tin Block 27	40.7	44.6	37.2	101.3	46.7	44.7	48.7	37.2	51	55	-4
95.1		40.2	44.3	37.7	101.3	45.3	44.8	48.6	37.7	50	55	-5
95.2		39.6	43.6	38.1	101.3	43.7	45.0	48.4	38.1	50	55	-5
95.3		38.9	41.7	38.3	101.3	42.3	45.1	47.8	38.3	49	55	-6
95a	SPGE Kwan Fong Nim Chee Home for the Elderly	39.3	45.7	37.4	62.3	33.2	47.3	49.9	37.4	50	55	-5
96	Garden Vista Block C	42.6	45.9	29.4	284.3	27.7	38.8	48.1	29.4	48	60	-12
96.1		42.3	44.6	29.4	284.3	27.3	38.8	47.3	29.4	47	60	-13
96.2		41.9	43.4	29.5	284.3	27.0	38.8	46.5	29.5	47	60	-13
97	Garden Vista Block F	43.3	47.3	29.4	243.4	27.2	38.9	49.2	29.4	49	60	-11
97.1		42.9	45.9	29.4	243.4	26.9	38.9	48.2	29.4	48	60	-12
97.2		42.6	44.3	29.4	243.4	26.6	38.8	47.2	29.4	47	60	-13
98	Garden Vista Block E	43.2	47.4	28.8	248.8	26.8	38.6	49.2	28.8	49	60	-11
98.1		42.8	45.7	28.8	248.8	26.4	38.6	48.0	28.8	48	60	-12
98.2		42.4	44.3	28.8	248.8	26.1	38.5	47.1	28.8	47	60	-13
99	Garden Vista Block D	43.6	48.2	28.6	227.1	26.5	38.7	49.9	28.6	50	60	-10
99.1		43.2	46.4	28.7	227.1	26.2	38.7	48.6	28.7	49	60	-11
99.2		42.8	44.8	28.7	227.1	25.9	38.6	47.5	28.7	48	60	-12
100	Abbey Court Pictorial Garden	44.8	52.3	28.4	199.7	26.7	39.0	53.2	28.4	53	60	-7
100.1		44.2	49.4	28.5	199.7	26.3	39.0	50.9	28.5	51	60	-9
100.2		43.8	47.7	28.5	199.7	26.0	39.0	49.6	28.5	50	60	-10

NSR No.	Description Location / Address	Airborne		Structural	Distance	Airborne	Airborne	Total	Total	Total	Criterion	Exceedance
		Outboard Leq (dB)	Inboard Leq (dB)	Noise Leq (dB)	(m)	Enclosure Portal Leq (dB)	Aircon. Units Leq (dB)	Airborne Leq (dB)	Structureborne Leq (dB)	Leq (dB)	(dB)	(dB)
100.3		43.4	45.6	28.5	199.7	25.7	38.8	48.2	28.5	48	60	-12
101	Belleve Court Pictorial Garden	45.4	52.6	28.2	181.7	26.6	39.2	53.5	28.2	54	60	-6
101.1		44.7	51.7	28.3	181.7	26.2	39.2	52.7	28.3	53	60	-7
101.2		44.2	48.6	28.3	181.7	25.9	39.2	50.3	28.3	50	60	-10
101.3		43.8	46.3	28.3	181.7	25.6	39.0	48.7	28.3	49	60	-11
102	Capilano Court Pictorial Garden	46.1	53.0	27.9	163.9	26.4	39.4	54.0	27.9	54	60	-6
102.1		45.4	53.2	28.0	163.9	26.0	39.4	54.0	28.0	54	60	-6
102.2		44.8	49.6	28.0	163.9	25.7	39.4	51.1	28.0	51	60	-9
102.3		44.2	47.1	28.0	163.9	25.4	39.1	49.3	28.0	49	60	-11
103	Galaxy Court Pictorial Garden	47.0	53.7	27.7	141.9	26.1	39.8	54.7	27.7	55	60	-5
103.1		46.3	53.8	27.7	141.9	25.8	39.9	54.7	27.7	55	60	-5
103.2		45.7	50.9	27.8	141.9	25.5	39.7	52.3	27.8	52	60	-8
103.3		44.9	48.1	27.8	141.9	25.2	39.4	50.2	27.8	50	60	-10
103a	Sunshine Grove	41.5	45.5	33.2	84.6	46.7	46.6	49.9	33.2	52	55	-3
103a.1		41.5	45.5	33.5	84.6	46.9	47.2	50.2	33.5	52	55	-3
103a.2		41.4	44.8	33.8	84.6	41.8	47.8	50.2	33.8	51	55	-4
103a.3		38.3	44.4	34.1	84.6	40.7	48.4	50.2	34.1	51	55	-4
103a.4		37.2	44.0	34.3	84.6	39.2	48.7	50.3	34.3	51	55	-4
103a.5		34.7	41.0	34.5	84.6	37.7	48.9	49.7	34.5	50	55	-5
103b	Sunshine Grove	41.7	45.5	33.7	84.6	47.8	46.0	49.6	33.7	52	55	-3
103b.1		41.8	45.6	34.0	84.6	48.1	46.6	49.9	34.0	52	55	-3
103b.2		41.7	44.7	34.4	84.6	43.1	47.0	49.8	34.4	51	55	-4
103b.3		38.7	44.3	34.7	84.6	41.9	47.5	49.6	34.7	50	55	-5
103b.4		37.0	43.9	34.9	84.6	40.3	47.8	49.6	34.9	50	55	-5
103b.5		35.2	40.7	35.0	84.6	38.7	47.9	49.0	35.0	49	55	-6
104	Forum Court Pictorial Garden	47.9	54.0	27.5	129.5	25.9	40.0	55.1	27.5	55	60	-5
104.1		47.0	54.0	27.5	129.5	25.7	40.2	55.0	27.5	55	60	-5
104.2		46.2	52.6	27.5	129.5	25.4	40.0	53.7	27.5	54	60	-6
104.3		45.5	48.9	27.5	129.5	25.1	39.6	50.9	27.5	51	60	-9
105	Elegant Court Pictorial Garden	49.4	54.7	27.2	108.2	25.8	40.4	56.0	27.2	56	60	-4
105.1		48.6	54.5	27.2	108.2	25.5	40.7	55.6	27.2	56	60	-4
105.2		47.8	54.5	27.2	108.2	25.2	40.5	55.5	27.2	56	60	-4
105.3		46.5	50.7	27.2	108.2	24.9	40.4	52.4	27.2	52	60	-8
106	Dragon Court Pictorial Garden	50.8	56.0	26.8	92.4	25.6	40.8	57.3	26.8	57	60	-3
106.1		49.9	54.9	26.9	92.4	25.4	41.1	56.2	26.9	56	60	-4
106.2		48.8	54.6	26.9	92.4	25.1	41.4	55.8	26.9	56	60	-4
106.3		47.6	51.8	26.9	92.4	24.8	40.8	53.4	26.9	53	60	-7
107	Hillview Court Pictorial Garden	49.8	54.2	26.3	98.7	25.2	40.7	55.7	26.3	56	60	-4
107.1		48.5	53.7	26.3	98.7	24.7	41.1	55.0	26.3	55	60	-5
107.2		47.4	51.1	26.3	98.7	24.5	40.3	52.9	26.3	53	60	-7

NSR No.	Description Location / Address	Airborne		Structural Noise Leq (dB)	Distance (m)	Airborne Enclosure Portal Leq (dB)	Airborne Aircon. Units Leq (dB)	Total Airborne Leq (dB)	Total Structureborne Leq (dB)	Total Leq (dB)	Criterion (dB)	Exceedance (dB)
		Outboard Leq (dB)	Inboard Leq (dB)									
108	Iris Court Pictorial Garden	51.2	55.9	26.0	83.7	25.0	41.1	57.3	26.0	57	60	-3
108.1		49.5	53.7	26.0	83.7	24.6	41.7	55.3	26.0	55	60	-5
108.2		48.4	51.9	26.0	83.7	24.3	40.8	53.7	26.0	54	60	-6
109	Juniper Court Pictorial Garden	53.8	58.7	25.6	51.9	24.9	42.1	60.0	25.6	60	60	0
109.1		52.4	56.7	25.6	51.9	24.5	43.0	58.2	25.6	58	60	-2
109.2		50.6	53.8	25.7	51.9	24.2	42.6	55.7	25.7	56	60	-4
122	Residential Development, R(A), to the north east of Chevalier Garden	53.1	54.2	29.3	75.1	28.0	43.8	56.9	29.3	57	60	-3
122.1		49.4	54.7	29.6	75.1	27.3	44.3	56.2	29.6	56	60	-4
122.2		47.6	55.3	29.8	75.1	26.7	44.7	56.3	29.8	56	60	-4
122.3		45.9	55.4	30.0	75.1	26.1	45.1	56.2	30.0	56	60	-4
122.4		44.7	49.8	30.1	75.1	24.4	45.3	52.0	30.1	52	60	-8
124	Residential Development in the south of Area 77, R(B)2	44.0	48.5	34.9	81.8	37.9	46.8	51.6	34.9	52	60	-8
124.1		43.7	48.2	35.4	81.8	38.0	47.4	51.6	35.4	52	60	-8
124.2		41.8	47.6	35.8	81.8	33.8	47.9	51.3	35.8	51	60	-9
124.3		40.9	47.1	36.1	81.8	32.9	48.2	51.2	36.1	51	60	-9
124.4		39.0	43.9	36.3	81.8	30.5	48.4	50.1	36.3	50	60	-10
126	Residential Development in the north of Area 77, R(B)2	42.8	46.8	38.8	49.9	52.0	43.9	50.0	38.8	54	55	-1
126.1		43.4	47.3	39.9	49.9	53.4	44.3	50.6	39.9	55	55	0
126.2		42.8	47.5	40.9	49.9	49.8	44.7	50.8	40.9	53	55	-2
126.3		38.8	47.7	41.9	49.9	47.8	45.0	50.8	41.9	52	55	-3
126.4		34.8	41.9	42.4	49.9	46.2	45.0	48.8	42.4	50	55	-5
129	G/IC site to the south of Vista Paradise	37.1	44.4	35.8	33.3	35.4	54.6	55.1	35.8	55	55	0
130	Vista Paradise	42.3	46.4	34.0	44.0	38.4	47.0	50.5	34.0	51	55	-4
130.1		43.1	47.0	34.6	44.0	38.4	47.8	51.2	34.6	51	55	-4
130.2		43.7	47.5	35.2	44.0	34.1	48.5	51.8	35.2	52	55	-3
130.3		40.3	45.9	35.9	44.0	33.2	49.2	51.2	35.9	51	55	-4
130.4		35.9	43.3	36.3	44.0	32.1	49.5	50.6	36.3	51	55	-4
134	Toi Shan Association Wong Tat To Memorial School	36.2	46.6	37.2	66.7	30.3	46.1	49.6	37.2	50	55	-5
137	The Waterside	45.7	49.9	36.2	46.3	32.8	43.6	52.0	36.2	52	55	-3
137.1		46.5	50.9	37.2	46.3	32.8	44.3	52.9	37.2	53	55	-2
137.2		47.4	51.9	38.1	46.3	32.8	44.9	53.8	38.1	54	55	-1
137.3		43.2	52.6	39.1	46.3	32.7	45.6	53.8	39.1	54	55	-1
137.4		38.6	47.0	39.7	46.3	28.8	45.8	49.8	39.7	50	55	-5
143	Fok On Garden	44.4	48.2	34.1	34.4	32.0	45.0	51.0	34.1	51	55	-4
143.1		45.5	49.2	34.8	34.4	32.0	45.8	51.9	34.8	52	55	-3
143.2		46.7	50.1	35.6	34.4	32.0	46.6	52.9	35.6	53	55	-2
143.3		48.0	48.0	36.6	34.4	32.0	47.5	52.6	36.6	53	55	-2

NSR No.	Description Location / Address	Airborne		Structural Noise Leq (dB)	Distance (m)	Airborne Enclosure Portal Leq (dB)	Airborne Aircon. Units Leq (dB)	Total Airborne Leq (dB)	Total Structureborne Leq (dB)	Total Leq (dB)	Criterion (dB)	Exceedance (dB)
		Outboard Leq (dB)	Inboard Leq (dB)									
143.4		41.9	46.2	37.4	34.4	32.0	48.0	50.8	37.4	51	55	-4
143a	Residential Development to the East of Vista Paradise (WIP)	34.0	41.9	31.8	189.5	33.4	44.3	46.6	31.8	47	55	-8
143a.1		33.3	41.8	31.9	189.5	32.8	44.5	46.7	31.9	47	55	-8
143a.2		32.9	40.7	32.0	189.5	32.2	44.7	46.4	32.0	47	55	-8
143a.3		31.4	38.6	32.1	189.5	31.7	44.8	46.0	32.1	46	55	-9
143a.4		29.0	34.8	32.1	189.5	31.3	44.7	45.3	32.1	46	55	-9
144	Tolo Place	43.2	47.1	33.4	25.5	31.8	46.4	50.6	33.4	51	55	-4
144.1		44.2	47.9	34.2	25.5	31.8	47.4	51.6	34.2	52	55	-3
144.2		45.4	48.8	35.1	25.5	31.8	48.4	52.5	35.1	53	55	-2
144.3		46.8	48.8	36.2	25.5	31.8	49.5	53.3	36.2	53	55	-2
144.4		43.8	45.7	37.5	25.5	31.8	50.4	52.4	37.5	53	55	-2
148a	Chun Dak House	45.2	49.8	36.3	35.6	33.8	43.3	51.8	36.3	52	55	-3
148a.1		46.2	50.8	37.2	35.6	33.8	44.0	52.7	37.2	53	55	-2
148a.2		45.9	51.9	38.3	35.6	33.8	44.7	53.5	38.3	54	55	-1
148a.3		45.8	53.2	39.5	35.6	33.8	45.6	54.5	39.5	55	55	0
148a.4		42.9	54.3	40.8	35.6	29.8	46.4	55.2	40.8	55	55	0
148a 5		36.6	42.4	41.5	35.6	28.7	44.2	46.9	41.5	48	55	-7
150	Bayshore Towers Block 5	42.3	46.1	33.2	45.9	31.5	47.6	50.6	33.2	51	55	-4
150.1		43.0	46.6	33.9	45.9	31.5	48.9	51.5	33.9	52	55	-3
150.2		42.7	45.5	34.7	45.9	31.5	49.8	51.8	34.7	52	55	-3
150.3		40.1	44.8	35.3	45.9	31.5	50.5	51.8	35.3	52	55	-3
151	Bayshore Towers Block 4	41.9	45.8	33.1	41.2	31.5	48.1	50.8	33.1	51	55	-4
151 1		42.6	46.3	33.9	41.2	31.5	49.5	51.8	33.9	52	55	-3
151.2		43.2	45.5	34.6	41.2	31.5	50.6	52.4	34.6	52	55	-3
151.3		40.1	45.0	35.3	41.2	31.5	51.4	52.6	35.3	53	55	-2
154	Bayshore Towers Block 3	41.4	45.3	33.0	39.5	31.3	48.3	50.6	33.0	51	60	-9
154.1		41.9	45.7	33.6	39.5	31.4	49.8	51.7	33.6	52	60	-8
154.2		42.4	44.9	34.3	39.5	31.4	51.0	52.4	34.3	52	60	-8
154.3		39.2	44.3	34.9	39.5	31.4	51.8	52.8	34.9	53	60	-7
154a	Chung On Estate, Chung Kwan House	40.1	46.6	33.3	134.2	32.2	41.6	48.5	33.3	49	55	-6
154a.1		38.0	46.7	33.7	134.2	28.3	41.8	48.4	33.7	49	55	-6
154a 2		36.4	46.6	33.9	134.2	27.9	41.9	48.2	33.9	48	55	-7
154a.3		34.4	46.0	34.1	134.2	27.5	42.1	47.7	34.1	48	55	-7
154a.4		32.7	41.3	34.3	134.2	27.0	42.0	45.0	34.3	45	55	-10
156	Ma On Shan Centre Block 1	41.8	45.8	33.2	21.3	31.4	46.8	50.1	33.2	50	60	-10
156 1		42.6	46.5	33.9	21.3	31.4	48.0	51.0	33.9	51	60	-9
156.2		43.5	47.2	34.7	21.3	31.4	49.2	52.0	34.7	52	60	-8
156 3		44.7	48.0	35.8	21.3	31.4	50.5	53.1	35.8	53	60	-7
156 4		42.6	44.9	37.3	21.3	31.4	51.8	53.1	37.3	53	60	-7

