



CLARITY
ACOUSTICS

STATEMENT OF EVIDENCE OF ROSS LEO
17 February 2019
EV01 19002

MORDIALLOC BYPASS PROJECT EES
INQUIRY AND ADVISORY COMMITTEE (IAC)
Review of Acoustic Assessment and Reporting

Instructed by: RUSSELL KENNEDY LAWYERS

Date of last site inspection: 31 January 2019

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STATEMENT OF EVIDENCE OF ROSS LEO

1.0 INTRODUCTION

- 1.1 My name is Ross Cameron Leo. I am a Director of the acoustic consulting practice of Clarity Acoustics Pty Ltd (Clarity Acoustics) which operates at 61 Gladstone Street in Kew. For the past 18 years I have worked in the field of noise and vibration control as a consultant.
- 1.2 My academic qualifications include a Bachelor of Applied Science (Applied Physics) from the Royal Melbourne Institute of Technology. I am a member of the Australian Acoustical Society.
- 1.3 I have been involved in noise and vibration assessments for more than 18 years including projects such as such as road and rail infrastructure developments. My curriculum vitae is attached in Appendix A.
- 1.4 Major Roads Projects Authority propose a new 9 km road linking the Mornington Peninsula Freeway with the Dingley Bypass. The Environment Effects Statement (EES) for the proposed new road includes a chapter on the Noise and Vibration Effects (Chapter 12) of the proposed road as well as a chapter on Biodiversity (Chapter 10) which includes a section on the effects of traffic noise on biodiversity.
- 1.5 I have been instructed by Russell Kennedy Lawyers to conduct a review of the EES and the EES attachments and appendices relevant to noise and vibration, respond to any other relevant submissions, and recommend improvements and/or changes including to the Environmental Performance Requirements (EPRs).
- 1.6 I confirm that I have no private or business relationship with the party for whom the assessment has been prepared other than my present engagement on this matter.
- 1.7 In the course of my investigations I have:
- Visited the site and undertaken noise surveys on Thursday, 31 January 2018
 - Reviewed relevant documentation and drawings
 - Performed acoustic calculations
 - Prepared a statement of evidence.

1.8 In the course of preparing this statement, I have considered the following documents:

Documents considered as part of the preparation of this statement

Scoping Requirements for Mordialloc Bypass Environment Effects Statement May 2018 (Scoping Requirements)

EES Chapter 12 Noise and Vibration Effects (Chapter 12)

EES Appendix E WSP Report number 2135645A-SE-26-TPL_REP-0004 Rev1 titled *Mordialloc Bypass Noise and Vibration Impact Assessment* (Appendix E)

EES Chapter 10 *Biodiversity* (Chapter 10)

EES Appendix C WSP Report number 2135645A-SE-26-TPL_ECO-REP-0001 Rev1 titled *Mordialloc Bypass Flora and Fauna Impact Assessment* (Appendix C)

VicRoads *Traffic Noise Reduction Policy 2005* (VicRoads TNRP)

VicRoads Road Design Note 06-01 dated July 2010 titled *Interpretation and application of VicRoads Traffic Noise Reduction Policy 2005* (VicRoads RDN 06-01)

VicRoads *Noise Guidelines – Construction and Maintenance Works 2007* (VicRoads Noise Guidelines)

EPA Victoria's Publication *Environmental Guidelines for Major Construction Sites* (EPA Publication 480)

EPA Victoria's Publication *Noise Control Guidelines* (EPA Publication 1254)

NSW Roads and Maritime Services *Construction Noise and Vibration Guidelines – August 2016* (NSW RMS's CN&VG)

NSW Department of Environment and Climate Change's Interim Construction Noise Guidelines (ICNG)

British Standard 6472-1:2008 titled *Guide to Evaluation of human exposure to vibration in buildings – Part 1: vibration sources other than blasting* (BS 6472-1)

German Institute for Standardisation DIN 4150-3:1999 titled *Vibrations in buildings, Part 3: Effects on Structures* (DIN 4150-3)

West Gate Tunnel Project Inquiry and Advisory Committee (IAC) Report

United Kingdom's Department of Transport publication *Calculation of Road Traffic Noise* (CoRTN)

1.9 I have prepared this statement with the assistance of the following staff at Clarity Acoustics:

Staff member	Tasks	Qualification
Anjali Chandhok (Associate Director)	Review of statement of evidence	Master of Design Science (Audio & Acoustics) Bachelor of Science (Electronic Media) Dip. Audio Engineering

1.10 A glossary of acoustic terminology is provided in Appendix B.

2.0 SITE CONTEXT AND POTENTIAL ACOUSTIC ISSUES

2.1 In May 2018, the Victorian Government announced its intentions to build the Mordialloc Bypass to link the Mornington Peninsula Freeway at Springvale Road to the Dingley Bypass in Dingley Village.

