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Rail Noise Assessment
5 Avon Road Pymble

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1 INTRODUCTION

This Acoustic Report provides an assessment of rail noise impacts at the site of the proposed multi-building residential development at Avon Road Pymble. The Report has been prepared in order to address the Director General requirements for the site and to provide an appropriate level of acoustic amenity for the occupants of the buildings.

The following documents have been used in the preparation of the Report:

- Director General's Requirements (DGR) dated 11 February 2009, Y09/283
- NSW Department of Planning Infrastructure SEPP (State Environmental Planning Policy) 2007
- NSW Department of Planning *Development Near Rail Corridors and Busy Roads – Interim Guideline* (2008)
- Drawings prepared by Ancher Mortlock Woolley

2 SITE AND PROJECT DESCRIPTION

The site is described as Numbers 1, 1A and 5 Avon Road, Numbers 4 and 8 Beechworth Road and 1 Arilla Road, Pymble. A site aerial view is shown in Figure 2-1. Figure 2-2 shows the site outline.

The project involves construction of five residential buildings. Land area is 2.5 hectares. A total of 350 apartments are proposed.

The land is not a simple shape (refer to Figures) but the north-eastern boundary of the site is bounded by the North Shore Railway Line. Up to around 212 passenger trains pass the site each weekday. No freight trains use this rail line.

