REVERB ACOUSTICS

Noise and Vibration Consultants

Noise Impact Assessment
Railway Freight Terminal
Lots 4 & 5 DP1201358
The Irrigation Way
Wumbulgal, NSW

February 2017

Prepared for Planningmatters Development Service
Report No. 17-2055-R1

Building Acoustics – Council/EPA Submissions - Modelling - Compliance - Certification

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SECTION 1
Introduction

1.1 INTRODUCTION

Reverb Acoustics has been commissioned to conduct a noise impact assessment for establishment of a railway freight terminal at Lots 4 and 5 DP.1201358 The Irrigation Way, Wumbulgal, NSW.

The purpose of this assessment is to determine the noise impact, operation of the facility will have on the surrounding rural environment and to ensure any noise control measures required are incorporated during the design stages. The assessment is to accompany and forms part of a Statement of Environmental Effects (SoEE) to Leeton Shire Council (LSC).

1.2 TECHNICAL REFERENCE / DOCUMENTS

Beranek, L.L and Istvan, L.V. (1992). *Noise and Vibration Control Engineering.* John Wiley and Sons, Inc.

Bies, D.A. and Hansen, C.H. (1996). *Engineering Noise Control: Theory and Practice.* London, E & F.N. Spon.

Hassall, J.R. and Zaveri, K. (1988) *Brüel & Kjaer – Acoustic Noise Measurements.* Denmark, K. Larson and Son.

Harris, C.M. (ed) (1957). *Handbook of Noise Control.* New York, McGraw-Hill.

Peterson, A.P.G. (1980). *Handbook of Noise Measurement.* Massachusetts, Genrad Inc.

Sharland, I. (1998). *Woods Practical Guide to Noise Control.* England, Woods Acoustics

AS 1055.1.2.3-1997 *"Acoustics – Description and measurement of environmental noise".*

NSW Environment Protection Authority (2000). *Industrial Noise Policy*

NSW Environment Protection Authority (1999). *Environmental Criteria for Road Traffic Noise*

NSW Roads and Traffic Authority (2001). *Environmental Noise Management Manual*

A Glossary of commonly used acoustical terms is presented in Appendix A to aid the reader in understanding the Report.

SECTION 2
Existing Acoustic Environment Assessment Criteria

2.1 PROJECT DESCRIPTION

The proposed development relates to the establishment of a railway freight terminal at Lots 4 and 5 DP1201358 The Irrigation Way, Wumbulgal.

Potential noise sources, which may impact nearby neighbours, will include trucks entering, leaving and manoeuvring on the site (up to 125 movements/day for the terminal), and locomotives entering, leaving, shunting, and forklifts loading and unloading containers onto and off trains and trucks. Other noise sources include mechanical plant, employee vehicle movements, delivery vehicles, and maintenance machinery.

Due to safety regulations, locomotive activities (i.e. approaching/departing, shunting, etc) will never occur at the same time as loading/unloading activities.

Operations at the site will generally occur during daylight hours, however, activities may occur at any time over a 24 hour period, year round.

Measurement of the existing acoustic environment at nearest receivers has not been carried out. Therefore, in order to provide a measure of conservatism, the background noise level of 30dB(A),L90 has been adopted for all time periods. Maps of the proposal and nearest receivers are presented within this report.

2.2 EXISTING ACOUSTIC ENVIRONMENT

Nearest receivers identified by our client are as follows:

R1. Res 2100m SW	R2. Res 2600m SE	R3. Res 3600m E
R4. Res 5200m NE	R5. Res 4800m N	R6. Res 2900m N
R7. Res 2700m NW	R8. Res 1600m W	R9. Res 1200m W

Figure 1: Location Plan

Consideration must be given to the extent of the existing acoustic environment and whether such levels are appropriate for the land use of the receiver areas. As previously stated, background noise levels have not been measured in the area. Therefore, the lowest possible Rating Background Level (RBL) of 30dB(A),L90 has been adopted, in accordance with Section 3.1.2 of the NSW Environment Protection Authority's (EPA's) Industrial Noise Policy (INP).

