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ROSANNA ROAD-GREENSBOROUGH HIGHWAY - HEAVY VEHICLE NOISE ASSESSMENT

Acoustic Report

7 April 2016

VicRoads

MB978-01F03 Acoustic Report (r1)

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1 Introduction

Renzo Tonin & Associates was engaged to undertake noise monitoring along the Rosanna Road-Greensborough Highway corridor with the objective of identifying the noise emissions associated with different classes of heavy vehicles, consistent with the Austroads vehicle classification system (presented in Appendix B).

The primary objective of the noise assessment was to identify which classes of heavy vehicles are most likely to contribute to sleep disturbance and amenity impacts for nearby residents based on the noise emissions associated with passby, braking, acceleration and turning events. It is noted that the Rosanna Road-Greensborough Highway corridor currently has a heavy vehicle curfew in place between the hours of 10pm – 6am to assist in mitigating residential amenity impacts.

This document summarises the results of noise monitoring conducted along the Rosanna Road-Greensborough Highway corridor between the 8th to the 16th of March 2016 and our assessment of the likely amenity impacts were the curfew to be repealed.

The work documented in this report was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian Standard / NZS ISO 9001. Appendix A contains a glossary of acoustic terms used in this report.

2 Noise Monitoring

2.1 Noise Monitoring Locations

Noise monitoring was undertaken at four (4) separate locations deemed to be subject to heavy vehicle noise emissions associated with passby, braking, acceleration and turning events along the Rosanna Road-Greensborough Highway corridor. These locations were agreed upon in discussions with VicRoads and are marked on an aerial photograph presented in Appendix C.

Proximity to residential properties along the Rosanna Road-Greensborough Highway and the likelihood of significant heavy vehicle noise emissions, including compression and engine braking, were the key consideration in determining appropriate noise monitoring locations. It was observed during the site visits that the dominant noise source at all four noise monitoring locations was traffic using the Rosanna Road-Greensborough Highway corridor, particularly heavy vehicle movements. A summary of the nominated noise monitoring locations is presented in Table 1.

Table 1: Noise Monitoring Locations

Location	Address	Distance to Rosanna Road-Greensborough Highway corridor (centre of road)	GPS Coordinates (GDA94)	
			Latitude	Longitude
L1	Adjacent 10 Rosanna Road, Heidelberg	10m	-37.756071°	145.069826°
L2	28 Laane Avenue, Rosanna	10m	-37.744010°	145.072138°
L3	52 Jones Crescent, Rosanna	13m	-37.737514°	145.075238°
L4	15 Greensborough Road, Rosanna	16m	-37.734402°	145.078459°

2.2 Noise Monitoring Methodology

Noise monitoring was conducted along the Rosanna Road-Greensborough Highway corridor between the 8th to the 16th of March 2016. As the corridor currently has a heavy vehicle curfew in place between the hours of 10pm – 6am, Renzo Tonin & Associates was instructed to conduct noise monitoring on the shoulder period of the current curfew hours (i.e. 8pm – 10pm and 6am – 8am). Noise monitoring was conducted for a duration of two (2) hours at each nominated location, distributed between the morning and evening shoulder periods.

The equipment used for noise measurements was a Soundbook multichannel sound & vibration analyser running Samurai software which is a Class 1 instrument having accuracy suitable for field and laboratory use. The instrument is equipped with a Bruel & Kjaer Type 4189 Class 1 microphone. The microphone was calibrated prior and subsequent to measurements using a Bruel & Kjaer Type 4231 calibrator. No significant drift in calibration was observed. All instrumentation complies with IEC 61672 (parts 1-3) '*Electroacoustics - Sound Level Meters*' and IEC 60942 '*Electroacoustics - Sound calibrators*' and carries current NATA certification (or if less than 2 years old, manufacturers certification). The data acquisition system included linked recording of noise, video and audio.

Noise monitoring was conducted in general accordance with the '*VicRoads Traffic Noise Measurement Requirements for Acoustic Consultants September 2011'*. In accordance with this guideline, noise monitoring was conducted during periods were no significant wind or precipitation were observed which could have adversely affected the measurements.