NSR No.	Description Location / Address	Airborne		Structural Noise Leq (dB)	Distance (m)	Airborne Enclosure Portal Leq (dB)	Airborne Aircon. Units Leq (dB)	Total Airborne Leq (dB)	Total Structureborne Leq (dB)	Total Leq (dB)	Criterion (dB)	Exceedance (dB)
		Outboard Leq (dB)	Inboard Leq (dB)									
156a	The Waterside	43.7	47.7	33.8	71.6	32.3	43.1	50.1	33.8	50	55	-5
156a.1		44.4	48.3	34.4	71.6	32.3	43.5	50.7	34.4	51	55	-4
156a.2		45.1	48.8	34.9	71.6	32.3	43.9	51.3	34.9	51	55	-4
156a.3		43.2	48.1	35.5	71.6	32.3	44.3	50.5	35.5	51	55	-4
156a.4		40.2	48.0	36.0	71.6	32.3	44.7	50.1	36.0	50	55	-5
156a.5		37.2	44.9	36.3	71.6	32.3	44.8	48.2	36.3	49	55	-6
157	Bayshore Towers Block 2	41.5	45.4	33.1	43.2	31.3	47.8	50.4	33.1	51	60	-9
157.1		42.1	45.9	33.8	43.2	31.3	49.1	51.4	33.8	51	60	-9
157.2		42.7	44.5	34.4	43.2	31.3	50.1	51.8	34.4	52	60	-8
157.3		39.0	44.1	35.1	43.2	31.3	50.9	51.9	35.1	52	60	-8
158	Ma On Shan Centre Block 2	42.3	46.3	33.5	20.5	31.4	46.2	50.0	33.5	50	60	-10
158.1		43.2	47.0	34.2	20.5	31.4	47.1	50.9	34.2	51	60	-9
158.2		44.2	47.9	35.0	20.5	31.4	48.2	51.9	35.0	52	60	-8
158.3		45.6	48.8	36.1	20.5	31.4	49.4	53.0	36.1	53	60	-7
158.4		43.6	44.7	37.5	20.5	31.4	50.7	52.3	37.5	52	60	-8
161	Villa Athena Block 1	45.0	48.7	36.6	45.6	31.8	44.9	51.4	36.6	52	55	-3
161.1		45.7	49.3	37.2	45.6	31.8	45.4	52.0	37.2	52	55	-3
161.2		42.1	49.4	38.1	45.6	31.8	46.1	51.6	38.1	52	55	-3
161.3		37.6	49.5	38.8	45.6	31.8	46.5	51.5	38.8	52	55	-3
162	Villa Athena Block 2	45.3	49.0	37.0	46.7	32.0	44.6	51.5	37.0	52	55	-3
162.1		46.0	49.6	37.6	46.7	32.0	45.1	52.1	37.6	52	55	-3
162.2		42.2	50.0	38.5	46.7	32.0	45.8	51.9	38.5	52	55	-3
162.3		37.7	49.4	39.2	46.7	32.0	46.2	51.3	39.2	52	55	-3
163	Villa Athena Block 5	47.4	50.0	38.9	29.5	33.7	44.4	52.7	38.9	53	55	-2
163.1		48.3	50.8	39.8	29.5	33.8	45.2	53.5	39.8	54	55	-1
163.2		49.6	52.0	41.2	29.5	33.8	46.3	54.7	41.2	55	55	0
163.3		41.6	52.4	42.4	29.5	33.8	47.1	53.9	42.4	54	55	-1
164	Villa Athena Block 3	45.7	49.3	37.4	44.4	32.2	44.5	51.8	37.4	52	55	-3
164.1		46.4	49.9	38.1	44.4	32.2	45.0	52.4	38.1	53	55	-2
164.2		43.0	50.5	39.0	44.4	32.2	45.8	52.4	39.0	53	55	-2
164.3		38.1	50.0	39.8	44.4	32.2	46.2	51.8	39.8	52	55	-3
165	Villa Athena Block 4	46.1	49.5	37.8	40.7	32.5	44.4	52.0	37.8	52	55	-3
165.1		46.9	50.2	38.5	40.7	32.5	45.0	52.7	38.5	53	55	-2
165.2		44.1	51.1	39.6	40.7	32.5	45.9	52.9	39.6	53	55	-2
165.3		39.0	50.7	40.4	40.7	32.5	46.3	52.3	40.4	53	55	-2
166	Villa Athena Block 6	47.4	49.8	38.9	34.9	34.3	44.2	52.5	38.9	53	55	-2
166.1		48.2	50.6	39.7	34.9	34.3	44.9	53.3	39.7	53	55	-2
166.2		48.7	51.5	40.9	34.9	34.3	45.9	54.1	40.9	54	55	-1
166.3		40.3	49.2	41.9	34.9	34.3	46.4	51.5	41.9	52	55	-3
167	Ma On Shan Centre Block 4	42.0	45.9	33.5	79.2	31.4	44.0	49.0	33.5	49	60	-11

NSR No.	Description Location / Address	Airborne Outboard Leq (dB)	Airborne Inboard Leq (dB)	Structural Noise Leq (dB)	Distance (m)	Airborne Enclosure Portal Leq (dB)	Airborne Aircon. Units Leq (dB)	Total Airborne Leq (dB)	Total Structureborne Leq (dB)	Total Leq (dB)	Criterion (dB)	Exceedance (dB)
167.1		42.5	45.4	34.0	79.2	31.4	44.5	49.1	34.0	49	60	-11
167.2		39.8	45.1	34.3	79.2	31.4	44.9	48.7	34.3	49	60	-11
167.3		37.5	44.8	34.7	79.2	31.4	45.3	48.5	34.7	49	60	-11
167.4		35.6	44.3	34.9	79.2	31.4	45.5	48.2	34.9	48	60	-12
168	Villa Athena Block 7	47.2	49.7	38.8	43.1	34.9	44.0	52.4	38.8	53	55	-2
168.1		47.8	50.3	39.5	43.1	34.9	44.6	53.0	39.5	53	55	-2
168.2		44.0	51.0	40.5	43.1	35.0	45.4	52.8	40.5	53	55	-2
168.3		39.0	46.4	41.2	43.1	35.0	45.7	49.6	41.2	50	55	-5
170	Villa Athena Block 8	46.9	49.5	38.7	52.6	35.6	43.7	52.2	38.7	52	55	-3
170.1		47.2	50.0	39.3	52.6	35.6	44.2	52.6	39.3	53	55	-2
170.2		42.0	50.5	40.0	52.6	35.7	44.8	52.1	40.0	52	55	-3
170.3		37.8	44.8	40.5	52.6	35.7	44.9	48.5	40.5	49	55	-6
171	Villa Athena Block 9	46.3	49.2	38.4	65.1	36.4	43.3	51.8	38.4	52	55	-3
171.1		42.9	49.7	38.9	65.1	36.5	43.6	51.4	38.9	52	55	-3
171.2		40.1	49.9	39.4	65.1	36.5	44.1	51.4	39.4	52	55	-3
171.3		36.7	43.1	39.7	65.1	36.6	44.1	47.4	39.7	48	55	-7
173	Villa Athena Block 10	44.9	49.3	38.2	76.5	37.3	42.8	51.5	38.2	52	55	-3
173.1		41.7	49.7	38.6	76.5	37.4	43.2	51.3	38.6	52	55	-3
173.2		38.8	49.8	39.0	76.5	37.5	43.5	51.2	39.0	51	55	-4
173.3		36.2	42.6	39.2	76.5	37.5	43.4	46.9	39.2	48	55	-7
174	Wu Kai Sha New Village nos.1-12	33.3	37.4	40.4	69.5	44.1	41.2	46.7	40.4	48	50	-2
176	Wu Kai Sha New Village nos.13-19A	36.2	40.5	41.5	110.9	29.8	40.4	44.4	41.5	46	50	-4
177	Lok Wo Sha nos.29-30	38.0	43.4	39.7	94.4	42.8	42.9	48.2	39.7	49	50	-1
178	Symphony Bay	44.6	44.6	34.8	90.5	34.6	41.0	48.7	34.8	49	50	-1
178.1		44.9	44.9	35.3	90.5	34.8	41.7	49.0	35.3	49	50	-1
178.2		45.3	45.3	35.6	90.5	34.9	42.3	49.4	35.6	50	50	0
178.3		42.7	42.7	35.9	90.5	34.9	43.1	47.8	35.9	48	50	-2
178.4		38.5	38.5	36.0	90.5	34.9	45.6	47.3	36.0	48	50	-2

Tai Wai to Ma On Shan Rail
Revenue Trains - Up

NSR No.	Description Location / Address	Airborne		Structural Noise Leq (dB)	Distance (m)	Airborne Enclosure Portal Leq (dB)	Airborne Aircon. Units Leq (dB)	Total Airborne Leq (dB)	Total Structureborne Leq (dB)	Total Leq (dB)	Criterion (dB)	Exceedance (dB)
		Outboard Leq (dB)	Inboard Leq (dB)									
1	Hing Tak House Hin Keng Estate	37.1	40.7	<20	237.3	<20	36.1	43.2	<20	43	50	-7
1.1		34.3	40.3	<20	237.3	<20	36.2	42.5	<20	43	50	-7
1.2		33.2	39.9	<20	237.3	<20	36.3	42.1	<20	42	50	-8
1.3		32.4	35.4	<20	237.3	<20	36.3	39.8	<20	40	50	-10
2	Hin Tin 64	32.2	33.3	<20	219.8	<20	37.2	39.6	<20	40	50	-10
10	Hing Yeung House Hin Keng Estate	38.2	45.8	20.4	162.5	<20	40.7	47.5	20.4	47	50	-3
10.1		37.8	45.9	20.4	162.5	<20	41.0	47.6	20.4	48	50	-2
10.2		37.4	45.5	20.4	162.5	<20	41.2	47.3	20.4	47	50	-3
10.3		37.2	40.2	20.4	162.5	<20	41.4	44.7	20.4	45	50	-5
10.4		37.0	38.2	20.4	162.5	<20	41.5	44.1	20.4	44	50	-6
13	Hing Tak House Hin Keng Estate	38.8	45.5	21.5	181.2	<20	40.4	47.3	21.5	47	50	-3
13.1		38.7	45.4	21.6	181.2	<20	40.6	47.2	21.6	47	50	-3
13.2		38.6	42.0	21.6	181.2	<20	40.7	45.4	21.6	45	50	-5
13.3		38.5	40.7	21.6	181.2	<20	40.9	44.9	21.6	45	50	-5
13.4		38.4	39.7	21.6	181.2	<20	40.9	44.6	21.6	45	50	-5
14	Carmel Alison Lam Primary School	39.5	45.0	22.3	195.3	<20	40.1	47.1	22.3	47	50	-3
14.1		39.5	44.5	22.4	195.3	<20	40.3	46.8	22.4	47	50	-3
14.2		39.5	41.9	22.4	195.3	<20	40.5	45.5	22.4	46	50	-4
14.3		39.6	41.0	22.4	195.3	<20	40.6	45.2	22.4	45	50	-5
14.4		39.6	40.5	22.4	195.3	<20	40.6	45.0	22.4	45	50	-5
14a	Hin Keng Community Centre	39.5	39.6	22.9	219.3	<20	40.1	44.5	22.9	45	50	-5
15	Carado Garden Block 6	38.7	41.7	24.7	239.5	<20	39.6	45.0	24.7	45	55	-10
15.1		38.8	40.1	24.7	239.5	<20	39.8	44.4	24.7	44	55	-11
15.2		38.9	39.7	24.8	239.5	<20	39.9	44.3	24.8	44	55	-11
15.3		39.0	39.4	24.8	239.5	<20	39.9	44.2	24.8	44	55	-11
15.4		39.1	39.2	24.8	239.5	<20	40.0	44.2	24.8	44	55	-11
16	Carado Garden Block 3	37.4	40.4	26.2	234.4	<20	39.8	44.2	26.2	44	55	-11
16.1		37.5	39.2	26.3	234.4	<20	40.0	43.8	26.3	44	55	-11
16.2		37.6	38.6	26.3	234.4	<20	40.1	43.7	26.3	44	55	-11
16.3		37.6	38.2	26.4	234.4	<20	40.1	43.6	26.4	44	55	-11
16.4		37.6	38.0	26.4	234.4	<20	40.2	43.5	26.4	44	55	-11
18	Tin Sam 182-185	34.6	35.2	31.6	161.6	<20	41.5	43.1	31.6	43	55	-12
19	Tin Sam 186-189	34.2	35.0	32.2	159.7	<20	41.5	43.0	32.2	43	55	-12
20	Tin Sam 192-197	33.8	34.7	32.8	155.6	<20	41.5	42.9	32.8	43	55	-12
21	Tin Sam 217-220	31.9	34.3	33.1	155.3	<20	41.0	42.3	33.1	43	55	-12
22	Sun Ming House	32.4	39.5	31.7	169.9	<20	40.2	43.2	31.7	44	55	-11
22.1		32.0	39.5	31.8	169.9	<20	40.3	43.2	31.8	44	55	-11

NSR No.	Description Location / Address	Airborne		Structural Noise	Distance	Airborne	Airborne	Total	Total	Total	Criterion	Exceedance
		Outboard Leq (dB)	Inboard Leq (dB)	Leq (dB)	(m)	Enclosure Portal Leq (dB)	Aircon. Units Leq (dB)	Airborne Leq (dB)	Structureborne Leq (dB)	Leq (dB)	(dB)	(dB)
22.2		31.7	36.4	31.9	169.9	<20	40.4	42.2	31.9	43	55	-12
22.3		31.3	35.1	32.0	169.9	<20	40.4	41.9	32.0	42	55	-13
23	Cheung Wong Wai Primary School	32.3	35.2	32.2	167.2	<20	40.8	37.0	32.2	43	55	-12
25	Sha Tin Tsung Tsin Secondary School	32.2	35.5	32.2	179.5	<20	41.0	37.2	32.2	43	55	-12
25a	Tin Sam Village nos. 217	32.7	31.6	33.2	154.5	<20	41.1	35.2	33.2	43	55	-12
26	Ng Yuk Secondary School	33.4	39.0	33.4	152.4	<20	42.1	44.2	33.4	45	55	-10
29	Koo Arm Temple	31.5	36.3	33.9	112.4	<20	47.8	48.2	33.9	48	55	-7
31	Kingdom Garden in Lei Uk	34.0	39.2	37.3	75.5	<20	46.6	47.5	37.3	48	55	-7
32	Tsang Tai Uk No.1-14	32.6	39.1	37.3	78.5	<20	44.2	45.6	37.3	46	55	-9
32b	Tsang Tai Uk (New Development)	37.6	40.5	45.0	15.3	<20	49.1	49.9	45.0	51	55	-4
33	Shek Fai House Chun Shek Estate	40.3	44.4	33.1	74.9	<20	49.1	50.8	33.1	51	55	-4
33.1		37.7	44.6	33.5	74.9	<20	50.2	51.4	33.5	51	55	-4
33.2		36.6	44.4	33.8	74.9	<20	50.7	51.8	33.8	52	55	-3
33.3		35.6	40.8	34.0	74.9	<20	51.0	51.5	34.0	52	55	-3
34	Shek Yuk House Chun Shek Estate	41.3	45.4	33.5	69.9	<20	48.3	50.6	33.5	51	55	-4
34.1		38.9	45.9	34.1	69.9	<20	49.2	51.2	34.1	51	55	-4
34.2		37.7	46.0	34.5	69.9	<20	49.7	51.5	34.5	52	55	-3
34.3		36.5	42.2	34.7	69.9	<20	50.0	50.8	34.7	51	55	-4
36	Sha Tin Tau 4-7	35.6	41.6	38.3	48.0	<20	47.5	48.7	38.3	49	60	-11
36a	Sun Fong House	34.1	42.8	31.8	203.9	<20	41.0	45.3	31.8	46	55	-9
36a.1		33.4	42.0	31.9	203.9	<20	41.1	44.9	31.9	45	55	-10
36a.2		32.7	38.3	32.0	203.9	<20	41.1	43.3	32.0	44	55	-11
36a.3		31.4	36.0	32.1	203.9	<20	41.1	42.6	32.1	43	55	-12
37	Lei Uk Tsuen 12-15	32.7	36.9	37.5	62.8	<20	48.9	49.2	37.5	50	55	-5
38a	San Tin Village	30.4	34.8	33.1	173.3	<20	42.2	43.1	33.1	44	55	-11
39	Sha Tin Tau 3	36.5	42.4	39.9	32.5	<20	48.9	50.0	39.9	50	60	-10
39a	Che Kung Miu (temple)	32.5	36.9	37.0	79.8	<20	45.0	45.9	37.0	46	55	-9
40a	Chee Hon Kindergarden	31.1	35.7	32.3	202.1	<20	41.9	43.1	32.3	43	55	-12
41a	Lei Uk Tsuen 1-6	31.5	35.8	35.9	91.0	<20	47.3	47.7	35.9	48	55	-7
45	Pok On House Pok Hong Estate	42.8	49.2	35.7	57.1	25.1	44.9	51.2	35.7	51	55	-4
45.1		42.6	49.2	36.5	57.1	24.6	45.4	51.3	36.5	51	55	-4
45.2		39.8	48.7	37.3	57.1	24.2	45.9	50.9	37.3	51	55	-4
45.3		37.3	43.3	37.8	57.1	23.8	46.1	48.3	37.8	49	55	-6
46	Pok Man House Pok Hong Estate	47.3	51.0	37.5	17.8	24.2	45.3	53.3	37.5	53	55	-2
46.1		48.9	52.5	39.1	17.8	23.8	46.4	54.7	39.1	55	55	0
46.2		46.2	53.7	40.9	17.8	<20	47.1	55.1	40.9	55	55	0
46.3		43.1	50.9	43.4	17.8	23.1	49.4	53.6	43.4	54	55	-1
48	Tin Ka Ping Salvation Army Primary School	42.0	53.4	41.8	17.8	<20	48.8	55.0	41.8	55	55	0
48a	Lei Uk Tsuen	33.5	38.1	33.0	149.9	<20	46.0	46.9	33.0	47	55	-8