2.3 CRITERIA

2.3.1 Road Traffic

The Roads and Maritime Services (RMS's) base their assessment criteria on those outlined by EPA. Reference to Page 160 of RMS's Environmental Noise Management Manual released in December 2001, indicates that noise reduction measures for new and existing developments should endeavour to meet the noise level targets set out in the EPA's Environmental Criteria for Road Traffic Noise (ECRTN). The ECRTN has been superceded by the NSW Road Noise Policy (RNP) which contains a number of criteria applied to a variety of road categories (freeway, arterial, sub-arterial and local roads) and situations (new, upgraded roads and new developments affected by road traffic). Table 1 shows the relevant categories, taken from Table 3 of the RNP:

Table 1: - Extract from Table 3 of RNP Showing Relevant Criteria.

Road Category	Day	Night
Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments.	60 LAeq,15hr (external)	55 LAeq,9hr (external)
Existing residences affected by additional traffic on existing local roads generated by land use developments.	55 LAeq,1hr (external)	50 LAeq,1hr (external)

Road categories are defined in the RNP are as follows:

Freeway/arterial	Support major regional and inter-regional traffic movement. Freeways and motorways usually feature strict access control via grade separated interchanges.
Sub-arterial	Provide connection between arterial roads and local roads. May provide a support role to arterial roads during peak periods. May have been designed as local streets but can serve major traffic generators or non-local traffic functions. Previously designated as "collector" roads in ECRTN.
Local Road	Provide vehicular access to abutting property and surrounding streets. Provide a network for the movement of pedestrians and cyclists, and enable social interaction in a neighbourhood. Should connect, where practicable, only to sub-arterial roads.

Based on the above definitions, The Irrigation Way is classified as a sub-arterial road.

2.3.2 Site Activities

Noise from industrial noise sources scheduled under the Protection of Environment Operations Act (PoEO Act) is assessed using the EPA's INP. However, local Councils and Government Departments may also apply the criteria for land use planning, compliance and complaints management. The INP specifies two separate criteria designed to ensure existing and future developments meet environmental noise objectives. The first limits intrusive noise to 5dB(A) above the background noise level and the other aims to protect against progressively increasing noise in developing areas, based on the existing (Leq) noise level from industrial noise sources. Project Specific Noise Levels are established for new developments by applying both criteria to the situation and adopting the more stringent of the two.

The existing L(A)eq for the receiver areas is dominated by farm activities, traffic on nearby roads and natural noise sources during the day, evening and night. Reference to Table 2.1 of the INP shows that the receiver area is classified as rural and industrial noise contributions are more than 6dB(A) below the recommended Leq, so the recommended Acceptable Noise Level (ANL) applies, i.e. no ANL reduction required for industrial noise contributions.

Table 2: - Base Noise Level Objectives

Period	Intrusiveness Criterion	Amenity Criterion
Day	35 (30+5)	50
Evening	35 (30+5)	45
Night	35 (30+5)	40
Receiver Type: Rural (See EPA's INP - Table 2.1)		

Project specific noise levels, determined as the more stringent of the intrusiveness criterion and the amenity / high traffic criterion, are as follows:

Day **35dB LAeq,15 Minute** 7am to 6pm Mon to Sat or 8am to 6pm Sun and Pub Hol.
Evening **35dB LAeq,15 Minute** 6pm to 10pm 7 days a week.
Night **35dB LAeq,15 Minute** 10pm to 7am Mon to Sat or 10pm to 8am Sun and Pub Hol.

2.3.3 Short Duration Events – Sleep Arousal

Section 2.4.5 of the EPA's Noise Guide for Local Government states, "the L1 level of any specific noise source should not exceed the background noise level (L90) by more than 15dB(A) when measured outside the bedroom window". This criterion is applied to residential situations between the hours of 10pm and 7am where a receptor's sleep may be interrupted by noise.

Based on an average minimum background noise level of 30dB(A),L90 for night (10pm-7am), the sleep arousal criterion is set at **45dB(A),$L1_{(1min)}$** at the bedroom window of any affected residence.

SECTION 3
Noise Impact Assessment

3.1 METHODOLOGY

3.1.1 Road Traffic

Due to the non-continuous nature of traffic flow to and from the site, noise generated by traffic associated with the freight terminal, on public roads, is assessed using the EPA approved US Environment Protection Agency's Intermittent Traffic Noise guidelines.

