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63-77 WEST PARADE, WEST RYDE

CONCEPT APPLICATION (MP 09_2009)

TRAFFIC AND RAILWAY NOISE AND VIBRATION ASSESSMENT

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TABLE OF CONTENTS

1. INTRODUCTION

This report presents our assessment of the impact of traffic and rail noise and vibration impacts on the amenity of the future occupants of the proposed mixed use development at 63 – 77 West Parade, West Ryde.

This assessment has been conducted as required by the Director General's Requirement number 11 for Concept Application (MP 09_2009).

The assessment has been based on noise and vibration levels generated by train movements on the Northern Train Line which runs parallel to the east of the site, and traffic noise from West Parade.

Noise and vibration results have been used to predict internal noise levels within the development. If necessary, appropriate indicative noise/vibration attenuation treatments will be recommended to prevent excessive impacts on residents.

This report is based on architectural plans by Caldis Cook Group dated 24 March 2009.

2. SITE DESCRIPTION & PROPOSED DEVELOPMENT

The subject site is located on West Parade, West Ryde. West Parade carries medium volumes of traffic and mainly acts as a conduit for local residents exiting Victoria Road and accessing local streets.

The development could potentially be impacted by traffic noise from West Parade which bounds the west of the site.

To the east of the site is the Northern Train Line. The site lies between West Ryde and Denistone Stations and could potentially be impacted by train noise and railway vibration from the adjacent railway line.

The proposed development consists of approximately 640m^2 of office space, two levels of parking and 142 apartments.

Figure1 details the site, surrounding noise sources and measurement positions.