Figure 2-1 Site Aerial Photo

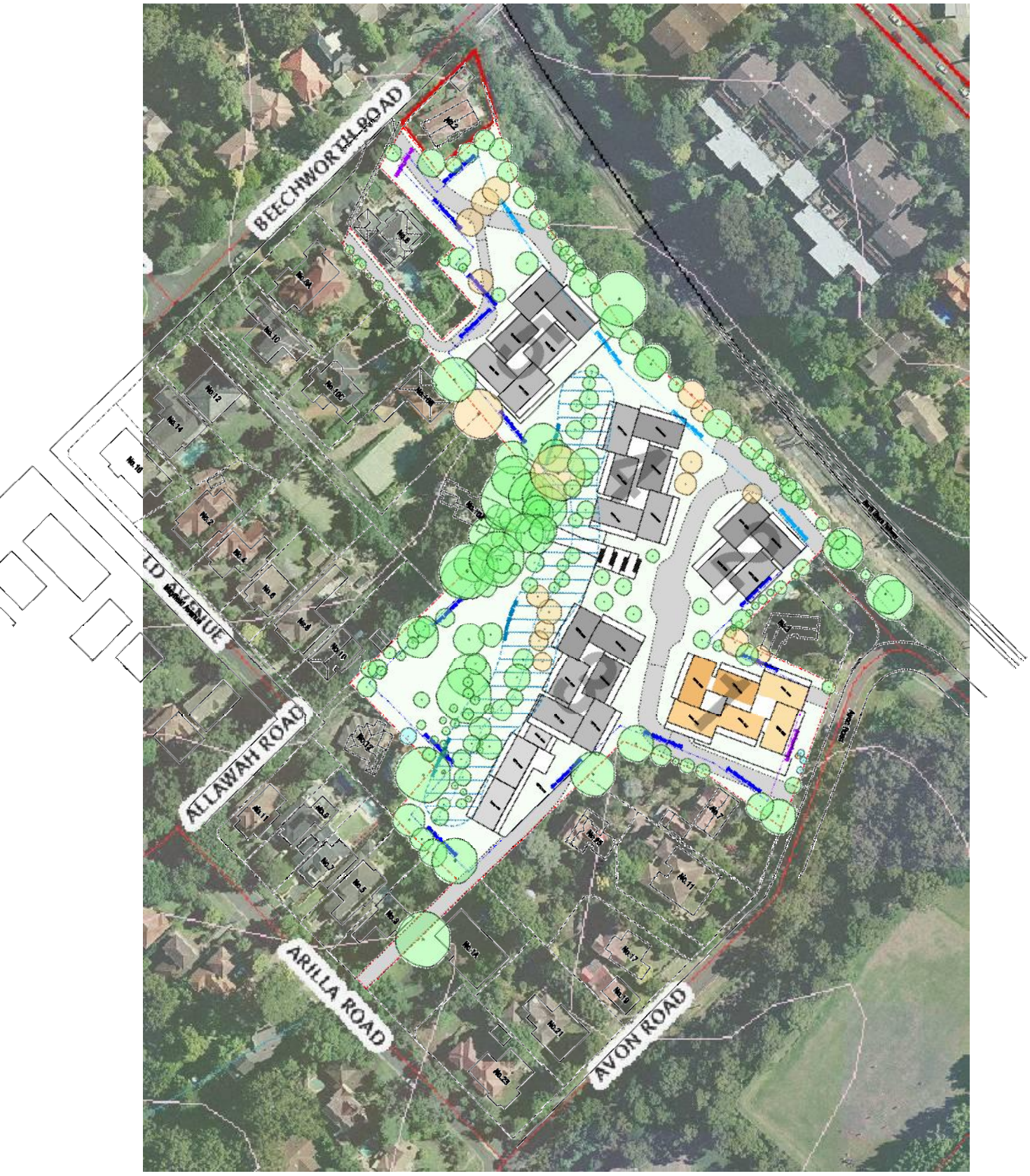
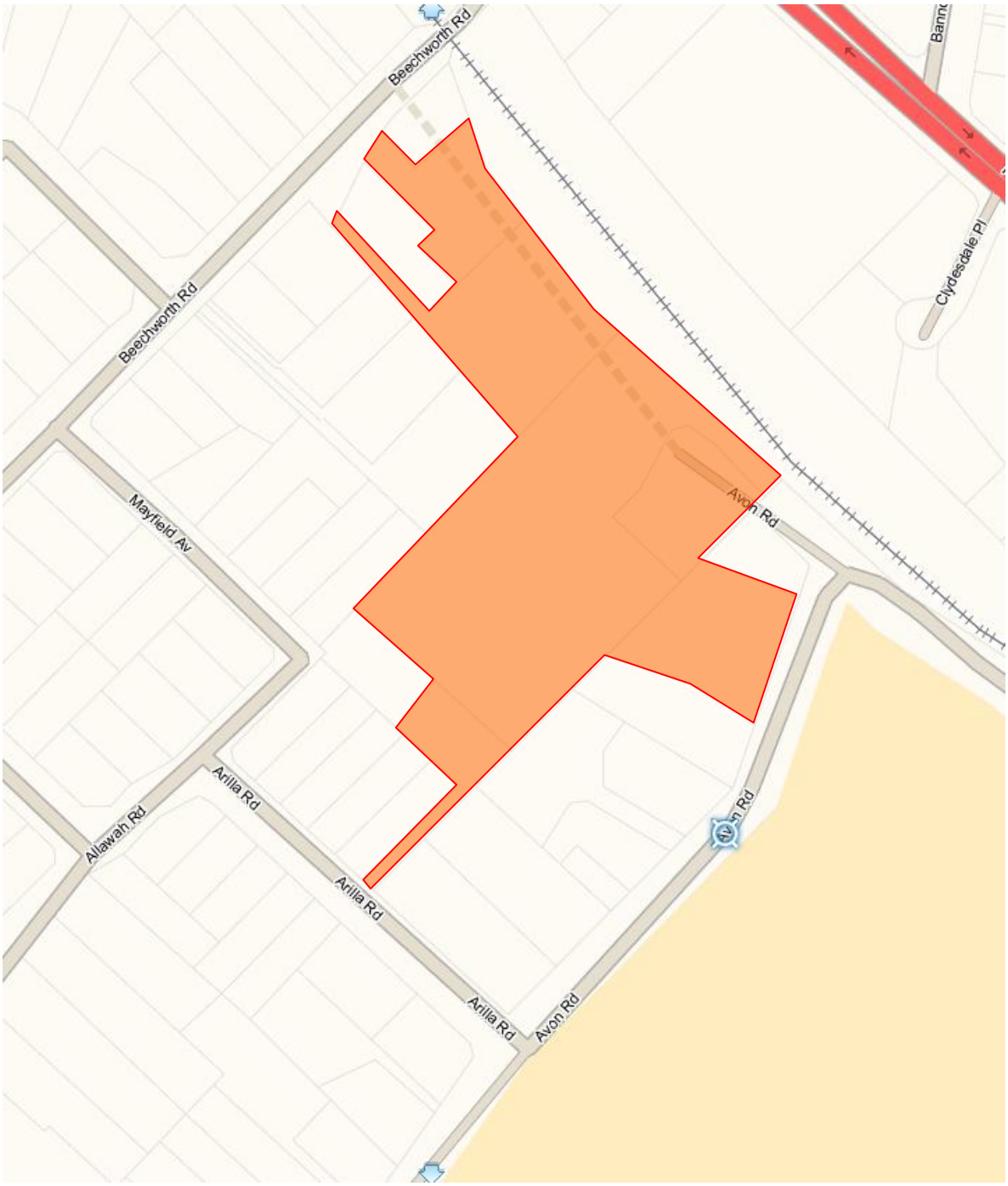