2.2 The proposed road is to:

- consist of two, dual lane 7.5 km long carriageways with scope for future upgrade to 3 lanes each. The project will also require 2.2 km of roadworks to integrate the proposed road with the existing Mornington Peninsula Freeway
- be constructed predominantly within the existing road reservation
- pass to the west of residences between Centre Dandenong Road and Lower Dandenong Road
- pass to the west of Braeside Park, the east of Woodlands Estate Reserve and traverse the wetlands at Waterways.

2.3 Figure 1 provides the project extent and the neighbouring areas.

Figure 1 – Project extent (Source: Sitemap)



3.0 REVIEW OF PUBLIC SUBMISSIONS

3.1 I have conducted a review of the public submissions relating to acoustics provided by Russell Kennedy Lawyers and provide the following summary:

- More than 40 % of submissions relating to acoustics highlighted the noise barrier design as a concern
- More than 30 % of submissions relating to acoustics highlighted noise to parklands and wetland areas as a concern
- Other acoustic issues raised include operational noise, construction noise, increase in existing noise level, noise to non-residential receivers and the cumulative impact of the Project when considered with other roads and proposed transport projects.

4.0 REVIEW OF CHAPTER 12 / APPENDIX E

4.1 Criteria - Operational noise

4.1.1 The assessment author correctly identifies the VicRoads Project Objective Noise Levels (PONLs) of 63 dB $L_{A10, 18 \text{ hour}}$ for Category A buildings¹ and 63 $L_{A10, 12 \text{ hour}}$ for Category B buildings² (Primary noise objectives as outlined in Section 2.5 of RDN 06-01). However, Section 2.5 of VicRoads RDN 06-01 states:

It should be noted that where the existing noise levels are less than 50 dB(A) $L_{10(18hr)}$, an assessment of the noise barrier requirements to limit the future noise level increase to 12 dB(A) must be undertaken. An assessment of the practicability of the measures will then be made (refer to Section 2.7.3), and valid reasons for adopting or not-adopting the lower noise objective, are to be documented.

4.1.2 The author's justification for applying a 63 dB $L_{A10, 18 \text{ hour}}$ criterion across the entire project is as follows:

MRPA have determined that a PONL of 63 dBA $L_{10,18hr}$ will be adopted for all receivers where existing levels are below 50 dBA $L_{10,18hr}$ based on the following:

- *Targets established on previous freeways and arterial roads projects completed in the Greater Melbourne region*
- *Consideration to the level of acoustic improvement that is likely to be achieved with the adoption of this criterion*
- *Potential costs, visual and aesthetic impacts to the project and surrounding environment with the adoption of this criteria based on indicative noise barrier heights and extents required to achieve this criterion.*

4.1.3 If the VicRoads criterion based on the existing noise level was adopted, the barrier design would change between Centre Dandenong Road (Section 2) to a point adjacent to the southern boundary of Chadwick Reserve (Section 3) and would result in an increase of 0.5 m to 1.5 m in barrier height to these areas of the project.

4.1.4 Considering the project is predicted to result in an increase in noise level of 16 dB at some properties it is recommended that the operational noise criteria include consideration of the existing conditions and that the mitigation to the relevant areas be designed based on minimising the future noise level increase to 12 dB.

¹ Category A - residential dwellings, aged persons homes, hospitals, motels, caravan parks and other buildings of a residential nature

² Category B buildings - Schools, kindergartens libraries and other noise-sensitive community buildings

4.1.5 VicRoads policy and guidelines do not provide operational noise criteria for recreational areas and, as such, the assessment author has not provided operational noise criteria for Braeside Park's recreational areas. It is recommended that EPR NV1 be updated to include criteria for recreational areas as follows:

- 63 dB $L_{A10, 18 \text{ hour}}$ for passive open space
- 68 dB $L_{A10, 18 \text{ hour}}$ for active open space.