NSR No.	Description Location / Address	Airborne Outboard Leq (dB)	Airborne Inboard Leq (dB)	Structural Noise Leq (dB)	Distance (m)	Airborne Enclosure Portal Leq (dB)	Airborne Aircon. Units Leq (dB)	Total Airborne Leq (dB)	Total Structureborne Leq (dB)	Total Leq (dB)	Criterion (dB)	Exceedance (dB)
48b	Sha Tin Methodist College	32.8	38.0	31.3	210.9	<20	44.3	45.5	31.3	46	55	-9
51a	Stewards High Rock Christain Camp	38.9	49.0	36.8	56.6	<20	48.0	51.7	36.8	52	55	-3
53	Pok Yue House Pok Hong Estate	46.1	49.4	35.3	26.5	25.9	49.2	53.3	35.3	53	55	-2
53.1		47.0	46.6	36.1	26.5	25.6	49.9	52.8	36.1	53	55	-2
53.2		39.8	43.3	37.3	26.5	25.2	50.6	51.6	37.3	52	55	-3
56	Pok Yat House Pok Hong Estate	42.3	46.2	32.8	38.9	27.3	49.3	51.6	32.8	52	55	-3
56.1		42.7	46.5	33.3	38.9	27.0	50.2	52.3	33.3	52	55	-3
56.2		43.2	46.8	34.0	38.9	26.5	51.4	53.1	34.0	53	55	-2
56.3		41.9	45.8	34.9	38.9	26.1	52.5	53.6	34.9	54	55	-1
58	Pok Tai House Pok Hong Estate	38.2	44.8	34.7	35.6	26.1	54.5	55.0	34.7	55	55	0
58.1		42.0	46.0	33.0	35.6	27.6	50.9	52.6	33.0	53	55	-2
58.2		42.1	46.4	33.5	35.6	27.2	52.3	53.6	33.5	54	55	-1
58.3		42.4	45.6	34.1	35.6	26.7	53.6	54.6	34.1	55	55	0
58.4		38.2	44.8	34.7	35.6	26.1	54.5	55.0	34.7	55	55	0
60	Sha Tin Wai 1-2	35.6	41.4	37.3	47.3	27.0	47.8	48.9	37.3	49	60	-11
61a	CC Shatin Church Pok Hong	34.2	36.6	43.2	20.2	<20	48.4	48.8	43.2	50	55	-5
62	Sha Tin Wai 8a	36.0	42.3	38.3	48.7	27.4	47.2	48.6	38.3	49	60	-11
65a	Pok Hong Estate, Pok Tat House	37.6	45.4	33.3	110.9	25.9	44.1	48.2	33.3	48	55	-7
65a.1		36.4	44.0	33.6	110.9	25.5	44.3	47.5	33.6	48	55	-7
65a.2		34.6	42.8	33.8	110.9	25.0	44.5	47.0	33.8	47	55	-8
65a.3		32.6	38.5	33.9	110.9	24.1	44.4	45.7	33.9	46	55	-9
70	Wong Uk Village 17-18	41.7	44.3	45.7	14.0	21.4	49.4	51.1	45.7	52	55	-3
70a	Pok Hong Estate Community Centre	32.3	38.3	33.8	76.3	24.8	47.8	48.4	33.8	49	55	-6
71	Wong Uk Village 11-12	41.9	44.6	45.0	17.5	22.1	48.7	50.8	45.0	52	55	-3
71a	Pok Hong Estate, Pok Che House	37.7	43.4	31.1	133.5	32.9	45.8	48.2	31.1	48	55	-7
71b.1		36.1	43.4	31.2	133.5	28.2	46.2	48.3	31.2	48	55	-7
71b.2		35.1	43.0	31.4	133.5	28.0	46.5	48.3	31.4	48	55	-7
71b.3		33.5	42.0	31.5	133.5	27.5	46.8	48.2	31.5	48	55	-7
71b.4		32.6	40.0	31.6	133.5	26.9	46.9	47.8	31.6	48	55	-7
72	Wong Uk Village 3-4	43.3	44.7	46.6	12.8	20.6	49.5	51.5	46.6	53	60	-7
72a	Christ College	32.9	39.9	32.1	130.1	26.0	45.3	46.6	32.1	47	55	-8
73	Wong Uk Village 1-2	45.0	45.8	46.1	18.1	21.6	48.6	51.5	46.1	53	60	-7
74	Prince of Wales Hospital	51.9	56.6	40.7	52.7	39.6	45.8	58.1	40.7	58	60	-2
75	Prince of Wales Hospital	51.6	56.3	40.2	56.9	39.7	45.6	57.8	40.2	58	60	-2
82a	Sha Tin Wai Village No. 104-107	35.8	41.7	34.2	75.3	27.0	47.8	49.0	34.2	49	55	-6
96a	Prince of Wales Hospital Accomodation	36.8	46.6	33.1	189.3	40.5	42.8	48.4	33.1	49	60	-11
96a 1		35.2	40.9	33.1	189.3	40.5	42.8	45.5	33.1	47	60	-13
99a	St. Rose of Lima's School	35.0	41.5	32.4	171.4	42.3	44.5	46.6	32.4	48	60	-12
101a	Residential Development (WIP)	42.3	46.8	33.6	47.3	45.9	49.8	52.1	33.6	53	60	-7
101a 1		42.6	46.8	34.0	47.3	45.9	50.9	52.8	34.0	54	60	-6

NSR	Description	Airborne		Structural	Distance	Airborne	Airborne	Total	Total	Total	Criterion	Exceedance
No.	Location / Address	Outboard Leq (dB)	Inboard Leq (dB)	Noise Leq (dB)	(m)	Enclosure Portal Leq (dB)	Aircon. Units Leq (dB)	Airborne Leq (dB)	Structureborne Leq (dB)	Leq (dB)	(dB)	(dB)
101a.2		42.8	46.4	34.4	47.3	46.0	52.0	53.4	34.4	54	60	-6
101a.3		40.8	46.3	34.8	47.3	46.0	52.8	53.9	34.8	55	60	-5
104a	Chap Wai Kon Street Fire Station	36.3	38.6	37.5	34.3	49.9	50.7	51.2	37.5	54	60	-6
110	Sha Tin Hospital	41.3	59.4	23.4	64.5	23.2	42.7	59.6	23.4	60	60	0
111	Sha Tin Hospital	40.7	59.1	23.3	69.1	23.2	42.5	59.3	23.3	59	60	-1
112	Fishermen's New Village no.113	37.8	49.9	22.6	69.0	<20	42.8	50.9	22.6	51	60	-9
113	Fishermen's New Village no.92	36.1	48.2	22.7	93.0	20.0	41.7	49.3	22.7	49	60	-11
113a	Planned Residential Development	40.9	46.6	33.6	73.9	46.4	48.7	51.2	33.6	52	60	-8
113a.1		39.8	46.6	33.9	73.9	46.5	49.4	51.6	33.9	53	60	-7
113a.2		39.0	46.6	34.2	73.9	46.6	50.1	51.9	34.2	53	60	-7
113a.3		38.3	46.4	34.4	73.9	46.6	50.5	52.1	34.4	53	60	-7
114	Fishermen's New Village no.37	37.0	49.5	23.3	80.7	20.7	42.4	50.5	23.3	50	60	-10
115	Fishermen's New Village no.29	36.9	49.2	23.5	83.6	<20	42.2	50.2	23.5	50	60	-10
116	Fishermen's New Village nos. 19	36.9	49.4	23.8	84.2	20.1	42.2	50.3	23.8	50	60	-10
117	Fishermen's New Village nos. 8	37.0	49.5	24.1	82.4	20.4	42.3	50.5	24.1	50	60	-10
118	Fishermen's New Village nos. 4	37.2	49.6	24.4	77.8	20.7	42.6	50.6	24.4	51	60	-9
119	Chevalier Garden Block 6	34.2	51.2	27.5	185.3	32.1	41.0	51.6	27.5	52	60	-8
119.1		33.2	47.1	27.5	185.3	32.1	41.1	48.2	27.5	48	60	-12
119.2		32.3	43.3	27.6	185.3	32.1	41.1	45.6	27.6	46	60	-14
120	Ma On Shan Tsung Tsin Secondary School	36.6	49.8	29.0	104.1	32.8	43.6	50.9	29.0	51	60	-9
121	Tai Shui Hang nos. 1-4	29.5	40.5	28.6	222.7	34.0	42.7	44.9	28.6	45	60	-15
123	Tai Shui Hang nos 14-15	33.8	42.8	30.6	125.4	34.7	46.1	47.9	30.6	48	60	-12
125	Shing On THA	28.2	35.3	38.2	124.6	51.4	43.1	44.7	38.2	52	60	-8
126a	Shatin Hospital Quarters	39.8	54.1	22.9	52.1	23.4	43.8	54.6	22.9	55	60	-5
127	Ngan On House Kam On Court	41.0	45.9	34.3	38.3	44.1	48.7	51.0	34.3	52	55	-3
127.1		41.6	46.4	34.8	38.3	44.3	49.9	51.9	34.8	53	55	-2
127.2		42.3	46.0	35.4	38.3	44.4	51.0	52.7	35.4	53	55	-2
127.3		39.6	45.7	36.1	38.3	44.5	52.1	53.2	36.1	54	55	-1
127.4		34.8	45.1	36.8	38.3	44.5	52.8	53.6	36.8	54	55	-1
128	Po On House Kam On Court	40.3	45.2	33.5	51.9	42.2	49.0	50.9	33.5	52	55	-3
128.1		40.6	45.2	33.9	51.9	42.3	50.1	51.7	33.9	52	55	-3
128.2		40.7	44.7	34.3	51.9	42.4	51.2	52.4	34.3	53	55	-2
128.3		36.3	44.5	34.6	51.9	42.4	52.1	52.9	34.6	53	55	-2
128.4		32.5	43.2	34.9	51.9	42.5	52.5	53.1	34.9	53	55	-2
130a	Scattered Residential Properties	35.5	46.9	27.5	97.7	23.4	42.3	48.4	27.5	48	55	-7
131	Heng Yat House Heng On Estate	40.6	45.2	33.2	84.0	39.4	46.6	49.6	33.2	50	55	-5
131.1		40.5	44.5	33.6	84.0	39.5	47.2	49.7	33.6	50	55	-5
131.2		36.6	44.4	33.9	84.0	39.5	47.7	49.6	33.9	50	55	-5
131.3		34.3	43.9	34.1	84.0	39.5	48.0	49.6	34.1	50	55	-5

NSR No.	Description Location / Address	Airborne		Structural Noise Leq (dB)	Distance (m)	Airborne Enclosure Portal Leq (dB)	Airborne Aircon. Units Leq (dB)	Total Airborne Leq (dB)	Total Structureborne Leq (dB)	Total Leq (dB)	Criterion (dB)	Exceedance (dB)
		Outboard Leq (dB)	Inboard Leq (dB)									
131.4		31.2	40.2	34.3	84.0	39.5	48.2	48.9	34.3	49	55	-6
132	Chinese YMCA College	36.3	43.7	35.9	44.8	39.6	50.5	51.5	35.9	52	55	-3
133	Hing On THA	32.7	38.4	37.8	56.4	37.3	46.9	47.7	37.8	48	55	-7
135	Tsang Pik Shan Secondary School	33.3	43.0	36.7	95.5	33.4	44.3	46.9	36.7	47	55	-8
136	Tsang Pik Shan Secondary School	33.4	43.1	36.7	93.0	33.3	44.5	47.0	36.7	48	55	-7
138	SunShine City Block K	41.1	46.5	33.1	79.0	32.3	45.3	49.6	33.1	50	55	-5
138.1		41.2	45.3	33.5	79.0	32.3	45.8	49.3	33.5	50	55	-5
138.2		37.3	44.9	33.9	79.0	32.3	46.3	49.0	33.9	49	55	-6
138.3		35.2	43.9	34.2	79.0	32.3	46.6	48.7	34.2	49	55	-6
138.4		32.9	41.0	34.4	79.0	32.3	46.8	48.0	34.4	48	55	-7
138a	Proposed Residential Development east of Area 86B	38.0	47.9	38.2	107.4	49.6	42.5	49.6	38.2	53	60	-7
138a.1		36.7	48.1	38.7	107.4	50.2	42.6	49.7	38.7	53	60	-7
138a.2		35.4	48.2	39.1	107.4	50.6	42.8	49.8	39.1	53	60	-7
138a.3		34.2	44.4	39.3	107.4	50.8	42.8	47.5	39.3	52	60	-8
139	SunShine City Block L	42.6	47.5	33.6	59.9	32.3	45.2	50.3	33.6	50	55	-5
139.1		43.2	48.0	34.2	59.9	32.4	45.8	50.9	34.2	51	55	-4
139.2		43.6	46.3	34.7	59.9	32.4	46.4	50.4	34.7	51	55	-4
139.3		38.6	45.4	35.2	59.9	32.4	46.9	49.6	35.2	50	55	-5
139.4		35.0	43.3	35.6	59.9	32.4	47.1	48.8	35.6	49	55	-6
140	SunShine City Block M	41.4	46.6	33.3	23.4	31.9	47.4	50.6	33.3	51	55	-4
140.1		42.0	47.3	34.1	23.4	31.9	48.6	51.5	34.1	52	55	-3
140.2		42.6	47.8	35.0	23.4	31.9	49.9	52.5	35.0	53	55	-2
140.3		43.5	46.9	36.3	23.4	31.9	51.3	53.2	36.3	53	55	-2
140.4		38.0	45.2	37.9	23.4	31.9	52.5	53.4	37.9	54	55	-1
141	Yan Chai Hospital Tung Chi Ying Memorial Secondary School	32.5	40.3	34.3	137.6	31.9	42.9	45.1	34.3	46	60	-14
142	SunShine City Block E	40.2	45.2	32.8	79.4	31.6	45.6	49.0	32.8	49	60	-11
142.1		40.0	43.8	33.2	79.4	31.7	46.2	48.8	33.2	49	60	-11
142.2		36.1	43.5	33.5	79.4	31.7	46.7	48.6	33.5	49	60	-11
142.3		34.2	43.1	33.8	79.4	31.7	47.0	48.7	33.8	49	60	-11
142.4		32.5	41.0	34.0	79.4	31.7	47.2	48.3	34.0	49	60	-11
142a.1	Chinese YMCA College	35.8	43.3	36.9	29.3	40.5	54.0	54.5	36.9	55	55	0
145	SunShine City Block G	40.6	45.6	33.0	23.9	31.6	47.8	50.3	33.0	50	55	-5
145.1		41.2	45.9	33.7	23.9	31.6	49.1	51.2	33.7	51	55	-4
145.2		41.7	46.3	34.5	23.9	31.6	50.5	52.3	34.5	52	55	-3
145.3		42.6	45.1	35.6	23.9	31.6	52.0	53.2	35.6	53	55	-2
145.4		36.9	44.8	36.9	23.9	31.6	53.3	53.9	36.9	54	55	-1
146	Saddle Ridge Garden Block 1	42.9	47.7	35.7	89.7	32.5	42.5	49.8	35.7	50	60	-10
146.1		40.1	48.3	36.4	89.7	32.5	43.0	49.9	36.4	50	60	-10