Figure 2-2 Site Outline



3 NOISE CRITERIA

The NSW Department of Planning has produced a document titled *Development Near Rail Corridors And Busy Roads – Interim Guideline*. This document provides a central document for assessment of rail noise affecting residential land developments in NSW. In the past, a number of documents existed (and still exist) for this purpose: including Development Control Plans issued by Hornsby Council, North Sydney Council, various other Councils and Council bodies such as the Southern Sydney Regional Organisation of Council's (SSROC), as well as State Rail's publication *Interim Guidelines for Applicants – Consideration of Rail Noise and Vibration in the Planning Process*.

The noise criteria of all these separate documents is reasonably similar (as one would expect) with subtle differences. In general, the principle goal is based upon consideration of the total acoustic energy experienced by residential occupants indoors within habitable rooms of apartments and houses. Acoustic energy is additive logarithmically and appears to provide good correlation with subjective experience.

The Department of Planning goals for noise within residences are as follows:

- 35dBA $L_{Aeq(9\text{-}hours)}$ for bedrooms, during the period 10pm-7am;
- 40dBA $L_{Aeq(15\text{-}hours)}$ for other habitable rooms, during the period 7am-10pm;
- If internal noise levels with windows or doors open exceed the criteria by more than 10dBA, the design of the ventilation for these rooms should be such that occupants can leave windows closed, if they so desire, and also to meet the ventilation requirements of the Building Code of Australia.

The 10dBA allowance with doors/windows open is based on the widely accepted premise that a noise reduction of 10dBA can be achieved through an open window.

For this project a slightly more stringent goal has been adopted, of $L_{Aeq,1\text{-}hour}$ of 35dBA and 40dBA, respectively. This is based upon the busiest 1-hour period in the night-time for bedrooms and the busiest 1-hour period over 24-hours for other habitable rooms.

4 NOISE LEVELS

For much of the site, the railway line is in cutting. Therefore, the lowest levels of each building will be shielded from rail noise. However, the upper levels will have an "acoustic" direct line-of-sight of the railway line (the actual view may be obscured by trees and foliage but these provide scant acoustic shielding).

Noise levels have not been measured at the site for the upper levels of the apartments. In order to measure noise at this height would have required a very tall cherry picker or mobile crane to be manoeuvred onto site for the purpose of such measurements. There were potential safety aspects with this approach. On the other hand, the Developer indicated that a conservative approach should be taken to the assessment of rail noise. Therefore the following approach has been adopted:

- SEL noise levels for Sydney suburban trains have been used from other sites;
- A small allowance has been made for potential reflected noise from the other side of the rail cutting;
- The number of trains per hour has been determined by reference to City Rail timetables;
- L_{Aeq} assessment levels have been determined by extrapolating known train SEL noise levels and distance calculations to each building.

At a distance of 25m from a rail track and a line speed of 80km/hr, typical Sydney suburban trains generate a Single Event noise level (SEL) of 84-88dBA, depending on whether it is a Tangara, Millenium train, K-set, S-set or V-set. The logarithmic average of these is 86dBA.