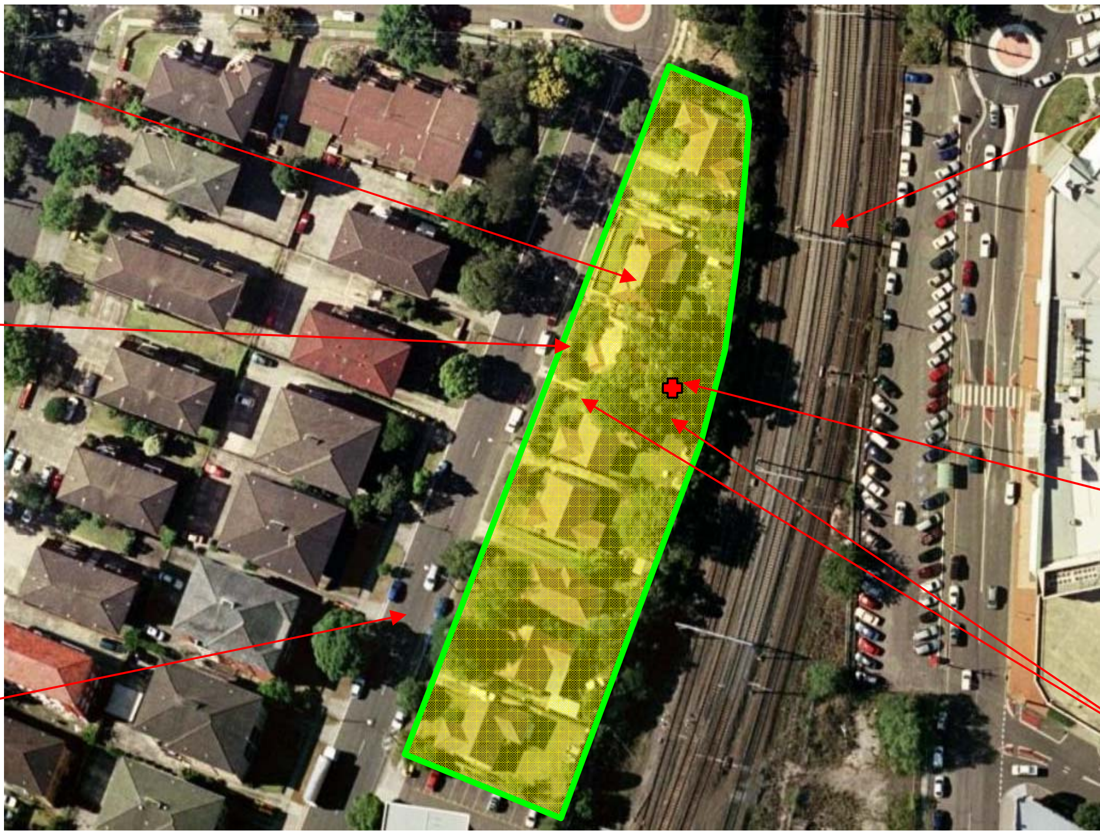

Figure 1 – Site Map

3. TRAFFIC & TRAIN NOISE ASSESSMENT

3.1 ACOUSTIC CRITERIA

The Director General's Requirement number 11 for Concept Application (MP 09_2009) states that:

> *"The EA shall address the issue of noise and vibration impact from the railway corridor and provide detail of how this will be managed and ameliorated through the deign of the building, in compliance with relevant Australian Standards and the Department's Interim Guidelines for Development near Rail Corridors and Busy Roads"*

The NSW Department of Planning's policy, Development Near Rail Corridors And Busy Roads – Interim Guideline, sets out internal noise level criteria adapted from the State Environmental Planning Policy (Infrastructure) 2007 (the 'Infrastructure SEPP') for developments with the potential to be impacted by traffic or rail noise and vibration.

The Infrastructure SEPP defines busy roads that are subject to an acoustic assessment as:

> *"Roads specified in Clause 102 of the Infrastructure SEPP: a freeway, tollway or a transitway or any other road with an average annual traffic (AADT) volume of more than 40,000 vehicles (based on the traffic volume data provided on the website of the RTA).*
>
> *Any other road – with an average annual daily traffic (AADT) volume of more than 20,000 vehicles (based on the traffic volume data published on the website of the RTA).*

Any other road – with a high level of truck movements or bus traffic."

As the site is located within 25m of a passenger and freight rail line it would be deemed as a Zone A site (refer to table 3.1 of the guidelines), and detailed acoustic assessment is recommended with SEPP Infrastructure criteria is required.

The Infrastructure SEPP sets out the following criteria for internal noise levels from airborne rail and traffic noise:

"For Clauses 87 (Rail) and 102 (Road):

"If the development is for the purpose of a building for residential use, the consent authority must be satisfied that appropriate measures will be taken to ensure that the following LAeq levels are not exceeded:

in any bedroom in the building : 35dB(A) at any time 10pm–7am

anywhere else in the building (other than a garage, kitchen, bathroom or hallway): 40dB(A) at any time."

For commercial properties, recommended noise levels in AS2107-2000 "Recommended Design Sound Levels and Reverberation Times for Building Interiors" will be adopted.

Pursuant to this, the following assessment criteria would apply to the proposed development for traffic and train noise intrusion.

Table 1 – Traffic & Train Noise Criteria for All Spaces

Space/Activity Type	Noise Level dB(A) L_{eq}
Bedrooms	35 (9 hour)
Living Areas	40 (15 hour)
Commercial Areas	45 (24 Hour)

In addition to the average noise levels (the L_{eq} noise levels) referred to above, an assessment will be conducted of sleep disturbance as a result of rail noise. This sleep disturbance assessment is necessitated as a result of the late night train movements.

Potential sleep disturbance to residents as a result of late night train movements will be assessed using the methodology set out in the EPA Environmental Criteria for Road Traffic Noise appendix B, table B3. This table is used to determine the number of awakenings that are likely to occur during the night time period (between 10pm and 7am) as a result of vehicle noise intrusion. For the purpose of this assessment, acoustic controls will be determined such that there will be less than one sleep disturbance per night as a result of external noise intrusion. In our opinion, a maximum of one awakening per night is considered acceptable, as, on average, a sleeper will have one awakening during the night as a result of some disturbance other than external noise.