NSR No.	Description Location / Address	Airborne Outboard Leq (dB)	Airborne Inboard Leq (dB)	Structural Noise Leq (dB)	Distance (m)	Airborne Enclosure Portal Leq (dB)	Airborne Aircon. Units Leq (dB)	Total Airborne Leq (dB)	Total Structureborne Leq (dB)	Total Leq (dB)	Criterion (dB)	Exceedance (dB)
146.2		38.1	48.7	36.9	89.7	32.5	43.3	50.1	36.9	50	60	-10
146.3		36.3	49.0	37.2	89.7	32.5	43.5	50.3	37.2	50	60	-10
147	Fu Fai Garden Block 1	42.3	46.7	34.0	28.8	31.5	46.6	50.4	34.0	51	60	-9
147.1		43.6	47.6	35.0	28.8	31.6	47.9	51.6	35.0	52	60	-8
147.2		44.5	45.7	35.9	28.8	31.6	48.9	51.6	35.9	52	60	-8
147.3		38.8	44.4	36.9	28.8	31.6	49.8	51.2	36.9	51	60	-9
148	Saddle Ridge Garden Block 2	43.2	48.2	36.2	80.6	32.9	42.4	50.3	36.2	50	55	-5
148.1		42.7	49.0	37.0	80.6	32.9	43.0	50.7	37.0	51	55	-4
148.2		39.2	49.5	37.5	80.6	32.9	43.3	50.8	37.5	51	55	-4
148.3		37.4	49.8	37.9	80.6	33.0	43.5	51.0	37.9	51	55	-4
149	Fu Fai Garden Block 2	43.1	47.4	34.6	29.2	31.6	45.8	50.6	34.6	51	55	-4
149.1		44.6	48.6	35.7	29.2	31.6	47.0	51.8	35.7	52	55	-3
149.2		45.7	46.9	36.6	29.2	31.6	48.1	51.8	36.6	52	55	-3
149.3		39.6	45.7	37.7	29.2	31.6	48.9	51.0	37.7	51	55	-4
149a	St. Francis Church	33.1	38.5	39.2	61.2	33.6	45.3	46.3	39.2	47	55	-8
150a	St. Josephs Secondary School	27.9	35.7	32.9	229.8	34.1	41.7	42.9	32.9	44	55	-11
151a	Fung Yiu King Memorial Secondary	29.3	37.0	33.5	190.3	33.5	42.6	43.8	33.5	45	55	-10
152	Saddle Ridge Garden Block 3	43.5	48.7	36.6	70.4	33.4	42.4	50.7	36.6	51	55	-4
152.1		43.8	49.6	37.5	70.4	33.5	43.1	51.4	37.5	52	55	-3
152.2		40.9	50.2	38.1	70.4	33.5	43.5	51.5	38.1	52	55	-3
152.3		38.4	50.6	38.6	70.4	33.5	43.8	51.7	38.6	52	55	-3
153	Saddle Ridge Garden Block 4	43.8	49.1	37.0	61.7	34.1	42.4	50.9	37.0	51	55	-4
153.1		44.6	50.1	38.0	61.7	34.2	43.2	51.8	38.0	52	55	-3
153.2		42.0	50.7	38.6	61.7	34.2	43.7	52.0	38.6	52	55	-3
153.3		39.1	51.2	39.2	61.7	34.2	44.1	52.3	39.2	52	55	-3
155	Saddle Ridge Garden Block 5	44.1	49.3	37.2	56.0	34.9	42.4	51.2	37.2	51	55	-4
155.1		45.0	50.3	38.3	56.0	35.0	43.3	52.1	38.3	52	55	-3
155.2		43.7	51.1	39.0	56.0	35.1	43.9	52.5	39.0	53	55	-2
155.3		39.2	51.6	39.6	56.0	35.1	44.3	52.6	39.6	53	55	-2
159	Saddle Ridge Garden Block 6	44.5	49.5	37.3	57.2	35.9	42.3	51.4	37.3	52	55	-3
159.1		45.4	50.3	38.4	57.2	36.0	43.2	52.2	38.4	52	55	-3
159.2		43.7	51.0	39.1	57.2	36.1	43.8	52.5	39.1	53	55	-2
159.3		38.1	51.6	39.6	57.2	36.1	44.2	52.5	39.6	53	55	-2
160	Skill Opportunity School (SOS) in Ma On Shan Area 103	39.7	51.4	39.7	57.7	38.0	44.0	52.5	39.7	53	55	-2
167a	Ma On Shan Health Care & Elderly Centre	33.2	37.6	40.8	29.4	29.4	47.9	48.5	40.8	49	55	-6
169	Lung Yiu House Kam Lung Court	45.2	49.3	38.2	46.2	41.1	41.7	51.7	38.2	52	55	-3
169.1		46.2	50.2	39.0	46.2	41.8	42.5	52.5	39.0	53	55	-2
169.2		47.2	51.1	39.8	46.2	42.4	43.3	53.4	39.8	54	55	-1
169.3		44.5	51.7	40.7	46.2	42.9	44.2	53.5	40.7	54	55	-1

NSR No.	Description Location / Address	Airborne		Structural Noise	Distance	Airborne Enclosure Portal	Airborne Aircon. Units	Total Airborne	Total Structureborne	Total	Criterion	Exceedance
		Outboard Leq (dB)	Inboard Leq (dB)	Leq (dB)	(m)	Leq (dB)	Leq (dB)	Leq (dB)	Leq (dB)	Leq (dB)	(dB)	(dB)
169.4		40.2	52.3	41.3	46.2	43.1	44.7	53.6	41.3	54	55	-1
172	Lung Sing House Kam Lung Court	45.2	49.3	38.9	41.2	43.3	41.5	51.9	38.9	52	55	-3
172.1		46.2	50.2	39.9	41.2	44.6	42.2	52.8	39.9	53	55	-2
172.2		47.2	51.1	40.8	41.2	45.9	42.9	53.8	40.8	54	55	-1
172.3		45.0	52.1	41.8	41.2	47.0	43.8	54.3	41.8	55	55	0
172.4		40.6	52.9	42.6	41.2	47.6	44.4	54.6	42.6	55	55	0
175	Lee Wing House Lee On Estate	46.8	50.5	40.8	68.2	36.9	41.5	52.5	40.8	53	55	-2
175.1		47.4	51.1	42.2	68.2	35.3	41.8	53.1	42.2	53	55	-2
175.2		48.0	51.7	43.7	68.2	33.6	42.0	53.6	43.7	54	55	-1
175.3		48.0	52.0	45.5	68.2	31.9	42.1	53.8	45.5	54	55	-1
175.4		42.4	51.6	47.0	68.2	32.5	41.9	52.5	47.0	54	55	-1
179a	Residential Development to the East of Lee On Estate (WIP)	45.6	48.5	35.9	124.6	36.9	44.3	51.4	35.9	52	55	-3
179a.1		46.0	48.9	36.2	124.6	37.2	44.7	51.8	36.2	52	55	-3
179a.2		45.0	49.1	36.5	124.6	37.3	45.0	51.8	36.5	52	55	-3
179a.3		40.5	49.0	36.7	124.6	37.5	45.2	51.1	36.7	51	55	-4

Tai Wai to Ma On Shan Rail
Non Revenue Trains - Down

NSR No.	Description Location / Address	Airborne Outboard Leq (dB)	Airborne Inboard Leq (dB)	Structural Noise Leq (dB)	Distance (m)	Airborne Enclosure Portal Leq (dB)	Total Airborne Leq (dB)	Total Structureborne Leq (dB)	Total Enclosure Portal Leq (dB)	Total Leq (dB)	Criterion (dB)	Exceedance (dB)
3	Keng Hau Rd 29	31.7	32.4	<20	196.8	<20	35.1	<20	<20	35	40	-5
4	Keng Hau Rd 27	31.6	32.3	<20	187.4	<20	35.0	<20	<20	35	40	-5
5	Keng Hau Rd 25	30.5	32.2	<20	163.7	<20	34.4	<20	<20	34	40	-6
6	Keng Hau Rd 24	30.7	32.5	<20	148.5	<20	34.7	<20	<20	35	40	-5
7	Keng Hau Rd 22	31.0	32.9	<20	133.8	<20	35.1	<20	<20	35	45	-10
8	Keng Hau Rd 18	31.1	33.2	<20	147.3	<20	35.3	<20	<20	35	45	-10
9	Keng Hau Rd13-15	31.1	33.3	<20	155.8	<20	35.4	<20	<20	35	45	-10
11	Keng Hau Rd 11	31.2	33.4	<20	166.6	<20	35.4	<20	<20	35	45	-10
12	Keng Hau Rd 9	31.2	33.5	<20	188.1	<20	35.5	<20	<20	36	45	-9
17	Shatin Heights	38.0	42.0	<20	138.3	<20	43.5	<20	<20	43	50	-7
23a	Fook Ki Court, Holford Garden	40.3	40.7	<20	168.5	<20	43.5	<20	<20	44	50	-6
23a.1		40.4	40.9	<20	168.5	<20	43.7	<20	<20	44	50	-6
23a.2		40.5	40.5	<20	168.5	<20	43.5	<20	<20	44	50	-6
23a.3		40.5	39.9	<20	168.5	<20	43.2	<20	<20	43	50	-7
24	Christian Alliance School (Daytime)	46.0	45.3	21.4	61.6	<20	48.7	21.4	<20	49	60	-11
27	Grandway Garden Block 2	41.0	41.1	22.1	122.7	<20	44.0	22.1	<20	44	50	-6
27.1		41.1	41.2	22.3	122.7	<20	44.1	22.3	<20	44	50	-6
27.2		39.7	41.4	22.7	122.7	<20	43.6	22.7	<20	44	50	-6
27.3		39.4	39.3	22.9	122.7	<20	42.4	22.9	<20	42	50	-8
28	Grandway Garden Block 3	40.0	40.0	21.5	118.0	<20	43.0	21.5	<20	43	50	-7
28.1		39.8	40.1	21.7	118.0	<20	42.9	21.7	<20	43	50	-7
28.2		38.7	40.2	22.1	118.0	<20	42.5	22.1	<20	43	50	-7
28.3		38.4	38.1	22.3	118.0	<20	41.3	22.3	<20	41	50	-9
30	Tai On Building	37.8	37.1	21.8	94.6	<20	40.5	21.8	<20	41	45	-4
32a	Sin Chu Wan Primary School	35.1	34.3	<20	177.6	<20	37.7	<20	<20	38	45	-7
35	Kam Cheong Building	37.7	36.9	21.6	97.3	<20	40.4	21.6	<20	40	45	-5
38	Wing Fu Bldg	37.7	36.8	21.4	99.3	<20	40.3	21.4	<20	40	45	-5
40	Moon Wah Bldg	37.5	36.6	21.2	103.6	<20	40.1	21.2	<20	40	45	-5
41	Lai Sing Mansion	37.5	36.6	21.1	104.8	<20	40.1	21.1	<20	40	45	-5
42	Man Lai Court Block 1	42.1	40.2	22.2	58.2	<20	44.3	22.2	<20	44	50	-6
42.1		40.5	40.9	22.9	58.2	<20	43.7	22.9	<20	44	50	-6
42 2		40.2	41.3	23.5	58.2	<20	43.8	23.5	<20	44	50	-6
43	Man Lai Court Block 2	42.2	40.4	22.3	54.6	<20	44.4	22.3	<20	44	50	-6
43.1		40.8	41.0	23.1	54.6	<20	43.9	23.1	<20	44	50	-6
43 2		40.5	41.5	23.8	54.6	<20	44.0	23.8	<20	44	50	-6
44	Man Lai Court Block 3	40.4	40.0	22.0	64.3	<20	43.2	22.0	<20	43	50	-7
44.1		40.1	40.5	22.6	64.3	<20	43.3	22.6	<20	43	50	-7
44.2		39.8	40.9	23.1	64.3	<20	43.4	23.1	<20	43	50	-7
44a	Immaculate Heart of Mary School (secondary building)	31.7	30.7	20.6	111.6	<20	34.2	20.6	<20	34	50	-16
47	Man Lai Court Block 4	39.5	39.5	21.4	78.5	<20	42.5	21.4	<20	43	55	-12
47.1		39.2	39.9	21.9	78.5	<20	42.6	21.9	<20	43	55	-12
47.2		38.7	38.8	22.3	78.5	<20	41.7	22.3	<20	42	55	-13
47b	Regional Council Heritage Museum	32.4	33.1	<20	220.9	<20	35.8	<20	<20	36	50	-14

NSR No.	Description Location / Address	Airborne Outboard Leq (dB)	Airborne Inboard Leq (dB)	Structural Noise Leq (dB)	Distance (m)	Airborne Enclosure Portal Leq (dB)	Total Airborne Leq (dB)	Total Structureborne Leq (dB)	Total Enclosure Portal Leq (dB)	Total Leq (dB)	Criterion (dB)	Exceedance (dB)
49	Lok Sin Tong Chan Cho Chak Primary School	41.0	44.2	25.1	40.8	<20	45.9	25.1	<20	46	50	-4
50	Immaculate Heart of Mary School	37.2	36.5	21.0	102.7	<20	39.9	21.0	<20	40	50	-10
51	Immaculate Heart of Mary College	41.8	44.9	25.9	33.2	<20	46.7	25.9	<20	47	50	-3
52	Caritas Lok Jun School	37.8	37.1	21.6	92.0	<20	40.5	21.6	<20	41	50	-9
54	Sha Tin Government Secondary School	35.8	35.2	<20	141.2	<20	38.5	<20	<20	39	50	-11
55	Ming Yan Lau	41.9	41.7	22.1	39.5	<20	44.8	22.1	<20	45	50	-5
55.1		42.3	42.1	22.6	39.5	<20	45.2	22.6	<20	45	50	-5
55.2		43.4	42.9	23.6	39.5	<20	46.1	23.6	<20	46	50	-4
55.3		41.3	43.6	24.7	39.5	<20	45.6	24.7	<20	46	50	-4
55.4		41.2	43.6	25.5	39.5	<20	45.5	25.5	<20	46	50	-4
57	Ecclesia Bible College	34.9	35.0	<20	186.0	<20	38.0	<20	<20	38	55	-17
58a	Jat Min Chuen, Ming Shun Lau	36.3	39.2	<20	134.5	<20	41.0	<20	<20	41	50	-9
58a.1		36.3	39.5	<20	134.5	<20	41.2	<20	<20	41	50	-9
58a.2		36.3	39.3	20.2	134.5	<20	41.1	20.2	<20	41	50	-9
58a.3		36.3	37.7	20.3	134.5	<20	40.1	20.3	<20	40	50	-10
58a.4		34.4	35.7	20.4	134.5	<20	38.1	20.4	<20	38	50	-12
59	Osprey House Sha Kok Estate	37.9	40.5	21.6	88.6	<20	42.4	21.6	<20	42	50	-8
59.1		38.0	40.6	21.8	88.6	<20	42.5	21.8	<20	43	50	-7
59.2		37.8	38.6	22.1	88.6	<20	41.2	22.1	<20	41	50	-9
59a	Jat Min Estate, Ming Yiu Lau	35.0	38.0	<20	186.7	<20	39.7	<20	<20	40	50	-10
59a.1		35.0	37.9	<20	186.7	<20	39.7	<20	<20	40	50	-10
59a.2		35.0	37.4	<20	186.7	<20	39.4	<20	<20	39	50	-11
59a.3		34.9	36.4	<20	186.7	<20	38.7	<20	<20	39	50	-11
59a.4		32.2	33.4	<20	186.7	<20	35.9	<20	<20	36	50	-14
61	Sand Martin House Sha Kok Estate	39.3	40.7	22.5	66.2	<20	43.1	22.5	<20	43	50	-7
61.1		39.2	40.8	22.9	66.2	<20	43.1	22.9	<20	43	50	-7
61.2		39.1	40.6	23.3	66.2	<20	42.9	23.3	<20	43	50	-7
63	Oriole House Sha Kok Estate	40.8	41.1	23.3	49.4	<20	44.0	23.3	<20	44	55	-11
63.1		40.6	41.2	23.9	49.4	<20	43.9	23.9	<20	44	55	-11
63.2		40.4	40.8	24.5	49.4	<20	43.6	24.5	<20	44	55	-11
64	Avon Garden Shatin Park	43.2	43.1	23.3	34.1	<20	46.2	23.3	<20	46	55	-9
64.1		44.4	44.0	24.4	34.1	<20	47.2	24.4	<20	47	55	-8
64.2		42.4	44.9	25.6	34.1	<20	46.8	25.6	<20	47	55	-8
65	Ashley Garden Shatin Park	43.8	43.7	23.8	15.0	<20	46.8	23.8	<20	47	55	-8
65.1		45.4	45.2	25.3	15.0	<20	48.3	25.3	<20	48	55	-7
65.2		47.7	47.1	27.5	15.0	<20	50.5	27.5	<20	50	55	-5
66	Escort Garden Shatin Park	43.0	42.9	23.0	41.4	<20	46.0	23.0	<20	46	55	-9
66.1		42.3	43.7	24.0	41.4	<20	46.0	24.0	<20	46	55	-9
66.2		41.4	44.4	24.9	41.4	<20	46.2	24.9	<20	46	55	-9
67	Greenwood Garden Block A	38.0	39.7	20.4	109.9	<20	41.9	20.4	<20	42	55	-13
67.1		37.5	40.0	20.7	109.9	<20	41.9	20.7	<20	42	55	-13
67.2		37.4	40.1	21.0	109.9	<20	42.0	21.0	<20	42	55	-13
67.3		37.0	38.6	21.2	109.9	<20	40.9	21.2	<20	41	55	-14
68	Artland Garden Shatin Park	44.0	43.9	23.8	18.5	<20	47.0	23.8	<20	47	55	-8
68.1		45.4	45.3	25.2	18.5	<20	48.3	25.2	<20	48	55	-7
68.2		46.4	46.9	27.2	18.5	<20	49.7	27.2	<20	50	55	-5