4.1.6 It should be noted that the above criteria were proposed for the West Gate Tunnel Project and the West Gate Tunnel Projects Inquiry and Advisory Committee (IAC) report states:

Noise limits during operation should be provided for public open space, including new open space areas created by the Project, adjacent to the West Gate Freeway between the western edge of Crofts Reserve to Hyde Street.

4.2 Criteria - Construction noise

4.2.1 The construction noise section of Appendix E includes reference to EPA Publication 1254 and Publication 480, however, does not provide clear guidance on the construction noise targets. EPR NV2 should be updated to provide clear construction noise targets to be achieved (including at non-residential receivers) and ground-borne noise targets.

4.2.2 The construction noise assessment does not consider recreational areas. It is recommended that EPR NV2 be updated to include criteria for recreational areas as follows:

- 60 dB $L_{Aeq, 15 \text{ min}}$ for passive open space
- 65 dB $L_{Aeq, 15 \text{ min}}$ for active open space.

4.2.3 It should be noted that the West Gate Tunnel Project IAC Report included similar recommendations.

4.2.4 It is recommended that EPR NV2 be updated to include clear construction noise targets such as the West Gate Tunnel EES assessment construction noise targets, which are based on EPA Publication 1254, EPA Guideline 480 and the NSW ICNG.

4.3 Criteria - Construction Vibration

- 4.3.1 EPR NV2 does not include criteria for construction vibration, however, the Policy, Guidelines and Criteria section of the assessment refers to BS 6472-1 and DIN 4150-3.
- 4.3.2 For human comfort, the assessment author proposes to assess construction vibration against the “low probability of adverse comment” criteria from BS 6472-1 which is considered acceptable.
- 4.3.3 For Building Damage, the author proposes to assess construction vibration against the “safe limits for construction short term vibration at structures” criteria from DIN 4150-3. These limits are based on short term vibration and should be updated to reflect long term vibration on structures as outlined in Table 1.

Table 1 – Structural damage ‘safe limits’ for long term construction vibration impacts on structures

Type of structure	Guideline values for velocity (mm/s) Vibration at horizontal plane of highest floor all frequencies
Buildings used for commercial purposes, industrial buildings, and buildings of similar design	10
Dwellings and buildings of similar design and/or occupancy	5
Structures that, because of their particular sensitivity to vibration, cannot be classified under lines 1 and 2 and are of intrinsic value (e.g. Heritage buildings)	2.5

- 4.3.4 For damage to buried assets, the assessment author proposes to assess construction vibration against Guideline values for vibration velocities for services outlined in DIN 4150.3-1999 which is considered acceptable.
- 4.3.5 It is recommended that EPR NV2 be updated to include clear construction vibration targets.

4.4 Existing conditions - Noise

4.4.1 Noise monitoring was conducted at positions representative of 13 residential receivers along the proposed road alignment and 5 positions within the parklands? (refer to figure 12.2 of Appendix E). At the residential properties, the typical range of measured noise levels was reported as 48-53 dB $L_{A10, 18 \text{ hour}}$ with the exception of 68/29 Wells Road, Aspendale Gardens (59 dB), 21 Soden Road, Bangholme (60 dB) and 80 Soden Road, Bangholme (58 dB). Interestingly, the $L_{A10, 18 \text{ hour}}$ level for the above three properties was higher than the $L_{A10, 15 \text{ hour}}$ suggesting a high level of noise between 0600-0700 hours and/or between 2200 hours to midnight.

4.4.2 It should be noted that my calculations of the $L_{A10, 18 \text{ hour}}$ noise levels at 14 Oploo Ct, Portland Place, Waterways and 7 Ferntree Grove are 1 dB lower than those provided in the assessment. The typical range of measured noise levels would then be 47-53 $L_{A10, 18 \text{ hour}}$ (with the exception of three properties listed above).

4.4.3 Noise monitoring was not conducted in the northern section of Braeside Park.

4.5 Existing Conditions - Vibration

4.5.1 Baseline vibration monitoring was not conducted as part of this assessment as vibration targets were established independent of existing vibration which is considered an acceptable approach.

4.6 Construction noise predictions

4.6.1 While construction noise level predictions are not directly provided, the assessment provides estimates of the total sound power levels for each construction scenario and the predicted noise levels at varying distances (Figure 7.1 of Appendix E). Residents are likely to be affected by day time construction noise levels that exceed the background noise level by 10 dB or more and be highly affected by day time construction noise of 75 dB L_{Aeq} or above.