2.3 Traffic Noise Criteria

2.3.1 Sleep Disturbance

There are currently no legislated policies or objective guidelines in Victoria for the control or assessment of noise induced sleep disturbance or its associated health impacts. Further, VicRoads policies and guidelines do not currently address discrete noise events such as transient heavy vehicle noise. Drawing on the results from an extensive survey of studies conducted world-wide on the impact of noise on domestic amenity, NSW EPA document *Environmental Criteria for Road Traffic Noise, 1999* (ECRTN) and the subsequent New South Wales Office of Environment and Heritage *Road Noise Policy, March 2011* (RNP), concluded that:

> *From the research on sleep disturbance to date it can be concluded that:*
>
> - *Maximum internal noise levels below 50-55dB(A) are unlikely to awaken people from sleep*
> - *One or two noise events per night, with maximum internal noise levels of 65-70dB(A), are not likely to affect health and wellbeing significantly.*

When a window to a room is open (such as might be required for natural ventilation during the night), it is commonly accepted that the noise level inside the room due to external sources would be 10dB(A) lower than the noise level outside the room.

The aforementioned criteria are generally accepted in Victoria where amenity may be affected due to sleep disturbance and are typically taken to apply between 10pm and 7am the following day. The established sleep disturbance criteria are presented in Table 2 below.

Table 2: Sleep Disturbance Criteria

Type	Period	Criterion
Maximum Noise	10pm – 7am	L_{Amax} 60-65 dB external to bedroom window (10dB above internal noise levels based on an open window)

2.4 Noise Monitoring Results

A summary of noise monitoring results in terms of L_{Amax} is presented in Table 3. Samurai analysis software was used to post-process the data to obtain the L_{Amax} noise metrics. Video recordings were used for vehicle class identification and correspondence with the recorded noise levels. A distance correction was then applied to each heavy vehicle pass-by to obtain a predicted estimated noise level at residential property facades along the Rosanna Road-Greensborough Highway corridor.

A sample of approx. 250 heavy vehicle pass-bys was used to obtain the results presented in Table 3. The most commonly observed vehicle type was Class 3 (two axle truck or bus), with Class 4 (three axle truck or bus) and Class 9 (six axle articulated) also found to be frequently using the corridor. No Class 12 (triple road train) vehicles were observed during the noise monitoring periods.

Table 3: Summary of Noise Monitoring Results – Heavy Vehicle Pass-bys

Class	Description	Sample Size	L_{Amax} – Minimum Recorded Pass-by	L_{Amax} – Median of Sample Pass-bys	L_{Amax} – Maximum Recorded Pass-by
Heavy Vehicles					
3	Two axle truck or bus	102	69	74	82
4	Three axle truck or bus	42	70	75	83
5	Four (or five) axle truck	5	74	77	83
6	Three axle articulated	2	76	77	78
7	Four axle articulated	8	72	74	79
8	Five axle articulated	23	72	78	87
9	Six axle articulated	52	71	78	86
Long Vehicles and Road Trains					
10	B double or heavy truck and trailer	10	74	80	82
11	Double road train	2	76	77	78
12	Triple road train	0	N/A	N/A	N/A

Notes: Presented L_{Amax} noise levels have been corrected to predict the noise level at a typical residential property façade along the Rosanna Road-Greensborough Highway corridor.

Table 3 indicates that the range of sample median L_{max} results for the different vehicle class types was 6 dB(A). Class 3 (two axle truck or bus) and Class 7 (four axle articulated) vehicles produced the lowest median L_{max} noise levels at 74 dB(A), while Class 10 (B double or heavy truck and trailer) produced the highest median L_{max} noise level at 80dB(A). However, based on the sleep disturbance criteria presented in Section 2.3.1, it is predicted that all Class 3 to 11 vehicle pass-bys within the sample obtained would exceed the sleep disturbance thresholds.

In addition to the pass-by results presented in Table 3, two instances of heavy vehicles using compression braking were observed during the noise monitoring. The predicted L_{Amax} noise level at a typical residential property façade along the corridor for these two events are presented in Table 4 below. It is noted that both compression braking results are predicted to significantly exceed the sleep disturbance thresholds.