NSR No.	Description Location / Address	Airborne		Structural Noise Leq (dB)	Distance (m)	Airborne Enclosure Portal Leq (dB)	Total Airborne Leq (dB)	Total Structureborne Leq (dB)	Total Enclosure Portal Leq (dB)	Total Leq (dB)	Criterion (dB)	Exceedance (dB)
		Outboard Leq (dB)	Inboard Leq (dB)									
68a	Tin Ka Ping Kindergarden	33.1	32.9	23.1	72.4	<20	36.0	23.1	<20	36	55	-19
69	Iris Garden Shatin Park	43.1	43.1	23.1	40.1	<20	46.1	23.1	<20	46	55	-9
69.1		43.1	43.9	24.1	40.1	<20	46.5	24.1	<20	47	55	-8
69.2		41.7	44.5	25.0	40.1	<20	46.3	25.0	<20	46	55	-9
76	Green Leave Garden Block A	46.8	46.7	24.7	43.2	<20	49.8	24.7	<20	50	55	-5
76.1		47.0	47.3	25.3	43.2	<20	50.1	25.3	<20	50	55	-5
76.2		45.9	48.2	26.2	43.2	<20	50.2	26.2	<20	50	55	-5
76a	Sha Kok Estate Food Stalls	32.1	29.7	24.8	46.1	<20	34.1	24.8	<20	35	55	-20
77	Toi Shan Association College	38.2	39.7	21.6	106.3	<20	42.0	21.6	<20	42	55	-13
78	Green Leave Block B	44.9	44.8	23.1	45.6	<20	47.9	23.1	<20	48	55	-7
78.1		46.3	46.2	24.4	45.6	<20	49.3	24.4	<20	49	55	-6
78.2		46.7	47.2	25.3	45.6	<20	50.0	25.3	<20	50	55	-5
78.3		45.2	47.8	26.1	45.6	<20	49.7	26.1	<20	50	55	-5
79	Pamela Youde Child Assessment Centre and School Dental Clinic	41.8	42.5	28.2	21.8	<20	45.2	28.2	<20	45	50	-5
80	Pamela Youde Child Assessment Centre and School Dental Clinic	44.9	42.1	29.1	16.0	<20	46.7	29.1	<20	47	50	-3
81	Yue Sui House Yue Tin Court	42.5	42.4	22.5	31.0	24.6	45.5	22.5	24.4	46	50	-4
81.1		43.5	43.1	23.5	31.0	24.6	46.3	23.5	24.5	46	50	-4
81.2		44.3	42.8	24.6	31.0	<20	46.6	24.6	<20	47	50	-3
81.3		42.5	43.0	25.9	31.0	<20	45.8	25.9	<20	46	50	-4
82	Yue Kwan House Yue Tin Court	41.4	41.4	21.6	36.4	25.2	44.5	21.6	25.1	45	50	-5
82.1		42.2	42.1	22.4	36.4	25.3	45.2	22.4	25.2	45	50	-5
82.2		43.1	42.5	23.3	36.4	25.3	45.8	23.3	25.2	46	50	-4
82.3		43.7	42.7	24.3	36.4	20.3	46.2	24.3	<20	46	50	-4
82.4		41.7	43.0	25.4	36.4	<20	45.4	25.4	<20	45	50	-5
83	Yue Yuet House Yue Tin Court	40.4	40.0	21.0	77.6	26.1	43.3	21.0	25.9	43	50	-7
83.1		40.3	40.1	21.5	77.6	21.4	43.3	21.5	21.0	43	50	-7
83.2		38.8	40.5	22.0	77.6	21.0	42.7	22.0	20.5	43	50	-7
83.3		38.5	40.7	22.5	77.6	<20	42.8	22.5	<20	43	50	-7
83.4		38.4	40.4	22.8	77.6	<20	42.6	22.8	<20	43	50	-7
84	Yue Yat House Yue Tin Court	40.0	39.5	20.9	85.7	27.0	42.9	20.9	26.8	43	50	-7
84.1		38.7	39.7	21.4	85.7	22.3	42.3	21.4	21.9	42	50	-8
84.2		38.1	39.9	21.8	85.7	21.7	42.2	21.8	21.2	42	50	-8
84.3		37.9	40.1	22.2	85.7	20.5	42.2	22.2	<20	42	50	-8
84.4		37.9	39.9	22.5	85.7	<20	42.0	22.5	<20	42	50	-8
85	Yow Kam Yuen Prevocational School	43.2	42.6	26.8	24.9	23.7	46.0	26.8	23.0	46	55	-9
85a	Greenwood Garden	38.6	40.2	20.7	97.1	<20	42.5	20.7	<20	43	55	-12
85a.1		38.1	40.5	21.1	97.1	<20	42.5	21.1	<20	43	55	-12
85a.2		38.0	40.8	21.4	97.1	<20	42.6	21.4	<20	43	55	-12
85a.3		37.6	39.4	21.7	97.1	<20	41.6	21.7	<20	42	55	-13
85a.4		34.2	34.1	21.8	97.1	<20	37.1	21.8	<20	37	55	-18
86	Yue Chak House Yue Tin Court	36.8	38.3	20.3	121.6	22.6	40.7	20.3	22.2	41	50	-9
86.1		36.5	38.5	20.6	121.6	21.9	40.7	20.6	21.4	41	50	-9
86.2		36.4	38.6	20.9	121.6	20.9	40.7	20.9	20.3	41	50	-9
86.3		36.4	38.7	21.1	121.6	<20	40.7	21.1	<20	41	50	-9
86.4		36.3	38.1	21.3	121.6	<20	40.3	21.3	<20	40	50	-10

MOS DOWN

NSR No.	Description Location / Address	Airborne Outboard Leq (dB)	Airborne Inboard Leq (dB)	Structural Noise Leq (dB)	Distance (m)	Airborne Enclosure Portal Leq (dB)	Total Airborne Leq (dB)	Total Structureborne Leq (dB)	Total Enclosure Portal Leq (dB)	Total Leq (dB)	Criterion (dB)	Exceedance (dB)
87	Lam Kau Mow Secondary School	41.7	42.3	26.5	32.7	26.6	45.1	26.5	25.3	45	55	-10
87a	Chuen Fai Centre	38.3	40.9	21.1	98.4	<20	42.8	21.1	<20	43	55	-12
87a.1		38.3	41.1	21.4	98.4	<20	42.9	21.4	<20	43	55	-12
87a.2		37.6	38.9	21.6	98.4	<20	41.3	21.6	<20	41	55	-14
87a.3		33.9	33.3	21.7	98.4	<20	36.7	21.7	<20	37	55	-18
88	City One Sha Tin Block 45	39.3	38.6	22.1	86.9	32.3	42.4	22.1	32.1	43	50	-7
88.1		37.6	38.8	22.5	86.9	27.8	41.4	22.5	27.3	42	50	-8
88.2		37.4	38.9	23.0	86.9	26.9	41.4	23.0	26.2	42	50	-8
88.3		37.2	39.1	23.3	86.9	25.4	41.4	23.3	24.2	42	50	-8
88.4		37.2	38.1	23.5	86.9	23.9	40.8	23.5	22.1	41	50	-9
89	City One Sha Tin Block 37	36.7	38.0	21.4	109.2	26.4	40.6	21.4	25.9	41	50	-9
89.1		36.5	38.1	21.7	109.2	25.9	40.5	21.7	25.3	41	50	-9
89.2		36.4	38.2	22.0	109.2	24.7	40.5	22.0	23.9	41	50	-9
89.3		36.3	38.1	22.3	109.2	23.4	40.4	22.3	22.1	41	50	-9
89.4		36.2	37.3	22.4	109.2	22.1	39.9	22.4	20.4	40	50	-10
90	City One Sha Tin Block 36	39.7	39.7	23.1	69.1	34.1	43.2	23.1	33.9	44	50	-6
90.1		40.1	39.8	23.6	69.1	34.5	43.5	23.6	34.3	44	50	-6
90.2		38.4	39.7	24.1	69.1	30.0	42.3	24.1	29.3	43	50	-7
90.3		38.0	40.0	24.7	69.1	28.4	42.3	24.7	27.2	43	50	-7
90.4		37.9	39.2	25.0	69.1	26.6	41.8	25.0	24.5	42	50	-8
90a	Caritus H.W.Lee Care & Attension Centre	39.2	36.2	25.4	45.1	<20	41.0	25.4	<20	41	50	-9
91	City One Sha Tin Block 34	36.5	37.8	22.7	102.3	34.4	41.2	22.7	34.3	42	50	-8
91.1		36.2	37.9	23.2	102.3	29.7	40.5	23.2	29.3	41	50	-9
91.2		35.9	38.0	23.6	102.3	28.5	40.4	23.6	27.8	41	50	-9
91.3		35.8	38.1	24.0	102.3	26.9	40.3	24.0	25.6	41	50	-9
91.4		35.7	36.8	24.2	102.3	25.5	39.5	24.2	23.5	40	50	-10
91a	Springfield Garden	40.8	42.6	21.6	108.4	<20	44.8	21.6	<20	45	50	-5
91a.1		39.9	42.8	21.9	108.4	<20	44.6	21.9	<20	45	50	-5
91a.2		39.4	41.2	22.1	108.4	<20	43.4	22.1	<20	43	50	-7
91a.3		37.5	36.4	22.1	108.4	<20	40.0	22.1	<20	40	50	-10
92	City One Sha Tin Block 32	37.1	38.2	24.9	88.1	32.5	41.3	24.9	32.4	42	50	-8
92.1		36.3	38.3	25.6	88.1	31.6	40.9	25.6	31.5	42	50	-8
92.2		36.0	38.3	26.2	88.1	28.8	40.6	26.2	28.8	41	50	-9
92.3		35.8	36.7	26.6	88.1	26.0	39.5	26.6	25.9	40	50	-10
93	City One Sha Tin Block 33	39.4	39.3	26.3	67.3	39.7	44.2	26.3	39.7	46	55	-9
93.1		39.0	38.8	27.5	67.3	40.9	44.4	27.5	40.9	46	55	-9
93.2		37.0	38.7	28.8	67.3	34.2	41.8	28.8	34.2	43	55	-12
93.3		36.5	37.5	29.6	67.3	29.8	40.4	29.6	29.8	41	55	-14
94	City One Sha Tin Block 28	40.2	40.1	25.9	43.5	38.9	44.5	25.9	38.7	46	55	-9
94.1		40.8	39.5	27.1	43.5	40.0	44.9	27.1	39.8	46	55	-9
94.2		38.7	39.6	28.2	43.5	34.2	42.8	28.2	33.3	43	55	-12
94.3		38.4	39.4	29.1	43.5	31.5	42.3	29.1	28.9	43	55	-12
95	City One Sha Tin Block 27	35.9	37.4	23.5	101.4	30.0	40.2	23.5	29.5	41	50	-9
95.1		35.7	37.5	24.0	101.4	28.5	40.0	24.0	27.8	40	50	-10
95.2		35.6	37.5	24.4	101.4	26.9	39.9	24.4	25.6	40	50	-10
95.3		35.5	35.8	24.6	101.4	25.4	38.8	24.6	23.4	39	50	-11

NSR No.	Description Location / Address	Airborne		Structural Noise Leq (dB)	Distance (m)	Airborne Enclosure Portal Leq (dB)	Total Airborne Leq (dB)	Total Structureborne Leq (dB)	Total Enclosure Portal Leq (dB)	Total Leq (dB)	Criterion (dB)	Exceedance (dB)
		Outboard Leq (dB)	Inboard Leq (dB)									
95a	SPGE Kwan Fong Nim Chee Home for the Elderly	39.7	40.8	24.3	62.5	<20	43.3	24.3	<20	43	50	-7
96	Garden Vista Block C	31.0	32.7	<20	284.3	<20	35.0	<20	<20	35	55	-20
96.1		30.9	31.8	<20	284.3	<20	34.4	<20	<20	34	55	-21
96.2		29.5	31.2	<20	284.3	<20	33.5	<20	<20	34	55	-21
97	Garden Vista Block F	31.4	33.2	<20	243.4	<20	35.4	<20	<20	35	55	-20
97.1		31.4	32.4	<20	243.4	<20	34.9	<20	<20	35	55	-20
97.2		29.9	31.8	<20	243.4	<20	34.0	<20	<20	34	55	-21
98	Garden Vista Block E	31.2	32.9	<20	248.8	<20	35.2	<20	<20	35	55	-20
98.1		31.1	32.2	<20	248.8	<20	34.7	<20	<20	35	55	-20
98.2		29.7	31.6	<20	248.8	<20	33.8	<20	<20	34	55	-21
99	Garden Vista Block D	31.4	33.8	<20	227.1	<20	35.8	<20	<20	36	55	-19
99.1		31.4	32.5	<20	227.1	<20	35.0	<20	<20	35	55	-20
99.2		30.0	31.9	<20	227.1	<20	34.1	<20	<20	34	55	-21
100	Abbey Court Pictorial Garden	31.9	35.2	<20	199.7	<20	36.9	<20	<20	37	55	-18
100.1		31.8	35.0	<20	199.7	<20	36.7	<20	<20	37	55	-18
100.2		31.8	33.1	<20	199.7	<20	35.5	<20	<20	36	55	-19
100.3		30.4	32.4	<20	199.7	<20	34.5	<20	<20	35	55	-20
101	Belleve Court Pictorial Garden	32.2	35.5	<20	181.7	<20	37.1	<20	<20	37	55	-18
101.1		32.1	35.3	<20	181.7	<20	37.0	<20	<20	37	55	-18
101.2		32.1	33.8	<20	181.7	<20	36.1	<20	<20	36	55	-19
101.3		31.2	32.7	<20	181.7	<20	35.1	<20	<20	35	55	-20
102	Capilano Court Pictorial Garden	32.6	35.7	<20	163.9	<20	37.5	<20	<20	37	55	-18
102.1		32.4	35.7	<20	163.9	<20	37.4	<20	<20	37	55	-18
102.2		32.4	34.3	<20	163.9	<20	36.4	<20	<20	36	55	-19
102.3		32.2	33.2	<20	163.9	<20	35.7	<20	<20	36	55	-19
103	Galaxy Court Pictorial Garden	33.4	36.2	<20	141.9	<20	38.0	<20	<20	38	55	-17
103.1		33.3	36.3	<20	141.9	<20	38.1	<20	<20	38	55	-17
103.2		33.1	35.9	<20	141.9	<20	37.7	<20	<20	38	55	-17
103.3		32.8	33.9	<20	141.9	<20	36.4	<20	<20	36	55	-19
103a	Sunshine Grove	39.6	39.5	20.9	84.7	28.3	42.7	20.9	28.2	43	50	-7
103a.1		39.8	39.2	21.3	84.7	28.5	42.7	21.3	28.4	43	50	-7
103a.2		38.1	39.5	21.8	84.7	23.6	41.9	21.8	23.2	42	50	-8
103a.3		37.9	39.6	22.2	84.7	22.6	41.9	22.2	22.0	42	50	-8
103a.4		37.8	39.7	22.6	84.7	21.2	41.9	22.6	20.3	42	50	-8
103a.5		37.6	39.2	22.8	84.7	<20	41.5	22.8	<20	42	50	-8
103b	Sunshine Grove	39.3	39.3	21.1	84.8	29.4	42.5	21.1	29.3	43	50	-7
103b.1		39.7	39.0	21.5	84.8	29.6	42.6	21.5	29.5	43	50	-7
103b.2		38.0	39.2	22.0	84.8	24.8	41.7	22.0	24.4	42	50	-8
103b.3		37.7	39.3	22.4	84.8	23.7	41.6	22.4	23.1	42	50	-8
103b.4		37.6	39.1	22.7	84.8	22.3	41.5	22.7	21.3	42	50	-8
103b.5		37.5	38.6	22.9	84.8	21.0	41.2	22.9	<20	41	50	-9
104	Forum Court Pictorial Garden	33.7	36.5	<20	129.5	<20	38.3	<20	<20	38	55	-17
104.1		33.5	36.5	<20	129.5	<20	38.3	<20	<20	38	55	-17
104.2		33.4	36.0	<20	129.5	<20	37.9	<20	<20	38	55	-17
104.3		33.1	34.3	<20	129.5	<20	36.7	<20	<20	37	55	-18
105	Elegant Court Pictorial Garden	34.5	37.1	<20	108.2	<20	39.0	<20	<20	39	55	-16