Equation 1 outlines the mathematical formula used in calculating the Leq,T noise level for intermittent traffic noise.

Equation 1:

$$L_{eq},T = L_b + 10\log\left[1 + \frac{ND}{T}\left(\frac{10^{(L\max - Lb)/10} - 1}{2.3} - \frac{(L_{\max} - L_b)}{10}\right)\right]$$

Where L_b background noise level (dB(A))
T is the time for each group of vehicles (min)
D is duration of noise of each vehicle (min)
L_{MAX} is vehicle noise (dB(A))
N is number of vehicle trips

Typical vehicle noise levels were sourced from our library of technical data, while background noise levels are those described in Section 2.2. The Lmax vehicle noise levels used in Equation 1 are the maximum predicted noise levels produced at the facade of a typical residence by vehicles entering and departing the site.

3.1.2 Site Noise

Noise levels produced by activities/equipment associated with the Wumbulgal railway freight terminal were measured by Reverb Acoustics in June 2016 at an existing railway freight terminal in the Griffith CBD and/or sourced from our library of technical data, which has been accumulated from measurements taken in many similar situations on other sites. These noise level measurements were taken with a Svan 912AE Sound and Vibration Analyser. The instrument is Type 1 accuracy, in accordance with the requirements of AS1259, and has the capability to measure steady, fluctuating, intermittent and/or impulsive sound, and to compute and display percentile noise levels for the measuring period. A calibration signal was used to align the instrument train prior to measuring and checked at the conclusion. Difference in the two measurements was less than 0.5dB. Each measurement was taken over a representative time period to include all aspects of machine operation, including additional start-up noise where applicable. Items of equipment, which produced a brief burst of noise, such as a truck, were measured for a similarly brief time period to ensure the results were not influenced by long periods of inactivity between operations.

Sound measurements were generally made around all sides of each machine/activity, to enable the acoustic sound power (dB re 1pW) to be calculated. The sound power level of each item is then theoretically propagated to each receiver with allowances made for geometric spreading, directivity, molecular absorption, intervening topography or barriers and ground effects giving the received noise level at the receiver from that particular plant item.

Addition of the received Sound Pressure Level (SPL) for each of the individual operating sources gives the total SPL at each receiver, which is then compared to the relevant criteria. Where noise impacts above the criteria are identified, suitable noise control measures are implemented and reassessed to demonstrate satisfactory received noise levels.

Due to the non-continuous nature of some site activities, adjustments for duration have been made using the following in-house mathematical formula. Note that no duration adjustment is necessary for items that operate continuously.

Equation 2:

$$L_{eq},T = Lw - \quad 10\ log\ (2\pi r^2) + 10\ log \frac{(D \times N)}{T}$$

Where Lw is sound power level of source (dB(A))
R distance to receiver (m)
D is duration of noise for each event (sec)
N is number of events
T is total assessment period (sec)

Calculations were performed with RTA Technology Environmental Noise Model computer software, which accepts information on ground type and topography, source and receiver locations, weather details and source sound power spectra. Ground contours were obtained from topographical maps of the site and surrounds. Results from the noise model are presented for various scenarios in later Sections of this report.

3.1.3 Atmospheric Conditions

In the Wumbulgal region atmospheric conditions can exacerbate received noise levels for a percentage of the time. Temperature inversions may be expected in the area during the night and early morning at a frequency of greater than 30% of the time during winter and to a lesser degree in the warmer months. Inversion effects are strongest in the early hours of the morning but tend to weaken rapidly and may be considered to have completely dissipated by 9am or earlier. The ENM model was prepared for the following operating scenarios, as shown below:

1. Neutral atmospheric conditions for day/evening, i.e. no wind or inversion.
2. 3m/sec wind source to receiver (day).
3. F-class temperature inversion of 3°C/100m and 2m/sec source to downhill receiver wind for night. (See Table C2, Appendix C-EPA's INP)

An F-class inversion, i.e. 3°C/100m, is typical in the Wumbulgal area and slightly weaker inversions are generally expected for coastal areas. Therefore, we have modelled this default inversion strength.