3.2 TRAFFIC MEASUREMENTS

Traffic noise measurements were obtained along West Parade (See Figure 1) during the morning peak of 22 April 2009. A CEL593 Type 1 Sound Analyser was used for the noise measurements. The analyser was set to fast response and calibrated before and after the measurements using a Rion NC-73 calibrator. No significant drift was noted.

3.2.1 Noise Descriptors

Traffic noise constantly varies in level, due to fluctuations in traffic speed, vehicle types, road conditions and traffic densities. Accordingly, it is not possible to accurately determine prevailing traffic noise conditions by measuring a single, instantaneous noise level. To accurately determine the effects of traffic noise a 15-20 minute measurement interval is utilised. Over this period, noise levels are monitored on a continuous basis and statistical and integrating techniques are used to determine noise description parameters. These parameters are used to measure how much annoyance would be caused by a particular noise source.

In the case of environmental noise three principle measurement parameters are used, namely L_{10}, L_{90} and L_{eq}.

The L_{10} and L_{90} measurement parameters are statistical levels that represent the average maximum and average minimum noise levels respectively, over the measurement intervals.

The L_{10} parameter is commonly used to measure noise produced by a particular intrusive noise source since it represents the average of the loudest noise levels produced at the source.

Conversely, the L_{10} level (which is commonly referred to as the background noise level) represents the noise level heard in the quieter periods during a measurement interval. The L_{90} parameter is used to set the allowable noise level for new, potentially intrusive noise sources since the disturbance caused by the new source will depend on how audible it is above the pre-existing noise environment, particularly during quiet periods, as represented by the L_{90} level.

The L_{eq} parameter represents the average noise energy during a measurement period. This parameter is derived by integrating the noise levels measured over the measurement period. L_{eq} is important in the assessment of traffic noise impact as it closely corresponds with human perception of a changing noise environment; such is the character of traffic noise.

3.2.2 Measured Noise Levels

The results of traffic noise monitoring at are detailed in the table below.

Table 2 - Measured Traffic Noise Levels – West Parade, 3m from curb

Time of Day	Noise Level - L_{Aeq}
7:00am – 10:00pm	67dB(A) L_{Aeq}
10:00pm – 7:00am	65dB(A) $L_{Aeq(}$

3.3 TRAIN MEASUREMENTS

Measurements were performed generally in accordance with the Australian Standard AS 1055 - “Description and measurement of environmental noise - General Procedures”. Rail noise measurements were conducted in line with the future proposed eastern façade which is the potentially worst affected façade nearest to the railway lines.

3.3.1 Attended Measurements

Attended train noise measurements were conducted on 22 April 2009. A CEL593 Type 1 Sound Analyser was used for the noise measurements. The analyser was set to fast response and calibrated before and after the measurements using a Rion NC-73 calibrator. No significant drift was noted.

3.3.2 Unattended Measurements

Unattended noise monitoring was conducted during the period of 22 and 28 April 2009. Train noise levels were monitored using an Acoustic Research Laboratories noise logger. The monitor continuously measures noise levels and every 15 minutes stores statistical data within memory. The stored data was downloaded at the end of the measurement period. The monitor was calibrated before and after the measurement using a Rion NC-73 calibrator. No significant drift was recorded.

3.3.3 Measured Noise Levels

The external noise levels from measurements conducted on site are detailed in Table 2 below.

Table 3 –External Noise Levels

Location	Day dB(A) $L_{eq,1hr}$	Night dB(A) $L_{eq,1hr}$
Eastern Façade	63	65

3.4 EVALUATION OF NOISE INTRUSION

Internal noise levels will primarily be as a result of noise transfer through the windows and doors and roof, as these are relatively light building elements that offer less resistance to the transmission of sound. All external walls are proposed to be heavy masonry elements that will not require upgrading.

The predicted noise levels through the windows, doors and roof are discussed below. The predicted noise levels have been based on the measured level and spectral characteristics of the external noise, the area of building elements exposed to traffic noise, the absorption characteristics of the rooms and the noise reduction performance of the building elements.