MOS DOWN

NSR No.	Description Location / Address	Airborne		Structural Noise Leq (dB)	Distance (m)	Airborne Enclosure Portal Leq (dB)	Total Airborne Leq (dB)	Total Structureborne Leq (dB)	Total Enclosure Portal Leq (dB)	Total Leq (dB)	Criterion (dB)	Exceedance (dB)
		Outboard Leq (dB)	Inboard Leq (dB)									
105.1		34.1	37.0	<20	108.2	<20	38.8	<20	<20	39	55	-16
105.2		33.9	36.5	<20	108.2	<20	38.4	<20	<20	38	55	-17
105.3		33.6	34.9	<20	108.2	<20	37.3	<20	<20	37	55	-18
106	Dragon Court Pictorial Garden	35.0	38.2	<20	92.4	<20	39.9	<20	<20	40	55	-15
106.1		34.6	37.5	<20	92.4	<20	39.3	<20	<20	39	55	-16
106.2		34.2	37.3	<20	92.4	<20	39.0	<20	<20	39	55	-16
106.3		33.8	35.2	<20	92.4	<20	37.5	<20	<20	38	55	-17
107	Hillview Court Pictorial Garden	34.1	37.0	<20	98.7	<20	38.8	<20	<20	39	55	-16
107.1		33.5	36.2	<20	98.7	<20	38.1	<20	<20	38	55	-17
107.2		33.1	34.5	<20	98.7	<20	36.9	<20	<20	37	55	-18
108	Iris Court Pictorial Garden	34.8	38.6	<20	83.7	<20	40.1	<20	<20	40	55	-15
108.1		33.8	37.1	<20	83.7	<20	38.8	<20	<20	39	55	-16
108.2		33.3	35.3	<20	83.7	<20	37.4	<20	<20	37	55	-18
109	Juniper Court Pictorial Garden	37.4	39.6	<20	51.9	<20	41.7	<20	<20	42	55	-13
109.1		35.9	39.8	<20	51.9	<20	41.3	<20	<20	41	55	-14
109.2		34.1	36.4	<20	51.9	<20	38.5	<20	<20	38	55	-17
122	Residential Development, R(A), to the north east of Chevalier Garden	38.4	38.7	<20	75.1	<20	41.5	<20	<20	42	55	-13
122.1		38.4	39.2	<20	75.1	<20	41.8	<20	<20	42	55	-13
122.2		37.0	39.7	<20	75.1	<20	41.6	<20	<20	42	55	-13
122.3		36.8	40.0	<20	75.1	<20	41.7	<20	<20	42	55	-13
122.4		36.8	38.5	<20	75.1	<20	40.7	<20	<20	41	55	-14
124	Residential Development in the south of Area 77, R(B)2	39.9	39.6	22.8	81.9	20.9	42.8	22.8	20.6	43	55	-12
124.1		38.8	39.6	23.5	81.9	20.9	42.3	23.5	20.6	42	55	-13
124.2		38.3	39.7	24.1	81.9	<20	42.1	24.1	<20	42	55	-13
124.3		38.2	39.9	24.6	81.9	<20	42.1	24.6	<20	42	55	-13
124.4		37.9	38.8	24.9	81.9	<20	41.4	24.9	<20	41	55	-14
126	Residential Development in the north of Area 77, R(B)2	39.3	39.2	24.2	50.0	33.8	42.8	24.2	33.5	43	50	-7
126.1		40.0	39.8	25.2	50.0	35.0	43.5	25.2	34.7	44	50	-6
126.2		38.8	39.9	26.2	50.0	31.5	42.7	26.2	30.4	43	50	-7
126.3		38.1	40.2	27.1	50.0	29.9	42.5	27.1	27.3	43	50	-7
126.4		37.0	37.7	27.7	50.0	28.6	40.6	27.7	23.3	41	50	-9
129	G/IC site to the south of Vista Paradise	41.7	43.5	25.9	33.4	<20	45.7	25.9	<20	46	50	-4
130	Vista Paradise	41.1	40.8	21.6	44.1	20.6	44.0	21.6	20.3	44	50	-6
130.1		42.0	41.6	22.5	44.1	20.6	44.8	22.5	20.3	45	50	-5
130.2		42.9	41.1	23.4	44.1	<20	45.1	23.4	<20	45	50	-5
130.3		41.0	41.1	24.3	44.1	<20	44.1	24.3	<20	44	50	-6
130.4		40.4	40.4	25.0	44.1	<20	43.4	25.0	<20	43	50	-7
134	Toi Shan Association Wong Tat To Memorial School	38.8	39.6	23.3	66.8	<20	42.3	23.3	<20	42	50	-8
137	The Waterside	41.1	40.9	21.4	46.4	<20	44.0	21.4	<20	44	50	-6
137.1		41.8	41.8	22.3	46.4	<20	44.8	22.3	<20	45	50	-5
137.2		41.7	42.6	23.2	46.4	<20	45.2	23.2	<20	45	50	-5
137.3		40.9	43.2	24.0	46.4	<20	45.2	24.0	<20	45	50	-5
137.4		40.0	40.2	24.6	46.4	<20	43.1	24.6	<20	43	50	-7

NSR No.	Description Location / Address	Airborne		Structural Noise Leq (dB)	Distance (m)	Airborne Enclosure Portal Leq (dB)	Total Airborne Leq (dB)	Total Structureborne Leq (dB)	Total Enclosure Portal Leq (dB)	Total Leq (dB)	Criterion (dB)	Exceedance (dB)
		Outboard Leq (dB)	Inboard Leq (dB)									
143	Fok On Garden	41.2	41.0	21.6	34.5	<20	44.1	21.6	<20	44	50	-6
143.1		42.3	41.9	22.5	34.5	<20	45.1	22.5	<20	45	50	-5
143.2		43.4	42.8	23.6	34.5	<20	46.1	23.6	<20	46	50	-4
143.3		43.4	41.4	24.8	34.5	<20	45.5	24.8	<20	46	50	-4
143.4		42.0	41.3	25.8	34.5	<20	44.7	25.8	<20	45	50	-5
143a	Residential Development to the East of Vista Paradise (WIP)	34.2	36.3	<20	189.7	<20	38.4	<20	<20	38	50	-12
143a.1		34.2	36.4	<20	189.7	<20	38.4	<20	<20	39	50	-11
143a.2		34.1	36.1	<20	189.7	<20	38.3	<20	<20	38	50	-12
143a.3		33.9	35.6	<20	189.7	<20	37.9	<20	<20	38	50	-12
143a.4		30.7	32.5	<20	189.7	<20	34.7	<20	<20	35	50	-15
144	Tolo Place	41.3	41.0	21.6	25.6	<20	44.2	21.6	<20	44	50	-6
144.1		42.4	42.0	22.6	25.6	<20	45.2	22.6	<20	45	50	-5
144.2		43.6	43.0	23.8	25.6	<20	46.3	23.8	<20	46	50	-4
144.3		45.1	42.6	25.2	25.6	<20	47.1	25.2	<20	47	50	-3
144.4		43.4	42.4	26.7	25.6	<20	46.0	26.7	<20	46	50	-4
148a	Chun Dak House	40.8	40.7	21.2	35.8	<20	43.8	21.2	<20	44	50	-6
148a.1		41.7	41.5	22.0	35.8	<20	44.6	22.0	<20	45	50	-5
148a.2		41.8	42.5	22.9	35.8	<20	45.2	22.9	<20	45	50	-5
148a.3		42.3	43.5	24.0	35.8	<20	46.0	24.0	<20	46	50	-4
148a.4		40.5	44.5	25.2	35.8	<20	46.0	25.2	<20	46	50	-4
148a.5		34.6	34.4	25.8	35.8	<20	37.5	25.8	<20	38	50	-12
150	Bayshore Towers Block 5	41.4	41.1	21.8	46.0	<20	44.3	21.8	<20	44	50	-6
150.1		42.6	41.5	22.8	46.0	<20	45.1	22.8	<20	45	50	-5
150.2		41.5	41.7	23.7	46.0	<20	44.6	23.7	<20	45	50	-5
150.3		41.0	42.0	24.5	46.0	<20	44.5	24.5	<20	45	50	-5
151	Bayshore Towers Block 4	41.6	41.2	21.9	41.3	<20	44.4	21.9	<20	44	50	-6
151.1		42.7	41.8	23.0	41.3	<20	45.3	23.0	<20	45	50	-5
151.2		42.0	42.2	24.0	41.3	<20	45.1	24.0	<20	45	50	-5
151.3		41.4	42.7	24.9	41.3	<20	45.1	24.9	<20	45	50	-5
154	Bayshore Towers Block 3	41.6	41.3	21.9	39.7	<20	44.4	21.9	<20	44	55	-11
154.1		42.8	41.9	23.1	39.7	<20	45.4	23.1	<20	45	55	-10
154.2		42.1	42.3	24.1	39.7	<20	45.2	24.1	<20	45	55	-10
154.3		41.4	42.8	25.1	39.7	<20	45.2	25.1	<20	45	55	-10
154a	Chung On Estate, Chung Kwan House	36.7	38.0	<20	134.3	<20	40.4	<20	<20	40	50	-10
154a.1		36.3	38.2	<20	134.3	<20	40.4	<20	<20	40	50	-10
154a.2		35.8	37.9	<20	134.3	<20	40.0	<20	<20	40	50	-10
154a.3		35.2	37.8	<20	134.3	<20	39.7	<20	<20	40	50	-10
154a.4		34.9	35.6	<20	134.3	<20	38.3	<20	<20	38	50	-12
156	Ma On Shan Centre Block 1	41.2	41.1	21.6	21.4	<20	44.2	21.6	<20	44	55	-11
156.1		42.3	42.0	22.6	21.4	<20	45.2	22.6	<20	45	55	-10
156.2		43.6	43.1	23.8	21.4	<20	46.3	23.8	<20	46	55	-9
156.3		45.2	43.1	25.3	21.4	<20	47.3	25.3	<20	47	55	-8
156.4		44.2	43.1	27.1	21.4	<20	46.7	27.1	<20	47	55	-8
156a	The Waterside	39.8	39.6	20.2	71.7	<20	42.7	20.2	<20	43	50	-7
156a.1		40.4	40.1	20.8	71.7	<20	43.3	20.8	<20	43	50	-7
156a.2		41.0	40.1	21.3	71.7	<20	43.6	21.3	<20	44	50	-6

MOS DOWN

NSR No.	Description Location / Address	Airborne		Structural Noise Leq (dB)	Distance (m)	Airborne Enclosure Portal Leq (dB)	Total Airborne Leq (dB)	Total Structureborne Leq (dB)	Total Enclosure Portal Leq (dB)	Total Leq (dB)	Criterion (dB)	Exceedance (dB)
		Outboard Leq (dB)	Inboard Leq (dB)									
156a.3		39.8	40.0	21.9	71.7	<20	42.9	21.9	<20	43	50	-7
156a.4		39.0	40.1	22.4	71.7	<20	42.6	22.4	<20	43	50	-7
156a.5		38.5	38.9	22.7	71.7	<20	41.7	22.7	<20	42	50	-8
157	Bayshore Towers Block 2	41.5	41.2	21.9	43.3	<20	44.3	21.9	<20	44	55	-11
157.1		42.7	41.5	23.0	43.3	<20	45.1	23.0	<20	45	55	-10
157.2		41.6	41.8	23.9	43.3	<20	44.7	23.9	<20	45	55	-10
157.3		41.0	42.2	24.8	43.3	<20	44.7	24.8	<20	45	55	-10
158	Ma On Shan Centre Block 2	41.2	41.1	21.6	20.6	<20	44.2	21.6	<20	44	55	-11
158.1		42.3	42.1	22.6	20.6	<20	45.2	22.6	<20	45	55	-10
158.2		43.6	43.1	23.8	20.6	<20	46.4	23.8	<20	46	55	-9
158.3		45.2	42.9	25.3	20.6	<20	47.2	25.3	<20	47	55	-8
158.4		44.3	42.5	27.2	20.6	<20	46.5	27.2	<20	47	55	-8
161	Villa Athena Block 1	42.1	42.0	22.6	45.7	<20	45.1	22.6	<20	45	50	-5
161.1		42.8	42.2	23.2	45.7	<20	45.5	23.2	<20	46	50	-4
161.2		40.9	42.6	24.1	45.7	<20	44.9	24.1	<20	45	50	-5
161.3		40.5	41.9	24.7	45.7	<20	44.3	24.7	<20	44	50	-6
162	Villa Athena Block 2	42.1	42.0	22.6	46.8	<20	45.0	22.6	<20	45	50	-5
162.1		42.7	42.5	23.2	46.8	<20	45.6	23.2	<20	46	50	-4
162.2		40.8	42.9	24.0	46.8	<20	45.0	24.0	<20	45	50	-5
162.3		40.4	41.7	24.7	46.8	<20	44.1	24.7	<20	44	50	-6
163	Villa Athena Block 5	42.8	42.7	23.3	29.6	<20	45.8	23.3	<20	46	50	-4
163.1		43.6	43.5	24.1	29.6	<20	46.6	24.1	<20	47	50	-3
163.2		44.8	44.7	25.4	29.6	<20	47.8	25.4	<20	48	50	-2
163.3		42.5	44.4	26.6	29.6	<20	46.5	26.6	<20	47	50	-3
164	Villa Athena Block 3	42.2	42.1	22.7	44.5	<20	45.1	22.7	<20	45	50	-5
164.1		42.8	42.7	23.3	44.5	<20	45.8	23.3	<20	46	50	-4
164.2		41.1	43.2	24.2	44.5	<20	45.3	24.2	<20	45	50	-5
164.3		40.6	42.1	24.9	44.5	<20	44.4	24.9	<20	44	50	-6
165	Villa Athena Block 4	42.3	42.3	22.8	40.9	<20	45.3	22.8	<20	45	50	-5
165.1		43.0	42.9	23.5	40.9	<20	46.0	23.5	<20	46	50	-4
165.2		41.5	43.7	24.5	40.9	<20	45.8	24.5	<20	46	50	-4
165.3		41.1	42.5	25.2	40.9	<20	44.9	25.2	<20	45	50	-5
166	Villa Athena Block 6	42.7	42.6	23.3	35.1	<20	45.7	23.3	<20	46	50	-4
166.1		43.4	43.3	24.0	35.1	<20	46.4	24.0	<20	46	50	-4
166.2		42.5	44.3	25.2	35.1	<20	46.5	25.2	<20	47	50	-3
166.3		41.8	42.4	26.1	35.1	<20	45.1	26.1	<20	45	50	-5
167	Ma On Shan Centre Block 4	40.0	39.9	20.6	79.3	<20	43.0	20.6	<20	43	55	-12
167.1		39.9	39.3	21.2	79.3	<20	42.7	21.2	<20	43	55	-12
167.2		38.5	39.5	21.7	79.3	<20	42.1	21.7	<20	42	55	-13
167.3		38.3	39.5	22.1	79.3	<20	42.0	22.1	<20	42	55	-13
167.4		38.2	39.0	22.4	79.3	<20	41.6	22.4	<20	42	55	-13
168	Villa Athena Block 7	42.4	42.4	23.2	43.2	<20	45.4	23.2	<20	45	50	-5
168.1		43.0	43.0	23.8	43.2	<20	46.0	23.8	<20	46	50	-4
168.2		41.4	43.8	24.7	43.2	<20	45.8	24.7	<20	46	50	-4
168.3		40.9	41.3	25.4	43.2	<20	44.1	25.4	<20	44	50	-6
170	Villa Athena Block 8	42.1	42.1	23.0	52.8	<20	45.1	23.0	<20	45	50	-5
170.1		41.5	42.6	23.6	52.8	<20	45.1	23.6	<20	45	50	-5