Wind in a particular direction causes increased received noise levels at downwind receivers, therefore the effect of noise enhancement due to wind has been considered. Wind will occur more often in the colder months just before dawn, implying the cause is from inversion build-up at night. The INP suggests a 3° inversion with 2m/sec wind downhill for an area with rainfall greater than 500mm/year (See Table C2, Appendix C). Therefore, modelled conditions for night are 3° inversion with 2m/sec wind in each direction. Alternatively, a 3m/sec wind could have been modelled, however less noise enhancement is given for a wind of this strength in all directions, hence the preferred modelling scenario is the former.

3.2 ANALYSIS AND DISCUSSION

3.2.1 Received Noise Levels – Road Traffic

Traffic associated with the proposal travelling on nearby public roads is assessed separate to site noise and is subject to the criteria described in Section 2.3.1 of this report. Trucks will approach and depart the site from the both directions along The Irrigation Way, however, to provide a measure of conservatism, this assessment assumes all trucks and vehicles will approach and depart the site from the same direction.

Our client informs us that up to 125 truck movements/day may be directly associated with the railway freight terminal over a 24 hour period. For assessment purposes, we have also assumed that up to 50 smaller vehicle movements associated with the railway freight terminal may occur each day. This equates to the following vehicle numbers:

Time Period	*Trucks*	*Cars*
Peak Day (7am-10pm)	125	50
Typical Day (7am-10pm)	80	30
Night (10pm-7am)	45	20

Truck noise varies from one machine to another, with more modern larger trucks consistently producing a sound power in the range 104 to 108 dB(A) at full power. This assessment assumes a typical truck sound power of 106dB(A), as full engine power is not typically required to approach and depart the site at low speed.

Cars typically produce an average sound power of 92dB(A), however wide variations are noted particularly with smaller modern cars and larger V8 or diesel powered vehicles. Our calculations present the worst case for the situation, as the noise produced by a typical car accelerating at full power is used to determine the received noise level. In reality, many people will not leave the site at full acceleration but will depart more sedately.

Traffic Noise Calculations

The following Tables show results of traffic noise calculations, propagated to a theoretical facade at varying distances from The Irrigation Way (100km/hr zone) for the proposed situation. Received noise is the combined noise impact from cars and trucks at the facade of the residence.

Table 3: Traffic Noise Calc's – The Irrigation Way dB(A),Leq

Traffic & Receiver	Peak Day (7am-10pm)		Typical Day (10pm-7am)		Night (10pm-7am)	
Vehicle Type	Trucks	Cars	Trucks	Cars	Trucks	Cars
Movements/period	125	50	80	30	45	20
Sound Power	106	92	106	92	106	92
Distance to Rec, m	20					
Rec Noise Level	49.1	30.8	48.8	30.8	46.6	29.2
Total Received	**49.2**		**48.9**		**46.7**	
Criteria	**60dB(A),Leq 15hr**		**60dB(A),Leq 15hr**		**55dB(A),Leq 9hr**	
Impact	-		-		-	
Distance to Rec, m	50					
Rec Noise Level	45.1	27.3	44.9	27.3	42.6	25.9
Total Received	**45.2**		**44.9**		**42.7**	
Criteria	**60dB(A),Leq 15hr**		**60dB(A),Leq 15hr**		**55dB(A),Leq 9hr**	
Impact	-		-		-	
Distance to Rec, m	100					
Rec Noise Level	42.1	25.0	41.9	25.0	39.7	23.8
Total Received	**42.2**		**41.9**		**39.8**	
Criteria	**60dB(A),Leq 15hr**		**60dB(A),Leq 15hr**		**55dB(A),Leq 9hr**	
Impact	-		-		-	

Results in the above Table show that noise levels from cars and trucks travelling to and from the freight terminal along The Irrigation Way are compliant with the RNP day and night criteria for all residences.