4.6.2 Based on the information provided in the assessment, without further mitigation, occupants of residences within 110 m of the bulk earthworks scenario would be highly affected. The assessment author suggests that noise barriers (albeit for traffic) will provide a reduction in construction noise of 5-15 dB meaning occupants of residences within 40 m of the bulk earthworks scenario would still likely be highly affected with noise barriers.

4.6.3 For the quietest scenario, such as corridor clearing, occupants of residences within 65 m would be highly noise affected without mitigation and are likely to be highly noise affected within 25 m even with barriers.

4.6.4 Considering the Zone 2 residences are within 20 m of the project boundary additional noise control measures will be required.

4.7 Construction vibration predictions

4.7.1 Construction vibration predictions are not provided in the assessment, however, recommended minimum working distances are provided based on the NSW RMS's CN&VG. Considering the Zone 2 residences are within 20 m of the project boundary, vibratory rollers, medium and large hydraulic hammers and vibratory pile drivers would be within the minimum setback for human comfort. At setbacks of 20 m or less there is a risk of cosmetic damage to building from Large vibratory rollers and hydraulic hammers.

4.8 **Construction noise and vibration management plan**

4.8.1 As outlined in Section 4.6.4 and 4.7.1 above, construction noise and vibration mitigation will be required during the construction phase of the project. The assessment author has recommended the use of a Construction Noise and Vibration Management Plan (CNVMP) to assist in the risk management of construction noise and vibration.

4.8.2 EPA publication 1254 and the CNVMP requirements do not provide clear guidance on the process for approving 'unavoidable works'.

4.8.3 It is recommended that EPR NV2 be updated to include clear construction noise and vibration targets and a clear process for approval of 'unavoidable works'.

4.9 **Operational noise predictions**

4.9.1 Operational noise was modelled using SoundPLAN 7.4 noise modelling software implementing CoRTN. Noise from existing roads has not been considered except for the Dingley Bypass and Mornington Peninsula Freeway. The modelling is based on 2031 traffic volume predictions and the assumption that the new road surface will be Open Graded Asphalt (OGA).

4.9.2 The above modelling software and inputs are considered appropriate, however, it is recommended that EPR NV1 be updated to reflect the modelled 2031 traffic volumes.

4.9.3 Noise modelling has been conducted at 1.5 m above ground level. The VicRoads TNRP is silent on the assessment position, however, VicRoads RDN 06-01 states:

The receptor point, where modelling for noise barriers and measurements are undertaken at a noise sensitive building, is the centre of the window of the most exposed external facade facing the traffic noise. The receptor point will be at the lowest habitable level of the building. This is due to ease of measurement, and because noise is generally louder at the lower level. Also the 63 dB(A) level is aimed at achieving acceptable outdoor levels, which generally occurs at ground level.

4.9.4 Despite the above, I am of the opinion that upper level habitable rooms should be afforded the same level of acoustic protection as ground floor habitable rooms. It should be noted that this approach is consistent with VicRoads publication *Requirements of Developers – Noise Sensitive Uses* and the approach taken on CityLink and East West Link where all levels of existing residential buildings were considered. This approach is also supported by the West Gate Tunnel Project's IAC Report which recommends (Section 7.2.3):

Noise limits should apply to all habitable levels of Category A and B Buildings.