NSR No.	Description Location / Address	Airborne		Structural Noise Leq (dB)	Distance (m)	Airborne Enclosure Portal Leq (dB)	Total Airborne Leq (dB)	Total Structureborne Leq (dB)	Total Enclosure Portal Leq (dB)	Total Leq (dB)	Criterion (dB)	Exceedance (dB)
		Outboard Leq (dB)	Inboard Leq (dB)									
170.2		40.5	43.2	24.3	52.8	<20	45.1	24.3	<20	45	50	-5
170.3		40.0	40.2	24.7	52.8	<20	43.1	24.7	<20	43	50	-7
171	Villa Athena Block 9	41.0	41.7	22.8	65.3	<20	44.3	22.8	<20	44	50	-6
171.1		39.9	42.1	23.2	65.3	<20	44.1	23.2	<20	44	50	-6
171.2		39.6	42.4	23.7	65.3	<20	44.3	23.7	<20	44	50	-6
171.3		39.2	39.1	24.0	65.3	<20	42.2	24.0	<20	42	50	-8
173	Villa Athena Block 10	39.5	41.2	22.6	76.6	<20	43.5	22.6	<20	44	50	-6
173.1		39.4	41.6	23.0	76.6	<20	43.6	23.0	<20	44	50	-6
173.2		39.1	41.6	23.4	76.6	<20	43.5	23.4	<20	44	50	-6
173.3		38.5	38.0	23.6	76.6	<20	41.3	23.6	<20	41	50	-9
174	Wu Kai Sha New Village nos.1-12	32.8	30.0	24.9	69.6	26.1	35.2	24.9	<20	36	45	-9
176	Wu Kai Sha New Village nos.13-19A	36.9	33.4	26.6	110.9	<20	38.5	26.6	<20	39	45	-6
177	Lok Wo Sha nos.29-30	40.0	39.3	25.6	94.5	26.0	42.8	25.6	<20	43	45	-2
178	Symphony Bay	42.7	40.7	22.3	81.3	<20	44.8	22.3	<20	45	45	0
178.1		42.9	41.2	22.9	81.3	<20	45.2	22.9	<20	45	45	0
178.2		43.2	41.5	23.4	81.3	<20	45.5	23.4	<20	45	45	0
178.3		41.6	41.9	23.8	81.3	<20	44.8	23.8	<20	45	45	0
178.4		39.8	38.1	24.0	81.3	<20	42.1	24.0	<20	42	45	-3

Tai Wai to Ma On Shan Rail
Non Revenue Trains - Up

NSR No.	Description Location / Address	Airborne Outboard Leq (dB)	Airborne Inboard Leq (dB)	Structural Noise Leq (dB)	Distance (m)	Airborne Enclosure Portal Leq (dB)	Total Airborne Leq (dB)	Total Structureborne Leq (dB)	Total Enclosure Portal Leq (dB)	Total Leq (dB)	Criterion (dB)	Exceedance (dB)
1	Hing Tak House Hin Keng Estate	31.1	31.4	<20	237.3	<20	34.3	<20	<20	34	45	-11
1.1		30.4	30.9	<20	237.3	<20	33.7	<20	<20	34	45	-11
1.2		29.6	30.3	<20	237.3	<20	33.0	<20	<20	33	45	-12
1.3		29.3	27.4	<20	237.3	<20	31.5	<20	<20	31	45	-14
2	Hin Tin 64	29.4	26.2	<20	219.8	<20	31.1	<20	<20	31	45	-14
10	Hing Yeung House Hin Keng Estate	35.3	36.2	<20	162.5	<20	38.8	<20	<20	39	45	-6
10.1		35.1	36.2	<20	162.5	<20	38.7	<20	<20	39	45	-6
10.2		35.1	35.4	<20	162.5	<20	38.3	<20	<20	38	45	-7
10.3		35.2	32.7	<20	162.5	<20	37.1	<20	<20	37	45	-8
10.4		35.2	31.6	<20	162.5	<20	36.7	<20	<20	37	45	-8
13	Hing Tak House Hin Keng Estate	36.4	36.8	<20	181.2	<20	39.6	<20	<20	40	45	-5
13.1		36.5	36.8	<20	181.2	<20	39.6	<20	<20	40	45	-5
13.2		36.6	35.6	<20	181.2	<20	39.1	<20	<20	39	45	-6
13.3		36.6	33.7	<20	181.2	<20	38.4	<20	<20	38	45	-7
13.4		36.6	33.0	<20	181.2	<20	38.2	<20	<20	38	45	-7
14	Carmel Alison Lam Primary School	37.0	36.8	<20	195.3	<20	39.9	<20	<20	40	45	-5
14.1		37.1	36.4	<20	195.3	<20	39.8	<20	<20	40	45	-5
14.2		37.2	35.3	<20	195.3	<20	39.4	<20	<20	39	45	-6
14.3		37.3	33.8	<20	195.3	<20	38.9	<20	<20	39	45	-6
14.4		37.4	33.4	<20	195.3	<20	38.8	<20	<20	39	45	-6
14a	Hin Keng Community Centre	36.8	34.6	<20	219.3	<20	38.8	<20	<20	39	45	-6
15	Carado Garden Block 6	36.3	34.8	<20	239.5	<20	38.6	<20	<20	39	50	-11
15.1		36.5	34.3	<20	239.5	<20	38.5	<20	<20	39	50	-11
15.2		36.6	33.8	<20	239.5	<20	38.4	<20	<20	38	50	-12
15.3		36.7	33.7	<20	239.5	<20	38.5	<20	<20	38	50	-12
15.4		36.7	33.6	<20	239.5	<20	38.4	<20	<20	38	50	-12
16	Carado Garden Block 3	35.0	33.7	<20	234.4	<20	37.4	<20	<20	37	50	-13
16.1		35.1	33.3	<20	234.4	<20	37.3	<20	<20	37	50	-13
16.2		35.2	32.7	<20	234.4	<20	37.1	<20	<20	37	50	-13
16.3		35.3	32.5	<20	234.4	<20	37.1	<20	<20	37	50	-13
16.4		35.2	32.4	<20	234.4	<20	37.0	<20	<20	37	50	-13
18	Tin Sam 182-185	31.6	31.0	<20	161.6	<20	34.3	<20	<20	34	50	-16
19	Tin Sam 186-189	31.5	31.0	<20	159.7	<20	34.3	<20	<20	34	50	-16
20	Tin Sam 192-197	31.2	30.2	20.5	155.7	<20	33.7	20.5	<20	34	50	-16
21	Tin Sam 217-220	31.2	30.5	21.0	155.4	<20	33.9	21.0	<20	34	50	-16
22	Sun Ming House	34.0	35.7	<20	170.0	<20	37.9	<20	<20	38	50	-12
22.1		34.0	35.8	<20	170.0	<20	38.0	<20	<20	38	50	-12
22.2		34.1	33.7	<20	170.0	<20	36.9	<20	<20	37	50	-13
22.3		33.9	33.1	<20	170.0	<20	36.5	<20	<20	37	50	-13
23	Cheung Wong Wai Primary School	34.5	33.6	<20	167.3	<20	37.1	<20	<20	37	50	-13
25	Sha Tin Tsung Tsin Secondary School	34.4	33.4	<20	179.6	<20	37.0	<20	<20	37	50	-13
25a	Tin Sam Village nos. 217	30.8	30.4	21.0	154.6	<20	33.6	21.0	<20	34	50	-16
26	Ng Yuk Secondary School	35.2	34.2	<20	152.5	<20	37.7	<20	<20	38	50	-12
29	Koo Arm Temple	32.8	31.6	21.1	112.5	<20	35.3	21.1	<20	35	50	-15

NSR No.	Description Location / Address	Airborne Outboard Leq (dB)	Airborne Inboard Leq (dB)	Structural Noise Leq (dB)	Distance (m)	Airborne Enclosure Portal Leq (dB)	Total Airborne Leq (dB)	Total Structureborne Leq (dB)	Total Enclosure Portal Leq (dB)	Total Leq (dB)	Criterion (dB)	Exceedance (dB)
31	Kingdom Garden in Lei Uk	37.8	36.4	22.9	75.6	<20	40.2	22.9	<20	40	50	-10
32	Tsang Tai Uk No.1-14	31.7	31.4	22.2	78.7	<20	34.6	22.2	<20	35	50	-15
32b	Tsang Tai Uk (New Development)	32.7	30.8	29.3	15.5	<20	34.9	29.3	<20	36	50	-14
33	Shek Fai House Chun Shek Estate	40.4	40.0	21.1	75.1	<20	43.2	21.1	<20	43	50	-7
33.1		38.6	40.7	21.9	75.1	<20	42.8	21.9	<20	43	50	-7
33.2		38.5	41.0	22.4	75.1	<20	43.0	22.4	<20	43	50	-7
33.3		38.5	38.2	22.7	75.1	<20	41.4	22.7	<20	41	50	-9
34	Shek Yuk House Chun Shek Estate	40.8	40.5	21.3	70.1	<20	43.7	21.3	<20	44	50	-6
34.1		39.0	41.3	22.1	70.1	<20	43.3	22.1	<20	43	50	-7
34.2		38.9	41.8	22.6	70.1	<20	43.6	22.6	<20	44	50	-6
34.3		38.8	38.9	23.0	70.1	<20	41.9	23.0	<20	42	50	-8
36	Sha Tin Tau 4-7	35.5	35.6	24.6	48.1	<20	38.6	24.6	<20	39	55	-16
36a	Sun Fong House	34.0	35.6	<20	204.0	<20	37.8	<20	<20	38	50	-12
36a.1		34.0	33.7	<20	204.0	<20	36.9	<20	<20	37	50	-13
36a.2		34.0	33.1	<20	204.0	<20	36.6	<20	<20	37	50	-13
36a.3		33.5	32.2	<20	204.0	<20	35.9	<20	<20	36	50	-14
37	Lei Uk Tsuen 12-15	34.0	32.5	23.7	62.9	<20	36.3	23.7	<20	37	50	-13
38a	San Tin Village	30.2	29.0	<20	173.5	<20	32.7	<20	<20	33	50	-17
39	Sha Tin Tau 3	36.8	36.7	26.3	32.6	<20	39.7	26.3	<20	40	55	-15
39a	Che Kung Miu (temple)	32.8	31.2	22.5	79.9	<20	35.1	22.5	<20	35	50	-15
40a	Chee Hon Kindergarden	33.0	32.1	<20	202.2	<20	35.6	<20	<20	36	50	-14
41a	Lei Uk Tsuen1-6	32.5	31.1	22.2	91.1	<20	34.9	22.2	<20	35	50	-15
45	Pok On House Pok Hong Estate	40.0	41.2	21.8	57.2	<20	43.6	21.8	<20	44	50	-6
45.1		40.0	41.5	22.6	57.2	<20	43.8	22.6	<20	44	50	-6
45.2		38.0	41.2	23.3	57.2	<20	42.9	23.3	<20	43	50	-7
45.3		36.7	37.2	23.8	57.2	<20	40.0	23.8	<20	40	50	-10
46	Pok Man House Pok Hong Estate	42.5	42.5	22.7	17.9	<20	45.5	22.7	<20	46	50	-4
46.1		44.0	43.9	24.2	17.9	<20	47.0	24.2	<20	47	50	-3
46.2		43.6	45.5	25.9	17.9	<20	47.7	25.9	<20	48	50	-2
46.3		39.9	44.4	28.0	17.9	<20	45.8	28.0	<20	46	50	-4
48	Tin Ka Ping Salvation Army Primary School	41.1	46.2	27.5	17.9	<20	47.4	27.5	<20	47	50	-3
48a	Lei Uk Tsuen	34.4	34.5	<20	150.1	<20	37.5	<20	<20	38	50	-12
48b	Sha Tin Methodist College	34.3	33.7	<20	211.0	<20	37.0	<20	<20	37	50	-13
51a	Stewards High Rock Christain Camp	39.9	40.9	23.7	56.7	<20	43.4	23.7	<20	43	50	-7
53	Pok Yue House Pok Hong Estate	44.0	42.6	24.2	26.6	<20	46.4	24.2	<20	46	50	-4
53.1		45.0	41.9	25.2	26.6	<20	46.7	25.2	<20	47	50	-3
53.2		42.6	41.7	26.7	26.6	<20	45.2	26.7	<20	45	50	-5
56	Pok Yat House Pok Hong Estate	41.4	41.2	21.7	39.0	<20	44.3	21.7	<20	44	50	-6
56.1		42.2	41.8	22.4	39.0	<20	45.0	22.4	<20	45	50	-5
56.2		43.2	42.0	23.4	39.0	<20	45.6	23.4	<20	46	50	-4
56.3		42.0	42.5	24.4	39.0	<20	45.2	24.4	<20	45	50	-5
58	Pok Tai House Pok Hong Estate	41.7	43.4	25.7	35.7	<20	45.7	25.7	<20	46	50	-4
58.1		42.3	41.9	22.5	35.7	<20	45.1	22.5	<20	45	50	-5
58.2		43.3	42.4	23.5	35.7	<20	45.9	23.5	<20	46	50	-4
58.3		42.3	43.0	24.7	35.7	<20	45.7	24.7	<20	46	50	-4
58.4		41.7	43.4	25.7	35.7	<20	45.7	25.7	<20	46	50	-4