3.2.2 Received Noise Levels – Site Noise

ACOUSTIC MODELLING SCENARIOS:

Modelling Scenario 1 (15 minute Assessment Period):

- S1. A locomotive enters the site and parks at rail siding (5 min).
- S2. Shunting of carriages (using Train Brakes or Independent Brakes) (5 sec several times)
- S3. Idling locomotive (15 min)

Modelling Scenario 2 (15 minute Assessment Period):

- S4. Truck travelling to railway freight terminal on access road off The Irrigation Way (1.5 min)
- S5. Truck idling at weighbridge (3 min)
- S6. Truck travelling from weighbridge to container storage area (1 min)
- S7. Hyster 52-16 Fork Lift continuously loading/unloading trucks (15 min)
- S8. Truck leaving railway freight terminal along access road to The Irrigation Way (1.5 min)

NOTE: As previously stated, due to safety regulations, locomotive activities (i.e. approaching/departing, shunting, etc) will **never** occur at the same time as unloading/loading activities.

Additional plant and noise sources encountered on the site include split system air conditioners, vehicle movements, etc, all of which produce a sound power less than 75dB. Collectively, with up to 3 or 4 sources operating simultaneously on occasions, the sum could be as high as 80dB. This overall sum is at least 10dB below significant sources shown in the above Table, therefore they will not contribute or raise the sound level at nearby receivers.

The Acoustic Power Levels (Lw's) of plant and equipment operating at the railway freight terminal site during the day, evening and night for current and proposed operations, which were input into our computer model, are shown in the following Table. The Tables give the A-weighted sound power levels for each listed plant item, principally based on our measurements at the existing railway freight terminal located in the Griffith CBD. Also shown is the number of plant operating at each location on the site for a worst-case situation (also see Figure 2).

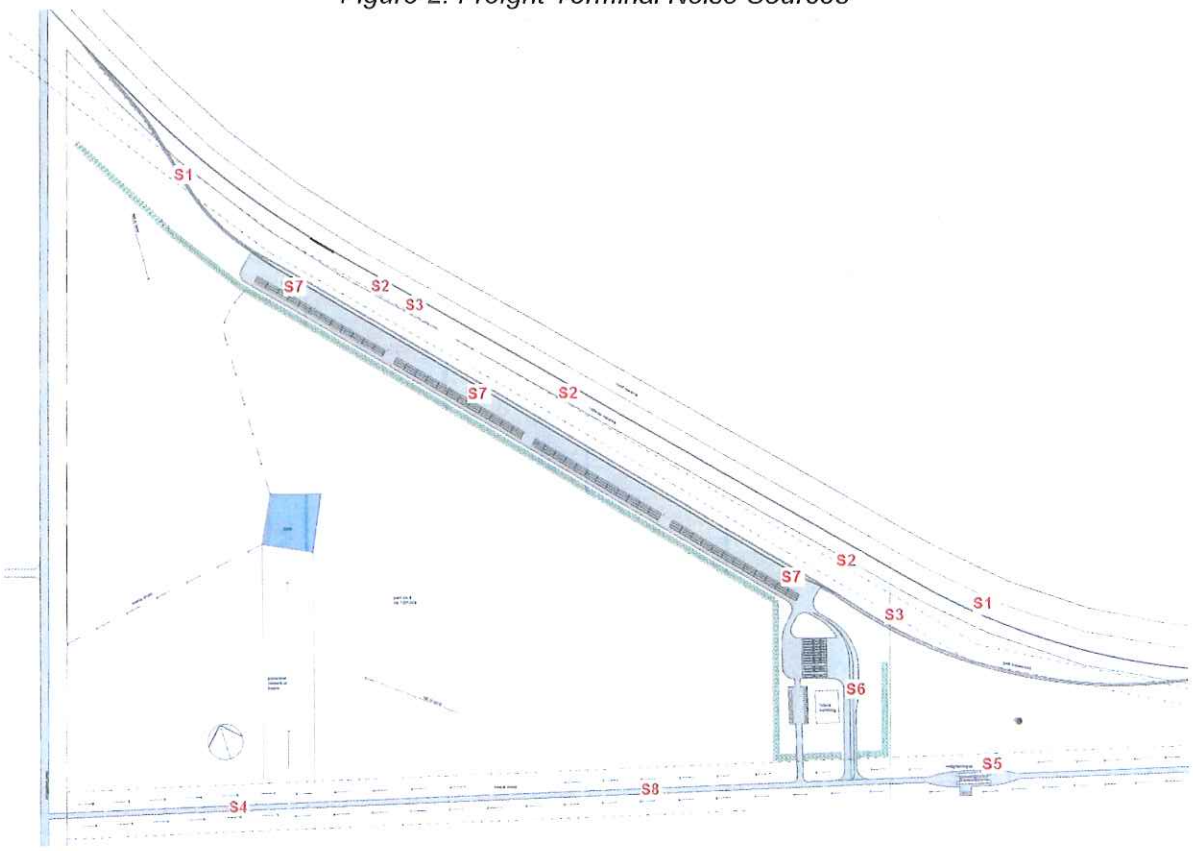
Table 4: Scenario 1 Locomotive – Day/Evening/Night