- 4.9.5 As there are a number of multiple storey dwellings along the proposed route (where the proposed mitigation would not result in compliance with the 63 dB $L_{A10, 18 \text{ hour}}$ criterion at the upper levels), it is recommended that EPR NV1 be updated to include upper levels of noise sensitive receivers.
- 4.9.6 Noise modelling has been conducted for Braeside Park with reported predicted levels of 65 dB $L_{A10, 18 \text{ hour}}$ for the Federation Picnic Area and 58 dB $L_{A10, 18 \text{ hour}}$ for the Telford Picnic Area. It should be noted that for a large section of the Howard Road Trail the predicted noise level is above 68 dB $L_{A10, 18 \text{ hour}}$ or 5 dB above the criterion proposed for passive recreation areas provided in Section 4.1.5. It should be noted that the above noise levels account for the 2.5 dB facade correction applied to the noise contours.
- 4.9.7 It is recommended that EPR NV1 be updated to include criteria for recreation areas as outlined in Section 4.1.5. Based on preliminary high-level calculations, in order to achieve the proposed targets for passive recreational areas, a noise barrier approximately 3 m high would be required to the east of the proposed road section adjacent to Braeside Park.
- 4.10 **Noise Barrier design**
- 4.10.1 Details of the proposed noise barrier construction have not been provided in the assessment. To provide adequate noise attenuation the construction material of the proposed barriers must have a minimum surface density of 12-15 kg/m² and be free from holes and gaps. The following materials will achieve the required surface mass and can be considered:
- 9 mm thick fibre cement sheet
 - 25 mm thick plywood timber panelling
 - 12 mm thick Perspex.
- 4.10.2 Any other approved material which meets the minimum surface density specification can also be used.
- 4.10.3 Considering the height of the proposed barriers and the proximity of the residences in Zone 2 to the proposed barriers, from an acoustic perspective, there is no reason why these barriers could not be of transparent construction provided the above surface mass is achieved.
- 4.10.4 It is also recommended that the multifunction fauna barriers be constructed with a minimum surface density of 12-15 kg/m² and be free from holes and gaps.

5.0 REVIEW OF CHAPTER 10 / APPENDIX C

- 5.1 Section 10.8.2 of Chapter 10 provides a summary of the noise modelling without and with mitigation (including the multifunction fauna barrier) and concluded that noise levels within the Wetlands habitat area and Mordialloc Creek vary between 59-70 dB $L_{A10, 18 \text{ hour}}$ without any mitigation to the proposed road and between 56-63 dB $L_{A10, 18 \text{ hour}}$ with the proposed mitigation.
- 5.2 Section 6.1.4.2 of Appendix C provides a literature review of papers relating to the effects of traffic noise on birds and the justification for the 'apparent threshold' of 55-60 dB $L_{A10, 18 \text{ hour}}$ for operational noise impact on fauna.
- 5.3 The proposed mitigation including the multifunction fauna barrier does not provide adequate attenuation of traffic noise to achieve the 'apparent threshold' and would result in an increase in noise level of up to 13 dB $L_{A10, 18 \text{ hour}}$ within the affected wetlands areas.
- 5.4 In order to achieve the 'apparent threshold' criteria, I estimate that the height of the multifunction fauna barrier would need to be increased to 3.5-4.0 m.
- 5.5 As outlined in Section 4.10.4, the multifunction fauna barriers should be constructed with a minimum surface density of 12-15 kg/m² and be free from holes and gaps.
- 5.6 It is recommended that the EPRs be updated to include an acoustic requirement to mitigate the risk of operational noise related to the effects on threatened fauna species.

6.0 RECOMMENDED REVISED EPRS

6.1 The following outlines my recommendations for the revised (and new) EPRS for the project.

EPR NUMBER	EPR
NV1	<p data-bbox="448 450 756 479">Noise and vibration (design)</p> <p data-bbox="448 506 1452 607">Noise and vibration impacts on residents during operation must be minimised by the inclusion of appropriate noise attenuation measures and road surface specifications in the design. Road traffic noise emissions must comply with the Project Objective Noise Levels:</p> <ul data-bbox="448 633 1437 748" style="list-style-type: none"> <li data-bbox="448 633 1437 696">— 63 dB $L_{A10, 18 \text{ hour}}$ or existing $L_{A10, 18 \text{ Hr}} + 12 \text{ dB}$ for dwellings where the existing noise levels are less than 50 dB $L_{A10, 18 \text{ hour}}$ for the new bypass, and <li data-bbox="448 723 1098 748">— 68 dB $L_{A10, 18 \text{ hour}}$ for the Mornington Peninsula Freeway works. <p data-bbox="448 775 1414 837">Compliance with the above criteria is to be measured at one metre from the centre of the most exposed window of all habitable levels of Category A buildings.</p> <p data-bbox="448 864 1390 965">Noise and vibration impacts on open spaces such as Braeside Park during operation must be minimised by the inclusion of appropriate noise attenuation measures and road surface specifications in the design. Road traffic noise emissions must comply with:</p> <ul data-bbox="448 992 871 1072" style="list-style-type: none"> <li data-bbox="448 992 871 1021">— 63 dB $L_{A10, 18 \text{ hour}}$ for passive open space <li data-bbox="448 1046 860 1072">— 68 dB $L_{A10, 18 \text{ hour}}$ for active open space. <p data-bbox="448 1099 1457 1198">Noise and vibration impacts on wetland areas during operation must be minimised by the inclusion of appropriate noise attenuation measures and road surface specifications in the design. Road traffic noise emissions must comply with the 60 dB $L_{A10, 18 \text{ Hr}}$ criterion within the wetlands area.</p>