MOS UP

NSR No.	Description Location / Address	Airborne Outboard Leq (dB)	Airborne Inboard Leq (dB)	Structural Noise Leq (dB)	Distance (m)	Airborne Enclosure Portal Leq (dB)	Total Airborne Leq (dB)	Total Structureborne Leq (dB)	Total Enclosure Portal Leq (dB)	Total Leq (dB)	Criterion (dB)	Exceedance (dB)
60	Sha Tin Wai 1-2	36.5	36.4	24.8	47.4	<20	39.5	24.8	<20	40	55	-15
61a	CC Shatin Church Pok Hong	29.3	27.7	28.1	20.3	<20	31.6	28.1	<20	33	50	-17
62	Sha Tin Wai 8a	36.5	36.7	24.7	48.8	<20	39.6	24.7	<20	40	55	-15
65a	Pok Hong Estate, Pok Tat House	36.1	38.3	20.2	111.0	<20	40.3	20.2	<20	40	50	-10
65a.1		35.7	37.7	20.5	111.0	<20	39.8	20.5	<20	40	50	-10
65a.2		35.5	36.7	20.8	111.0	<20	39.2	20.8	<20	39	50	-11
65a.3		33.8	34.0	20.9	111.0	<20	36.9	20.9	<20	37	50	-13
70	Wong Uk Village 17-18	39.1	35.3	29.8	14.1	<20	40.6	29.8	<20	41	50	-9
70a	Pok Hong Estate Community Centre	36.1	36.0	22.5	76.4	<20	39.1	22.5	<20	39	50	-11
71	Wong Uk Village 11-12	40.1	36.0	29.1	17.7	<20	41.6	29.1	<20	42	50	-8
71a	Pok Hong Estate, Pok Che House	36.3	37.8	<20	133.7	<20	40.2	<20	<20	40	50	-10
71b.1		36.1	38.0	<20	133.7	<20	40.2	<20	<20	40	50	-10
71b.2		35.9	38.1	<20	133.7	<20	40.1	<20	<20	40	50	-10
71b.3		35.8	37.9	20.0	133.7	<20	40.0	20.0	<20	40	50	-10
71b.4		35.7	37.4	20.1	133.7	<20	39.7	20.1	<20	40	50	-10
72	Wong Uk Village 3-4	43.3	36.1	30.7	12.9	<20	44.1	30.7	<20	44	55	-11
72a	Christ College	35.4	36.5	20.0	130.3	<20	39.0	20.0	<20	39	50	-11
73	Wong Uk Village 1-2	46.2	37.6	30.3	18.2	<20	46.7	30.3	<20	47	55	-8
74	Prince of Wales Hospital	47.5	47.8	25.8	52.8	21.7	50.7	25.8	21.6	51	55	-4
75	Prince of Wales Hospital	47.3	47.5	25.5	57.0	21.8	50.4	25.5	21.7	50	55	-5
82a	Sha Tin Wai Village No. 104-107	38.5	38.2	22.7	75.4	<20	41.4	22.7	<20	41	50	-9
96a	Prince of Wales Hospital Accomodation	36.4	37.5	<20	189.4	22.5	40.1	<20	22.4	40	55	-15
96a.1		34.8	35.3	<20	189.4	22.5	38.2	<20	22.4	38	55	-17
99a	St. Rose of Lima's School	34.8	35.5	<20	171.5	24.3	38.4	<20	24.2	39	55	-16
101a	Residential Development (WIP)	41.8	41.4	22.2	47.4	27.7	44.7	22.2	27.6	45	55	-10
101a.1		42.6	41.6	22.9	47.4	27.8	45.2	22.9	27.7	45	55	-10
101a.2		41.5	42.1	23.8	47.4	27.8	44.9	23.8	27.7	45	55	-10
101a.3		41.0	42.6	24.5	47.4	27.9	45.0	24.5	27.7	45	55	-10
104a	Chap Wai Kon Street Fire Station	36.1	33.4	26.4	34.5	31.5	38.8	26.4	31.3	40	55	-15
110	Sha Tin Hospital	38.9	40.4	<20	64.6	<20	42.7	<20	<20	43	55	-12
111	Sha Tin Hospital	38.6	40.1	<20	69.2	<20	42.4	<20	<20	42	55	-13
112	Fishermen's New Village no.113	38.8	37.3	<20	69.1	<20	41.1	<20	<20	41	55	-14
113	Fishermen's New Village no.92	37.5	36.1	<20	93.1	<20	39.9	<20	<20	40	55	-15
113a	Planned Residential Development	40.6	40.1	21.8	74.0	29.5	43.5	21.8	29.4	44	55	-11
113a.1		39.1	40.6	22.3	74.0	29.6	43.1	22.3	29.5	43	55	-12
113a.2		38.8	41.0	22.8	74.0	29.7	43.2	22.8	29.6	43	55	-12
113a.3		38.7	41.3	23.2	74.0	29.7	43.4	23.2	29.6	44	55	-11
114	Fishermen's New Village no.37	38.1	36.8	<20	80.9	<20	40.6	<20	<20	41	55	-14
115	Fishermen's New Village no.29	38.0	36.7	<20	83.7	<20	40.4	<20	<20	40	55	-15
116	Fishermen's New Village nos. 19	38.0	36.8	<20	84.3	<20	40.4	<20	<20	40	55	-15
117	Fishermen's New Village nos. 8	38.0	36.8	<20	82.5	<20	40.5	<20	<20	40	55	-15
118	Fishermen's New Village nos. 4	38.2	37.0	<20	77.9	<20	40.7	<20	<20	41	55	-14
119	Chevalier Garden Block 6	34.2	35.9	<20	185.4	<20	38.1	<20	<20	38	55	-17
119.1		34.1	34.9	<20	185.4	<20	37.5	<20	<20	38	55	-17
119.2		34.0	33.2	<20	185.4	<20	36.7	<20	<20	37	55	-18
120	Ma On Shan Tsung Tsin Secondary	36.9	37.4	<20	104.2	<20	40.2	<20	<20	40	55	-15
121	Tai Shui Hang nos. 1-4	31.7	31.1	<20	222.8	<20	34.5	<20	<20	35	55	-20

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123	Tai Shui Hang nos. 14-15	34.1	32.9	<20	125.5	<20	36.6	<20	<20	37	55	-18
125	Shing On THA	30.1	29.2	23.5	124.7	33.6	36.2	23.5	33.4	38	55	-17
126a	Shatin Hospital Quarters	39.8	39.0	<20	52.2	<20	42.4	<20	<20	42	55	-13
127	Ngan On House Kam On Court	40.8	40.6	22.0	38.4	26.2	43.8	22.0	25.8	44	50	-6
127.1		41.8	41.5	22.9	38.4	26.3	44.7	22.9	26.0	45	50	-5
127.2		42.9	41.6	23.8	38.4	26.4	45.4	23.8	26.1	45	50	-5
127.3		41.5	42.3	24.8	38.4	26.5	45.0	24.8	26.2	45	50	-5
127.4		40.9	42.7	25.6	38.4	26.5	44.9	25.6	26.2	45	50	-5
128	Po On House Kam On Court	40.6	40.3	21.6	52.1	24.3	43.5	21.6	24.0	44	50	-6
128.1		41.5	40.8	22.4	52.1	24.4	44.2	22.4	24.1	44	50	-6
128.2		41.4	41.1	23.1	52.1	24.5	44.3	23.1	24.2	44	50	-6
128.3		39.8	41.6	23.9	52.1	24.6	43.9	23.9	24.3	44	50	-6
128.4		39.6	41.8	24.4	52.1	24.6	43.9	24.4	24.3	44	50	-6
130a	Scattered Residential Properties	37.1	36.0	<20	97.9	<20	39.6	<20	<20	40	50	-10
131	Heng Yat House Heng On Estate	39.7	39.1	20.8	84.1	21.6	42.5	20.8	21.3	43	50	-7
131.1		38.6	39.0	21.3	84.1	21.7	41.8	21.3	21.4	42	50	-8
131.2		37.8	39.1	21.8	84.1	21.7	41.5	21.8	21.4	42	50	-8
131.3		37.7	39.1	22.2	84.1	21.8	41.5	22.2	21.5	42	50	-8
131.4		37.4	38.2	22.4	84.1	21.8	40.9	22.4	21.5	41	50	-9
132	Chinese YMCA College	40.4	40.8	24.7	44.9	21.9	43.6	24.7	21.6	44	50	-6
133	Hing On THA	34.4	33.1	24.1	56.5	<20	36.9	24.1	<20	37	50	-13
135	Tsang Pik Shan Secondary School	37.5	38.0	22.2	95.6	<20	40.8	22.2	<20	41	50	-9
136	Tsang Pik Shan Secondary School	37.6	38.1	22.3	93.1	<20	40.9	22.3	<20	41	50	-9
138	SunShine City Block K	39.8	39.6	20.8	79.1	<20	42.7	20.8	<20	43	50	-7
138.1		39.0	39.4	21.4	79.1	<20	42.2	21.4	<20	42	50	-8
138.2		38.2	39.4	21.9	79.1	<20	41.8	21.9	<20	42	50	-8
138.3		38.1	39.3	22.4	79.1	<20	41.8	22.4	<20	42	50	-8
138.4		38.1	39.0	22.7	79.1	<20	41.6	22.7	<20	42	50	-8
138a	Proposed Residential Development east of Area 86B	36.0	38.2	23.2	107.5	32.8	40.9	23.2	32.5	42	55	-13
138a.1		35.9	38.4	23.7	107.5	33.4	41.1	23.7	33.1	42	55	-13
138a.2		35.8	38.2	24.1	107.5	33.8	41.1	24.1	33.6	42	55	-13
138a.3		35.7	36.2	24.3	107.5	34.0	40.2	24.3	33.8	41	55	-14
139	SunShine City Block L	40.4	40.5	21.2	60.0	<20	43.5	21.2	<20	44	50	-6
139.1		41.1	40.7	22.0	60.0	<20	43.9	22.0	<20	44	50	-6
139.2		40.1	40.2	22.7	60.0	<20	43.2	22.7	<20	43	50	-7
139.3		39.4	40.1	23.3	60.0	<20	42.8	23.3	<20	43	50	-7
139.4		39.4	39.7	23.8	60.0	<20	42.5	23.8	<20	43	50	-7
140	SunShine City Block M	41.1	41.2	21.7	23.5	<20	44.2	21.7	<20	44	50	-6
140.1		42.2	42.1	22.8	23.5	<20	45.2	22.8	<20	45	50	-5
140.2		43.5	43.0	23.9	23.5	<20	46.3	23.9	<20	46	50	-4
140.3		45.1	43.1	25.4	23.5	<20	47.2	25.4	<20	47	50	-3
140.4		43.2	43.6	27.1	23.5	<20	46.4	27.1	<20	46	50	-4
141	Yan Chai Hospital Tung Chi Ying Memorial Secondary School	35.6	36.0	20.5	137.8	<20	38.8	20.5	<20	39	55	-16
142	SunShine City Block E	39.8	39.0	20.8	79.5	<20	42.5	20.8	<20	42	55	-13
142.1		38.3	39.2	21.3	79.5	<20	41.8	21.3	<20	42	55	-13

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142.2		38.1	39.4	21.9	79.5	<20	41.8	21.9	<20	42	55	-13
142.3		38.0	39.5	22.3	79.5	<20	41.8	22.3	<20	42	55	-13
142.4		37.9	39.3	22.6	79.5	<20	41.7	22.6	<20	42	55	-13
142a.1	Chinese YMCA College	42.1	42.5	26.5	29.4	22.7	45.3	26.5	22.4	45	50	-5
145	SunShine City Block G	41.2	41.1	21.7	24.0	<20	44.2	21.7	<20	44	50	-6
145.1		42.3	42.1	22.8	24.0	<20	45.2	22.8	<20	45	50	-5
145.2		43.5	43.0	23.9	24.0	<20	46.3	23.9	<20	46	50	-4
145.3		45.1	43.3	25.4	24.0	<20	47.3	25.4	<20	47	50	-3
145.4		43.1	44.1	27.0	24.0	<20	46.6	27.0	<20	47	50	-3
146	Saddle Ridge Garden Block 1	39.3	39.6	20.8	89.8	<20	42.4	20.8	<20	42	55	-13
146.1		38.0	40.2	21.4	89.8	<20	42.3	21.4	<20	42	55	-13
146.2		37.8	40.6	21.8	89.8	<20	42.4	21.8	<20	42	55	-13
146.3		37.6	39.7	22.1	89.8	<20	41.8	22.1	<20	42	55	-13
147	Fu Fai Garden Block 1	41.7	41.5	22.2	28.9	<20	44.6	22.2	<20	45	55	-10
147.1		43.2	42.8	23.6	28.9	<20	46.0	23.6	<20	46	55	-9
147.2		44.5	41.7	24.9	28.9	<20	46.3	24.9	<20	46	55	-9
147.3		42.4	41.8	26.3	28.9	<20	45.1	26.3	<20	45	55	-10
148	Saddle Ridge Garden Block 2	39.9	39.9	21.0	80.7	<20	42.9	21.0	<20	43	50	-7
148.1		38.8	40.6	21.7	80.7	<20	42.8	21.7	<20	43	50	-7
148.2		38.3	41.0	22.2	80.7	<20	42.9	22.2	<20	43	50	-7
148.3		38.1	40.3	22.5	80.7	<20	42.4	22.5	<20	42	50	-8
149	Fu Fai Garden Block 2	41.7	41.6	22.2	29.4	<20	44.7	22.2	<20	45	50	-5
149.1		43.3	42.9	23.6	29.4	<20	46.1	23.6	<20	46	50	-4
149.2		44.5	42.0	24.9	29.4	<20	46.4	24.9	<20	46	50	-4
149.3		42.3	42.0	26.3	29.4	<20	45.2	26.3	<20	45	50	-5
149a	St. Francis Church	32.3	31.4	24.0	61.3	<20	34.9	24.0	<20	35	50	-15
150a	St. Josephs Secondary School	31.9	31.9	<20	230.0	<20	35.0	<20	<20	35	50	-15
151a	Fung Yiu King Memorial Secondary	32.9	33.6	<20	190.5	<20	36.3	<20	<20	36	50	-14
152	Saddle Ridge Garden Block 3	40.2	40.1	21.3	70.5	<20	43.2	21.3	<20	43	50	-7
152.1		39.6	41.0	22.1	70.5	<20	43.4	22.1	<20	43	50	-7
152.2		39.0	41.5	22.6	70.5	<20	43.5	22.6	<20	43	50	-7
152.3		38.7	41.9	23.0	70.5	<20	43.6	23.0	<20	44	50	-6
153	Saddle Ridge Garden Block 4	40.5	40.4	21.5	61.8	<20	43.5	21.5	<20	44	50	-6
153.1		41.3	41.3	22.4	61.8	<20	44.3	22.4	<20	44	50	-6
153.2		39.6	42.0	23.0	61.8	<20	44.0	23.0	<20	44	50	-6
153.3		39.2	42.4	23.5	61.8	<20	44.1	23.5	<20	44	50	-6
155	Saddle Ridge Garden Block 5	40.7	40.6	21.7	56.2	<20	43.7	21.7	<20	44	50	-6
155.1		41.7	41.5	22.6	56.2	<20	44.6	22.6	<20	45	50	-5
155.2		40.2	42.2	23.3	56.2	<20	44.4	23.3	<20	44	50	-6
155.3		39.6	42.8	23.9	56.2	<20	44.5	23.9	<20	45	50	-5
159	Saddle Ridge Garden Block 6	40.7	40.6	21.8	57.3	<20	43.7	21.8	<20	44	50	-6
159.1		41.8	41.5	22.7	57.3	<20	44.7	22.7	<20	45	50	-5
159.2		40.2	42.2	23.4	57.3	<20	44.3	23.4	<20	44	50	-6
159.3		39.3	42.6	23.9	57.3	<20	44.3	23.9	<20	44	50	-6
160	Skill Opportunity School (SOS) in Ma On Shan Area 103	39.5	42.5	23.9	57.8	20.1	44.3	23.9	<20	44	50	-6
167a	Ma On Shan Health Care & Elderly	33.2	30.7	26.7	29.5	<20	35.1	26.7	<20	36	50	-14

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169	Lung Yiu House Kam Lung Court	40.8	40.7	22.8	46.3	23.1	43.8	22.8	<20	44	50	-6
169.1		41.6	41.5	23.5	46.3	23.9	44.6	23.5	<20	45	50	-5
169.2		42.4	42.4	24.3	46.3	24.5	45.4	24.3	<20	45	50	-5
169.3		40.9	43.2	25.0	46.3	24.9	45.3	25.0	<20	45	50	-5
169.4		40.6	42.4	25.6	46.3	25.2	44.6	25.6	<20	45	50	-5
172	Lung Sing House Kam Lung Court	40.8	40.8	23.6	41.3	25.4	43.8	23.6	<20	44	50	-6
172.1		41.6	41.5	24.5	41.3	26.7	44.7	24.5	<20	45	50	-5
172.2		42.4	42.4	25.4	41.3	27.9	45.5	25.4	<20	46	50	-4
172.3		41.1	43.3	26.3	41.3	29.0	45.5	26.3	<20	46	50	-4
172.4		40.9	43.3	27.0	41.3	29.7	45.4	27.0	<20	45	50	-5
175	Lee Wing House Lee On Estate	42.5	42.4	26.0	72.5	<20	45.5	26.0	<20	46	50	-4
175.1		43.1	43.0	27.4	72.5	<20	46.1	27.4	<20	46	50	-4
175.2		43.4	43.5	28.9	72.5	<20	46.5	28.9	<20	47	50	-3
175.3		43.2	43.8	30.6	72.5	<20	46.5	30.6	<20	47	50	-3
175.4		40.7	43.6	32.1	72.5	<20	45.4	32.1	<20	46	50	-4
179a	Residential Development to the East of Lee On Estate (WIP)			22.6		20.1	44.3	22.6	<20	44		-6
		41.0	41.6		126.6						50	
179a.1		41.3	41.9	23.0	126.6	20.4	44.7	23.0	<20	45	50	-5
179a.2		39.9	42.2	23.3	126.6	20.6	44.2	23.3	<20	44	50	-6
179a.3		39.6	42.2	23.5	126.6	20.7	44.1	23.5	<20	44	50	-6