Calculations were performed taking into account the orientation of windows, barrier effects (where applicable), the total area of glazing, facade transmission loss and the likely room sound absorption characteristics. In this way the likely interior noise levels can be predicted.

3.5 RECOMMENDED GLAZING

Windows and doors will require upgrading to a single glazed system from standard installations. Precise thickness and glazing type to be determined as the project stages advance.

3.6 ROOF / CEILING

The roof is to be constructed of a concrete slab and will not require upgrading.

3.7 EXTERNAL WALLS

External walls composed of concrete or masonry elements would not require upgrading. Light weight walls will require upgrading in some areas to ensure that internal noise goals are met.

3.8 MECHANICAL VENTILATION

In some units facing the rail corridor and West Parade, internal levels cannot be achieved with windows open; in these instances it is required that an alternative outside air supply system or air conditioning be installed to meet AS 1668.2 requirements. Any mechanical ventilation system that is installed should be acoustically designed such that the acoustic performance of the recommended constructions are not reduced by any duct or pipe penetrating the wall/ceiling/roof. Noise emitted to the property boundaries by any ventilation system shall comply with Council requirements.

4. RAILWAY VIBRATION

Trains induce ground born vibration that is transmitted through the subsoil. This vibration can be perceptible close to railways, both a tactile vibration and as structure borne noise.

4.1 VIBRATION CRITERIA

The Director General's Requirement number 11 for Concept Application (MP 09_2009) states that:

> *"The EA shall address the issue of noise and vibration impact from the railway corridor and provide detail of how this will be managed and ameliorated through the deign of the building, in compliance with relevant Australian Standards and the Department's Interim Guidelines for Development near Rail Corridors and Busy Roads"*

As the site is located within 25m of a passenger and freight rail line is deemed to require an acoustic assessment (refer to table 3.2 of the guidelines).

Section 3.6.3 of the Interim Guidelines for Development near Rail Corridors and Busy Roads states that:

> *"Vibration levels such as the intermittent vibration emitted by trains should comply with the criteria in Assessing Vibration: a technical guideline (DECC 2006)".*

Assessing Vibration: A Technical Guide 2006 assesses the annoyance of intermittent vibration by using the Vibration Dose Value (VDV). Alternatively the VDV may be estimated by the eVDV which is derived by a simpler calculation using an empirical factor. The VDV or eVDV is calculated for the two periods of the day being the "Daytime" (7am-10pm) and "Night time" (10pm-7am). The overall value is then compared to the levels in Table 1. For this project the aim will be for a low probability of adverse comment.

Table 4 - Vibration Dose Values ($m/s^{1.75}$) above which various degrees of adverse comment may be expected in residential buildings.

Place	Low Probability of adverse comment	Adverse comment possible	Adverse comment probable
Residential buildings 16hr day	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Residential buildings 8hr night	0.13	0.26	0.51
Commercial buildings 16hr day	0.4	0.8	1.6
Commercial buildings 8hr night	0.4	0.8	1.6

Section 3.6.2 of the Interim Guidelines for Development near Rail Corridors and Busy Roads states that:

> *"Where buildings are constructed over or adjacent to land over tunnels, ground borne noise may be present without the normal masking effect of airborne noise. In such cases, residential buildings should be designed so that the 95th percentile of train pass-bys complies with a ground borne LAmax noise limit of 40dBA (daytime) or 35dBA (night-time) measured using the "slow" response time setting on a sound level meter.*
>
> *The Interim Guidelines for the Assessment of Noise from Rail Infrastructure Projects (DECC 2007)provides further guidance on this issue."*

Vibration generated by train passbys adjacent to the proposed development will potentially generate structure born vibration which will be radiated of internal building elements such as walls, floors and ceiling as audible noise. Internal noise levels associated with structure born noise generated from train passbys should comply with Table 3 of the Interim Guidelines for the Assessment of Noise from Rail Infrastructure Projects (DECC 2007) which sets out internal noise goals for structure borne noise. These objectives are detailed in Table 5.