Machine/Process	Lw dB(A)	Access Road	Rail Siding	Weighbridge
Locomotive approach	**112**		1 (S1)	
Locomotive Shunting	**116**		1 (S2)	
Locomotive Idling	**98**		1 (S3)	

Table 5: Scenario 2 Site Activities – Day/Evening/Night

Machine/Process	Lw dB(A)	Access Road	Rail Siding	Weighbridge
Truck travelling	**106**	2 (S4) (S8)		
Truck idling	**90**			1 (S5)
Truck parking	**108**		1 (S6)	
Hyster 52-16 Fork Lift	**104**		1 (S7)	

Figure 2: Freight Terminal Noise Sources



The following Tables show summaries of predicted received noise levels at nearby residential receivers under neutral and noise enhancing atmospheric conditions. Allowances have been made in our acoustic model for topographical features.

Table 6: Received Noise Levels from Locomotive (SCENARIO 1) dB(A)Leq (15 minute)

Receiver	Received Noise Levels, dB(A),Leq			
	Neutral Conditions (DAY)	3m/sec Wind Source to Rec (DAY)	Neutral Conditions (NIGHT)	3°C/100m Inversion (NIGHT)
R1 – Res. (SW)	31	33	31	34
R2 – Res. (SE)	29	32	29	32
R3 – Res. (E)	27	31	27	31
R4 – Res. (NE)	17	21	17	22
R5 – Res. (N)	17	21	17	22
R6 – Res. (N)	24	28	24	28
R7 – Res. (NW)	27	31	27	30
R8 – Res. (W)	28	30	28	30
R9 – Res. (W)	30	32	30	32

Criteria: Day=35dB(A),Leq, Evening=35dB(A),Leq, Night=35dB(A),Leq.

Table 7: Received Noise Levels from Site Activities (SCENARIO 2) dB(A)Leq (15 minute)

Receiver	Received Noise Levels, dB(A),Leq			
	Neutral Conditions (DAY)	3m/sec Wind Source to Rec (DAY)	Neutral Conditions (NIGHT)	3°C/100m Inversion (NIGHT)
R1 – Res. (SW)	29	31	29	32
R2 – Res. (SE)	26	29	26	29
R3 – Res. (E)	22	26	22	26
R4 – Res. (NE)	14	18	14	19
R5 – Res. (N)	14	18	14	19
R6 – Res. (N)	20	24	20	24
R7 – Res. (NW)	23	27	23	26
R8 – Res. (W)	25	27	25	27
R9 – Res. (W)	27	29	27	29

Criteria: Day=35dB(A),Leq, Evening=35dB(A),Leq, Night=35dB(A),Leq.

Table 8: Received Noise Levels from Locomotive (SCENARIO 1) dB(A)L1 (1 minute)

Receiver	Received Noise Levels, dB(A),L1			
	Neutral Conditions (DAY)	3m/sec Wind Source to Rec (DAY)	Neutral Conditions (NIGHT)	3°C/100m Inversion (NIGHT)
R1 – Res. (SW)	N/A	N/A	38	41
R2 – Res. (SE)	N/A	N/A	39	42
R3 – Res. (E)	N/A	N/A	32	36
R4 – Res. (NE)	N/A	N/A	24	29
R5 – Res. (N)	N/A	N/A	24	29
R6 – Res. (N)	N/A	N/A	31	35
R7 – Res. (NW)	N/A	N/A	34	37
R8 – Res. (W)	N/A	N/A	35	37
R9 – Res. (W)	N/A	N/A	37	39

Criteria: Night=45dB(A),L1.