NV2

Construction Noise and Vibration Management Plan

A Construction Noise and Vibration Management Plan (CNVMP) should be prepared and implemented in consultation with EPA Victoria in accordance with the criteria and methodologies outlined in the noise and vibration EPRs.

The CNVMP must be informed by monitoring and modelling undertaken by a suitably qualified acoustic and vibration consultant prior to the construction works and include (but not be limited to) the following:

A. Noise and vibration management levels

- The construction noise, vibration and regenerated noise targets as defined in EPRs NV4, 5, 6, 7, 8
- Updated noise and vibration modelling of the noise and vibration impacts

B. Noise and vibration mitigation measures

- Identification of sensitive receptors potentially impacted by the construction stage of the Project
- Identification of the scheduling, duration, activities and equipment with the potential to generate airborne noise or surface vibration impacts at the identified sensitive receptors
- Implementation of construction noise and vibration targets including management measures, where practicable to achieve these targets such as:
 - o Scheduling
 - o Measures to manage night works
 - o Vehicle and traffic management related to any relevant traffic management plan prepared under EPR TP3
 - o Temporary structures to attenuate noise impacts if required to achieve Noise and Vibration EPRs.
- Detail of practicable measures that will be adopted to manage noise and vibration impacts that exceed the targets or values set out in the EPRs and CNVMP including:
 - o Engagement and notification measures
 - o Off-site measures (e.g. temporary relocation or respite offers)

C. Vibration

Procedures for condition surveys to be undertaken, with the prior approval of the relevant property owner and/or occupier, for property, land, ground and infrastructure that is reasonably accessible and that may be affected by the project activities.

Any alternative vibration guideline values identified under EPR NV5 (refer Note 2).

D. Monitoring

Noise and vibration monitoring commitments (including real time monitoring in high risk areas) and response protocols for managing noise complaints and remedial action.

E. Community consultation

Details of the communication plan to be adopted throughout construction including any specific measures related to particular locations or activities

Detail of the complaints management system for noise complaints

F. Unavoidable works

A qualification rationale or list of planned works that constitute 'unavoidable works'; and response strategies best suited to mitigation of the impacts of those unavoidable works, consistent with EPA Publication 1254 – *Noise Control Guidelines*. An independent auditor should be appointed and prior approval must be obtained from the independent auditor for planned unavoidable work to be undertaken (except for emergency works to avoid the loss of life or damage to property, or to prevent environmental harm).

NV3

Traffic noise verification

Traffic noise must be measured between 6 to 12 months after opening of the project, in accordance with the VicRoads *Traffic Noise Measurement Requirements for Acoustic Consultants – September 2011*, to verify conformance with the external traffic noise performance requirements set out in EPR NV1. Remedial action must be completed by Final Completion (at the completion of the Defects Liability Period) if the performance requirements set out in EPR NV1 are not met.

NV4

Construction noise targets

Sensitive areas (non-residential)

For sensitive land uses (based on AS/NZS 2107:2016³) implement management actions if construction noise is predicted to or does exceed the internal and external noise levels below, and a noise sensitive receptor is adversely impacted.

If construction exceeds the noise levels below:

- Consider the duration of construction noise
- Consider the existing ambient noise levels
- Consult with the owner or operator of the noise sensitive receptor
- Consider any specific acoustic requirements of land uses listed below.