There are no documented rail structure borne noise level objectives for commercial buildings. For this reason, the rail structure borne noise level objectives will be based on the noise level recommended by Interim Guidelines for the Assessment of Noise from Rail Infrastructure Projects (DECC 2007) for residential buildings. The residential requirement is that the resulting structure borne noise level should not exceed 40 dB(A) L_{max}. Assuming this has been applied to limit loss of amenity in residential bedrooms, the corresponding difference in noise levels recommended in AS 2021 for these spaces will be used to adjust the bedroom level. AS 2021 recommends a noise level of 50 dB(A) L_{max} in sleeping areas, 65 dB(A) in generally office areas and 75 dB(A) in retail areas. Extrapolating this difference to railway induced noise gives a requirement of 55 dB(A) L_{max} in office areas. At this level, structure radiated noise levels may be audible but would not be excessively intrusive.

Table 5 - Internal Railway Noise Level Criteria

Location	dB(A) L_{MAX}
Sleeping Areas	35
Living	40
Office Areas	55

Train vibration measurements conducted as part this assessment will be used to calculate internal noise levels generated from structure born vibration.

4.2 RAIL TRAFFIC VIBRATION MEASUREMENTS

Train vibration measurements were taken conducted on a number of locations within the site.

The manned measurements were carried out from 8:00am to 9:30am on 22 April 2009.

Equipment used consisted of:

- A Svan 912 AE Sound Analyser was used for the vibration measurements. The analyser was connected to a SV08 four channel input module fitted with a Dytran triaxial accelerometer (tri-axial measurements)

- A Svan 912 AE Sound and Vibration Analyzer with a Dytran 3100B/5923 accelerometer (single axis measurements)

Measurements were undertaken at the locations set out in Figure 1.

4.2.1 Measurement Results : Vibration Dose Values

The maximum train passby ground vibration acceleration, the typical passby period (gained from both the noise and vibration measurements) and the estimated number of train passbys were used to calculate the overall eVDV values for each period of the day. The results are presented in Table 6.

eVDV values were determined on the assumption that there will be one train every 5 minutes during the daytime. The VDV per train used in the eVDV calculation was determined by using the highest measured vibration level during a passby.

Table 6 - Vibration Dose Values

Test Location	Time Period	Calculated eVDV $m/s^{1.75}$	Criteria eVDV $m/s^{1.75}$	Complies
Residential	Day (7am – 10pm)	0.13	0.2	Yes
	Night (10pm -7am)	0.11	0.13	Yes
Commercial	Day (7am – 10pm)	0.13	0.4	Yes
	Night (10pm -7am)	0.11	0.4	Yes

In the event the future train use increases, say by 10%, predicted eVDV will not increase significantly (no more than approximately 0.02 more than the levels predicted in the table above) and will not impact recommended vibration isolation treatments.

4.3 STRUCTURE BORN NOISE MEASUREMENTS

Internal noise levels as a result of structure born noise have been calculated at a number of positions within the development. Noise levels have been determined based on on-site measurements of rail induced vibration.

Table 7 - Structure Born Vibration Levels

Level	Noise Level Criteria dB(A)L_{MAX}	Calculated/Measured Noise Level dB(A)L_{Max}	Complies
Ground (Office)	55	52	Yes
Level 2 (Residential)	40	49	No

4.4 RECOMMENDATIONS

The results of the structure born vibration investigation indicate that internal structure borne noise levels will potentially exceed project requirements without the addition of vibration isolation. Specific vibration isolation to the structure to ameliorate any adverse impacts of the residents or occupants of the development will be provided as the project stages progress.

5. CONCLUSION

This report provides the results of our assessment of train noise and vibration, and traffic noise effects on the amenity of tenants within the proposed mixed used development located at 63 – 77 West Parade, West Ryde.

Traffic and railway noise and vibration impacts have been assessed in accordance with Director General Requirement number 11 for Concept Application (MP 09_2009). It has been found that Concept Application (MP 09_2009) can comply with noise and vibration objectives with upgraded single glazing, and building structure vibration isolation.

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