Table 4: Summary of Noise Monitoring Results – Compression Braking

Class	Description	L_{Amax} Noise Level, Compression Braking
6	Three axle articulated	91
9	Six axle articulated	92

3 Conclusion

Renzo Tonin & Associates has undertaken noise monitoring along the Rosanna Road-Greensborough Highway corridor with the primary objective of identifying which classes of heavy vehicles are most likely to contribute to sleep disturbance for nearby residents based on the noise emissions associated with breaking, acceleration and turning events.

A sample of approx. 250 heavy vehicle pass-bys was obtained and the range of sample median L_{max} results for the different vehicle class types was 6 dB(A). Class 3 (two axle truck or bus) and Class 7 (four axle articulated) vehicles produced the lowest median L_{max} noise levels at 74 dB(A), while Class 10 (B double or heavy truck and trailer) produced the highest median L_{max} noise level at 80dB(A).

Based on the sleep disturbance criteria established from the New South Wales Office of Environment and Heritage *Road Noise Policy, March 2011* (RNP), it is predicted that all heavy vehicle pass-bys within the sample obtained will exceed the sleep disturbance thresholds of 60 – 65 dB(A), measured externally at a typical residential property facade along the corridor.

In addition, two instances of heavy vehicles using compression braking were observed during the noise monitoring period. The predicted L_{Amax} noise level at a typical residential property façade along the corridor for these two events are also predicted to significantly exceed the sleep disturbance thresholds.

APPENDIX A Glossary of terminology

The following is a brief description of the technical terms used to describe noise to assist in understanding the technical issues presented.

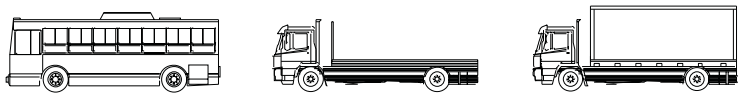
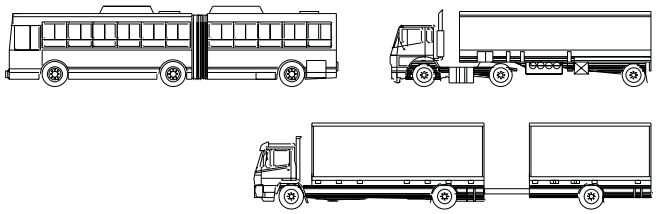
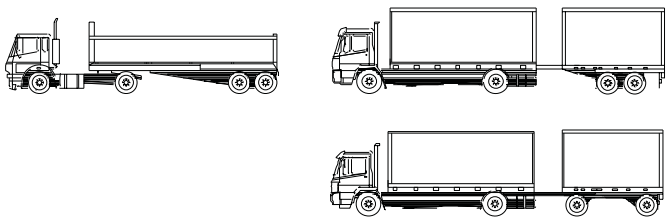
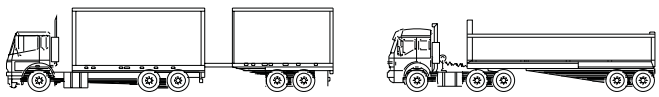
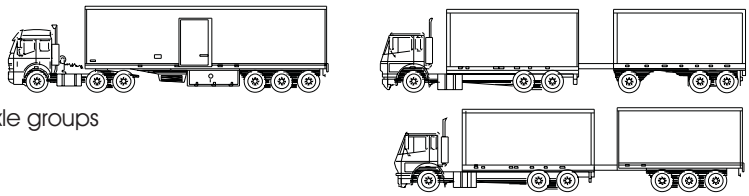
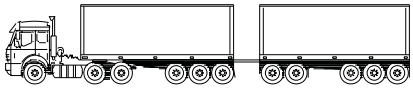
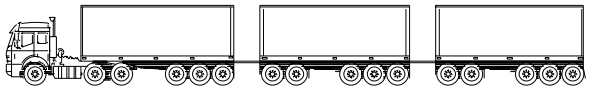
Adverse weather	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).
Ambient noise	The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.
Assessment period	The period in a day over which assessments are made.
Assessment point	A point at which noise measurements are taken or estimated. A point at which noise measurements are taken or estimated.
Background noise	Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation, when extraneous noise is removed. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the L90 noise level (see below).
Decibel [dB]	The units that sound is measured in. The following are examples of the decibel readings of every day sounds: 0dB The faintest sound we can hear 30dB A quiet library or in a quiet location in the country 45dB Typical office space. Ambience in the city at night 60dB CBD mall at lunch time 70dB The sound of a car passing on the street 80dB Loud music played at home 90dB The sound of a truck passing on the street 100dB The sound of a rock band 115dB Limit of sound permitted in industry 120dB Deafening
dB(A)	A-weighted decibels. The A- weighting noise filter simulates the response of the human ear at relatively low levels, where the ear is not as effective in hearing low frequency sounds as it is in hearing high frequency sounds. That is, low frequency sounds of the same dB level are not heard as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the "A" filter. A sound level measured with this filter switched on is denoted as dB(A). Practically all noise is measured using the A filter.
dB(C)	C-weighted decibels. The C-weighting noise filter simulates the response of the human ear at relatively high levels, where the human ear is nearly equally effective at hearing from mid-low frequency (63Hz) to mid-high frequency (4kHz), but is less effective outside these frequencies.
Frequency	Frequency is synonymous to pitch. Sounds have a pitch which is peculiar to the nature of the sound generator. For example, the sound of a tiny bell has a high pitch and the sound of a bass drum has a low pitch. Frequency or pitch can be measured on a scale in units of Hertz or Hz.
Impulsive noise	Having a high peak of short duration or a sequence of such peaks. A sequence of impulses in rapid succession is termed repetitive impulsive noise.
Intermittent noise	The level suddenly drops to that of the background noise several times during the period of observation. The time during which the noise remains at levels different from that of the ambient is one second or more.
L_{Max}	The maximum sound pressure level measured over a given period.
L_{Min}	The minimum sound pressure level measured over a given period.