The SEL noise level is a shorthand descriptor of the total energy of a noise event – in this case a train passby. In order to determine L_{Aeq} from SEL, the total energy of all train passbys is summed and logarithmically divided by the time taken (in this case, 1 hour). The result of these calculations is shown in Table 4-1. Note that the numbers of trains has been determined from City rail timetables – see Table 4-2.

Table 4-1 Summary of rail noise exposure

Building	Distance from Nearest Track	Shielding by Other Buildings	Bedroom rail Noise	Other Habitable Rooms Rail Noise
2	25m	None	61	63
4,5	30m	None	60	62
1	55m	Moderately shielded	54	56
3	90m	Well-shielded	48	50
Windows Open External Noise Goal			45	50
Internal noise goal, Windows Closed			35	40

The above data for bedrooms is based upon the busiest 1-hour period during night-time, which is 6am-7am in this case (11 trains, both directions). For other habitable rooms the busiest time is 4-5pm (18 trains).

Table 4-2 Summary of Typical Weekday Rail Movements Passing the Site (both directions)

Time Period	Northbound	Southbound	Total
Midnight-1am	5	0	5
1-2am	1	0	1
2-3am	0	0	0
3-4am	0	0	0
4-5am	1	2	3
5-6am	1	5	6
6-7am	4	7	11
7-8am	6	9	15
8-9am	9	7	16
9-10am	8	5	13
10-11am	5	4	9
11am-midday	4	4	8
Midday-1pm	5	4	9
1-2pm	4	4	8
2-3pm	4	5	9
3-4pm	8	8	16

Time Period	Northbound	Southbound	Total
4-5pm	7	11	18
5-6pm	8	8	16
6-7pm	6	6	12
7-8pm	6	4	10
8-9pm	4	4	8
9-10pm	4	4	8
10-11pm	4	4	8
11pm-Midnight	4	3	7

5 RECOMMENDED NOISE CONTROL MEASURES

5.1 Façade Treatment

The following Table summarises the recommended construction recommendations for the façade of each building. Refer to Figure 5-1 for a location plan. Acoustic Treatment is divided into 4 tiers. Tier 1 is for the most highly exposed facades, Tier 2 for the next most highly exposed, and so on. Tier 4 is for no acoustic treatment.

Note that ALL rooms listed as requiring sound-rated glazing will also require alternative ventilation.

Table 5-1 Summary of Acoustic Treatments to Facade

Tier (Level of Acoustic Treatment)	Bedroom Glazing	Living Room Glazing
1	6.38mm lam	5mm
2	6mm	4mm
3	4mm	Conventional
4	Conventional	Conventional

Notes

- The thickness of glass shown in the above Table is indicative only. It is necessary to obtain from the window manufacturer test certificates showing the sound rating achieved by the specific window.
- The Author uses the following sound insulation ratings and indicative glass thicknesses:
  - 6.38mm laminated glass Rw 32 windows and external glazed doors
  - 6mm glass Rw 30 windows and external glazed doors
  - 5mm glass Rw 28 windows and external glazed doors
  - 4mm glass Rw 25 windows and external glazed doors

Figure 5-1 Façade Treatment Legend Showing Location of Each Tier of Acoustic Treatment

5.2 Alternative Ventilation

The provision of alternative ventilation can be achieved in a number of ways. Some of these are described in principle below. A mechanical engineer should confirm that the final design complies with the requirements of the relevant ventilation Standard (typically 10litres/second of fresh air per person).

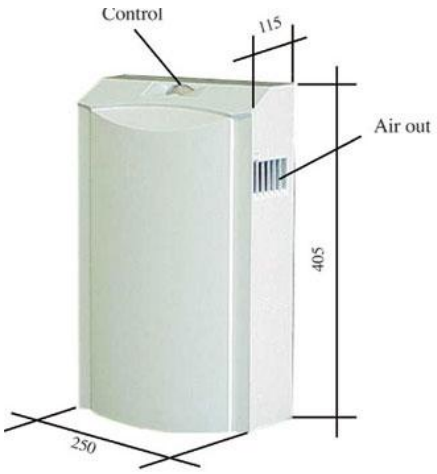
Option 1

Fully ducted air-conditioning with provision included of Outside Air. Many domestic air-conditioning systems do not include outside air by default – it must be specified at the time of tendering/ordering.