Table 9: Received Noise Levels from Site Activities (SCENARIO 2) dB(A)L1 (1 minute)

Receiver	Received Noise Levels, dB(A),L1			
	Neutral Conditions (DAY)	3m/sec Wind Source to Rec (DAY)	Neutral Conditions (NIGHT)	3°C/100m Inversion (NIGHT)
R1 – Res. (SW)	N/A	N/A	32	35
R2 – Res. (SE)	N/A	N/A	20	23
R3 – Res. (E)	N/A	N/A	24	28
R4 – Res. (NE)	N/A	N/A	16	21
R5 – Res. (N)	N/A	N/A	16	21
R6 – Res. (N)	N/A	N/A	23	27
R7 – Res. (NW)	N/A	N/A	26	29
R8 – Res. (W)	N/A	N/A	27	29
R9 – Res. (W)	N/A	N/A	29	31

Criteria: Night=45dB(A),L1.

Reference to theoretical results in the above Tables show that site operations are predicted to be compliant with the criteria at all nearby residential receivers during the day and night for neutral and adverse weather conditions, subject to noise control strategies detailed in Section 4.

SECTION 4
Summary of Recommended Noise Control Strategies

4.1 NOISE CONTROL STRATEGIES

1. The railway freight terminal may operate over a 24 hour period.

2. Speed restriction signs should be erected at regular intervals along all access roads. A speed limit of 40-50km/hr should be imposed.

3. All access roads should be kept in good condition, i.e. no potholes, etc.

4. Trucks and other machines should not be left idling for extended periods unnecessarily. Machines found to produce excessive noise compared to industry best practice should be removed from the site or stood down until repairs or modifications can be made.

5. A regular maintenance schedule should be adopted for all mobile and fixed plant items. Items found producing high noise should be stood down until repairs are completed.

6. The site manager should take responsibility and be available to consult with community representatives, perhaps only during opening hours. Response to complaints or comments should be made in a timely manner and action taken reported to the concerned party.

7. All staff and employees directly involved with the facility should receive informal training with regard to noise control procedures. Additional ongoing on the job environmental training should be incorporated with the introduction of any new process or procedure. This training should flow down contractually to all sub-contractors.

SECTION 5
Conclusion

5.1 CONCLUSION

A noise impact assessment for establishment of a railway freight terminal at Wumbulgal has been completed. The site is suitable for the intended purpose providing recommendations outlined in this report are incorporated into the design. With these or equivalent measures in place, the cumulative noise impact from the site will either be within the criteria or generally below the existing background noise level in the area for the majority of the time.

A noise monitoring program, during commissioning, or in the early life of the site is recommended. This program will verify our predictions and in the event of any non-compliance(s), enable noise control strategies to be implemented, where required.

Noise created by traffic associated with the proposal on nearby roads is predicted to be within the criteria at all nearby receivers.

Providing the recommendations presented in this report are implemented, operation of the proposed freight terminal will not have any long term adverse noise impact upon the acoustical amenity of nearby residents. We therefore see no acoustic reason why the proposal should be denied.

REVERB ACOUSTICS

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APPENDIX A
Definition of Acoustic Terms

Definition of Acoustic Terms

Term	Definition
dB(A)	A unit of measurement in decibels (A), of sound pressure level which has its frequency characteristics modified by a filter ("A-weighted") so as to more closely approximate the frequency response of the human ear.
ABL	*Assessment Background Level* – A single figure representing each individual assessment period (day, evening, night). Determined as the L90 of the L90's for each separate period.
RBL	*Rating Background Level* – The overall single figure background level for each assessment period (day, evening, night) over the entire monitoring period.
Leq	Equivalent Continuous Noise Level - which, lasting for as long as a given noise event has the same amount of acoustic energy as the given event.
L90	The noise level which is equalled or exceeded for 90% of the measurement period. An indicator of the mean minimum noise level, and is used in Australia as the descriptor for background or ambient noise (usually in dBA).
L10	The noise level which is equalled or exceeded for 10% of the measurement period. L_{10} is an indicator of the mean maximum noise level, and was previously used in Australia as the descriptor for intrusive noise (usually in dBA).