Land Use	Construction noise management level, L_{Aeq} (15 min) (applies when properties are in use)
Classrooms in schools and other educational institutions	Internal noise level 45 dB
Places of worship	Internal noise level 45 dB
Active recreation areas characterised by sporting activities and activities which generate their own noise, making them less sensitive to external noise intrusion	External noise level 65 dB

³ AS/NZS 2107:2016 *Recommended design sound levels and reverberation times for building interiors* (AS2107)

Passive recreation areas characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion, for example reading, meditation	External noise level 60 dB
Community centres	Depends on the intended use of the centre. Refer to the recommended "maximum" internal levels in AS/NZS 2107:2016 for specific uses.
Industrial premises	External noise level 75 dB
Offices, retail outlets	External noise level 70 dB
Other noise sensitive land uses as identified in AS/NZS 2107:2016	Refer to the noise levels in AS/NZS 2107:2016 for specific uses

Sensitive areas (Residential)

For residential dwellings, implement management actions if construction noise is predicted to or does exceed the noise targets in EPA Victoria Publication 1254 or the daytime management levels specified for noise at residences during recommended standard hours in Part 4.1.1 of the NSW *Interim Construction Noise Guidelines* (ICNG) with the hours amended to correspond to the EPA Victoria Publication 1254 hours as shown in the table below.

Time of Day	Construction noise management level, $L_{Aeq, 15 \text{ min}}$ (applies when properties are in use)
7 am-6 pm Monday to Friday	Noise affected ¹
7 am-1 pm Saturday	Background $L_{A90} + 10 \text{ dB}$ Highly noise affected ² 75 dB
6 pm-10 pm Monday to Friday 1 pm-10 pm Saturday	Noise level at any residential premises not to exceed background noise by:
7 am-10 pm Sunday and public holidays	10 dB or more for up to 18 months 5 dB or more after 18 months
10 pm-7 am Monday to Sunday	Noise inaudible within a habitable room of any residential premises

Notes

1. The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured $L_{Aeq, 15 \text{ min}}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. The proponent should inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.

2. The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account:

- Times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences)
- Whether the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.

NV5
Construction vibration targets (human comfort)

Implement management actions if the following guideline target levels or continuous vibration from construction activity to protect human comfort of occupied buildings (including heritage buildings) are not achieved (levels are calculated from the British Standard BS6472-1:2008).

Type of space occupancy	Vibration Dose Value VDV ($m/s^{1.75}$)			
	Day (7am to 10 pm)		Night (10pm to 7am)	
	Preferred value	Maximum	Preferred value	Maximum
Residential	0.2	0.4	0.1	0.2
Offices, schools, educational institutions, place of worship	0.4	0.8	0.4	0.8
Workshops	0.8	1.6	0.8	1.6

Notes

1. The Guideline Targets are non-mandatory; they are goals that should be sought to be achieved through the application of practicable mitigation measures. If exceeded then management actions would be required
2. The VDV's may be converted to Peak Particle Velocities (PPVs) within a noise and vibration construction management plan.

NV6 Construction vibration targets (cosmetic damage)

Construction vibration targets for structures are summarised in the tables below.

Guideline values for the vibration velocity to be used when evaluating the effects of short-term vibration on structures, mm/s

Type of structure	Vibration at the foundation at a frequency of			Vibration at horizontal plane of highest floor (Hz)
	1 to 10 Hz	10 to 50 Hz	50 to 100 Hz *	
1. Buildings used for commercial purposes, industrial buildings, and buildings of similar design	20	20 to 40	40 to 50	40
2. Dwellings and buildings of similar design and/or occupancy	5	5 to 15	15 to 20	15
3. Structures that, because of their particular sensitivity to vibration, cannot be classified under lines 1 and 2 and are of intrinsic value (eg. Heritage buildings)	3	3 to 8	8 to 10	8

* At frequencies > 100 Hz, the values given in this column may be used as a minimum.

Notes:

1. Vibration levels marginally exceeding those vibration levels in the table would not necessarily mean that damage would occur and further investigation would be required to determine if higher vibration levels can be accommodated without risk of damage.
 2. For civil engineering structures (e.g. with reinforced concrete constructions used as abutments or foundation pads) the values for Type 1 buildings may be increased by a factor of 2
 3. Short-term vibration is defined as vibration which does not occur often enough to cause structural fatigue and which does not produce resonance in the structure being evaluated.
-

Guideline values for the vibration velocity to be used when evaluating the effects of long-term vibration on structures, mm/s

Type of structure	Vibration at horizontal plane of highest floor (Hz)
1. Buildings used for commercial purposes, industrial buildings, and buildings of similar design	10
2. Dwellings and buildings of similar design and/or occupancy	5
3. Structures that, because of their particular sensitivity to vibration, cannot be classified under lines 1 and 2 and are of intrinsic value (eg. Heritage buildings)	2.5

Notes:

1. Vibration levels marginally exceeding those in the table would not necessarily mean that damage would occur and further investigation would be required to determine if higher vibration levels can be accommodated without risk of damage
2. Targets in the above table may need to be adjusted where deemed necessary and/or appropriate to protect the structural integrity of structures based on a pre-construction condition survey and/or modelling
3. Long-term vibration relates to events that may result in a resonant structural response.