Option 2

Proprietary wall-mounted ventilation system, such as Aeropac. Aeropac units are approximately $800 each (per habitable room or per group of rooms – refer to the Mechanical Consultant). Available from Acoustica, ph: 1300 722 825.

Figure 5-2 Example of proprietary wall-mounted ventilation unit that provides air filtering as well as noise control (Aeropac)



In all cases a Mechanical Engineer must certify that the ventilation requirements have been met.

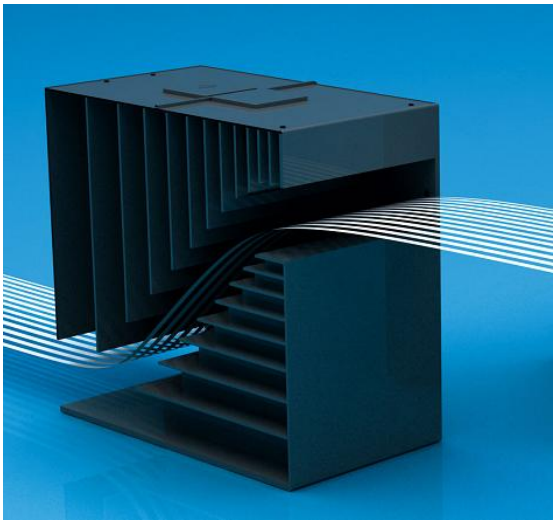
Option 3

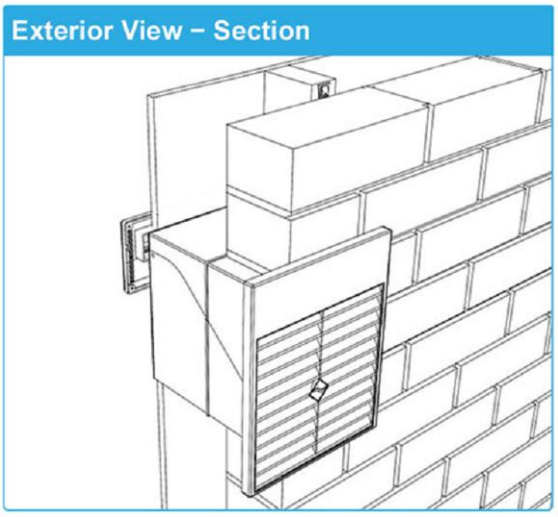
Provision of an attenuated air inlet in an external faced and an oversized exhaust fan in the ensuite or bathroom. Having the oversized exhaust fan can promote cross-flow ventilation in the apartment.

Attenuated air inlet could be a proprietary unit such as "Silenceair".

Figure 5-3 SilenceAir external ventilation bricks

Silenceair units are approximately $160-180 each, plus the cost of upgraded toilet/laundry exhaust fans. Available from www.silenceair.com





Note that an oversize toilet/laundry exhaust fan is essential to ensure that flow through ventilation occurs.

Option 4

Similar to Option 3 but with an alternative attenuated air inlet provided by the Builder. This could consist of a simple external air grille in the brick wall, connected to a 1.2m long internally insulated plasterboard bulkhead.

In all cases, a mechanical engineer should confirm that the design complies with the ventilation regulations.

6 CONCLUSION

This Acoustic Report has investigated the implications for rail noise for the new residential buildings proposed for the development at 5 Avon Road, Pymble. It has been found that a number of building facades will require sound-rated glazing in order to achieve indoor rail noise levels that satisfy the acoustic requirements of the Department of Planning *Guideline* document. Sound-rated windows have been recommended; each of these rooms will also require alternative fresh air ventilation. A number of possible systems for alternative ventilation were presented in the Report.

In conclusion it has been found that rail noise levels are not particularly high at the site and that the Director General Requirements can be met in a relatively straightforward manner.

Report Version: 1.1
Date: 18 December 2009
Engineer: Sebastian Giglio

Please note that this correspondence has only addressed the acoustical issues discussed. Other aspects of building design, such as fire-rating, structural and waterproofing considerations must be referred to others.