L_1	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
L_{10}	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
L_{90}	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L90 noise level expressed in units of dB(A).
L_{eq}	The "equivalent noise level" is the summation of noise events and integrated over a selected period of time.
Reflection	Sound wave changed in direction of propagation due to a solid object obscuring its path.
SEL	Sound Exposure Level (SEL) is the constant sound level which, if maintained for a period of 1 second would have the same acoustic energy as the measured noise event. SEL noise measurements are useful as they can be converted to obtain Leq sound levels over any period of time and can be used for predicting noise at various locations.
Sound	A fluctuation of air pressure which is propagated as a wave through air.
Sound absorption	The ability of a material to absorb sound energy through its conversion into thermal energy.
Sound level meter	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.
Sound pressure level	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone.
Sound power level	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power.
Tonal noise	Containing a prominent frequency and characterised by a definite pitch.

APPENDIX B Austroads Vehicle Classification System

VEHICLE CLASSIFICATION SYSTEM

AUSTROADS

CLASS	LIGHT VEHICLES
1	SHORT Car, Van, Wagon, 4WD, Utility, Bicycle, Motorcycle 
2	SHORT - TOWING Trailer, Caravan, Boat 
	HEAVY VEHICLES
3	TWO AXLE TRUCK OR BUS *2 axles 
4	THREE AXLE TRUCK OR BUS *3 axles, 2 axle groups 
5	FOUR (or FIVE) AXLE TRUCK *4 (5) axles, 2 axle groups 
6	THREE AXLE ARTICULATED *3 axles, 3 axle groups 
7	FOUR AXLE ARTICULATED *4 axles, 3 or 4 axle groups 
8	FIVE AXLE ARTICULATED *5 axles, 3+ axle groups 
9	SIX AXLE ARTICULATED *6 axles, 3+ axle groups or 7+ axles, 3 axle groups 
	LONG VEHICLES AND ROAD TRAINS
10	B DOUBLE or HEAVY TRUCK and TRAILER *7+ axles, 4 axle groups 
11	DOUBLE ROAD TRAIN *7+ axles, 5 or 6 axle groups 
12	TRIPLE ROAD TRAIN *7+ axles, 7+ axle groups 

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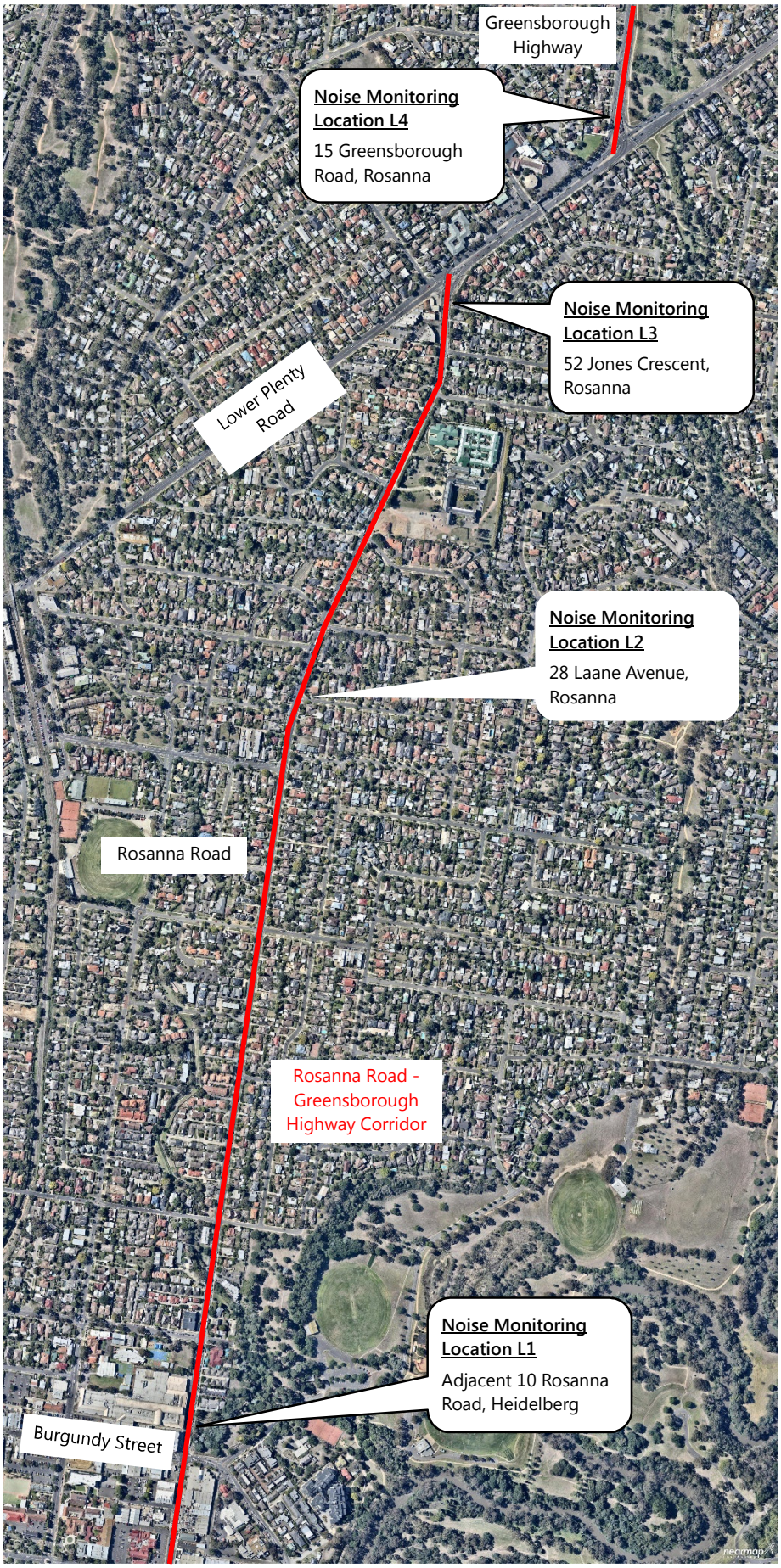
APPENDIX C Noise Monitoring Locations


Greensborough Highway
Noise Monitoring Location L4
15 Greensborough Road, Rosanna
Noise Monitoring Location L3
52 Jones Crescent, Rosanna
Lower Plenty Road
Noise Monitoring Location L2
28 Laane Avenue, Rosanna
Rosanna Road
Rosanna Road - Greensborough Highway Corridor
Noise Monitoring Location L1
Adjacent 10 Rosanna Road, Heidelberg
Burgundy Street