Implement management actions if, due to construction activity, the DIN 4150.3 Guideline Targets for structural damage to buildings (for short-term vibration or long-term vibration) are not achieved.

NV7 Ground-borne construction noise targets (internal)

Implement management actions as determined in consultation with potentially affected land owners to protect amenity at residences where the following ground borne noise guideline targets are exceeded during construction.

Time of Day	Internal noise level measured at the centre of the most affected habitable room, $L_{Aeq, 15 \text{ min}}$
Evening (6pm to 10pm)	40 dB
Night (10pm – 6am)	35 dB

Notes

1. Levels are only applicable when ground borne noise levels are higher than airborne noise levels.
 2. Management actions include community consultation to determine acceptable level of disruption and provision of respite accommodation in some circumstances.
-

NV8 Utility asset protection

Prior to construction undertake condition assessments of above and below ground utility assets and establish construction vibration limits in consultation with asset owners to maintain asset integrity. Where construction vibration limits are not agreed with the asset owner, the guideline values in the table below apply.

Pipe Material	Guideline values for velocity measured on the pipe
Steel (including welded pipes)	100 mm/s
Clay, concrete, reinforced concrete, pre-stressed concrete, metal (with or without flanges)	80 mm/s
Masonry, plastic	50 mm/s

Notes

1. These values may be reduced by 50% when evaluating the effects of long-term vibration on buried pipework
2. It is assumed pipes have been manufactured and laid using current technology.

Monitor vibration levels during construction to demonstrate compliance with agreed vibration limits. Identify contingency measures to be implemented if limits are not met. Where necessary rectify any defects that are attributable to the Project.

7.0 SUMMARY

- 7.1 In May 2018, the Victorian Government announced its intentions to build the Mordialloc Bypass to link the Mornington Peninsula Freeway at Springvale Road to the Dingley Bypass in Dingley Village.
- 7.2 Major Roads Projects Authority propose a new 9 km road linking the Mornington Peninsula Freeway with the Dingley Bypass. The Environment Effects Statement (EES) for the proposed new road includes a chapter on the Noise and Vibration Effects (Chapter 12) of the proposed road as well as a chapter on Biodiversity (Chapter 10) which includes a section on the effects of traffic noise on biodiversity.
- 7.3 The proposed road is to:
- consist of two, dual lane 7.5 km long carriageways with scope for future upgrade to 3 lanes each. The project will also require 2.2 km of roadworks to integrate the proposed road with the existing Mornington Peninsula Freeway
 - be constructed predominantly within the existing road reservation
 - pass to the west of residences between Centre Dandenong Road and Lower Dandenong Road
 - pass to the west of Braeside Park, the east of Woodlands Estate Reserve and traverse the wetlands at Waterways.
- 7.4 I have reviewed the public submissions relating to acoustics and found that the most common concerns are related to operational and construction noise, noise barrier design and noise to parkland and wetland areas.
- 7.5 I have conducted a review of the noise and vibration aspects of the EES and found that the proposed EPRs relating to noise and vibration are not adequate to control construction and operation noise.
- 7.6 Accordingly, I have provided recommendations for revised and new EPRs to control operational and construction noise from the Mordialloc Bypass (refer to Section 6.0).

8.0 DECLARATION

- 8.1 I have made all the inquiries that I believe are desirable and appropriate and confirm that no matters of significance, which I regard as relevant, have to my knowledge been withheld from the Tribunal.



Ross Leo
Director

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APPENDIX A CURRICULUM VITAE

	<p>Bachelor of Science (Applied Physics), Royal Melbourne Institute of Technology</p> <p>Member of the Australian Acoustical Society, (MAAS)</p>
	<p>Ross has worked as an acoustic consultant since 2001. Ross specialises in planning and environmental noise and has extensive experience as an expert witness at the Victorian Civil and Administrative Tribunal and Planning Panels. In the last 18 years, Ross has developed a broad range of project experience includes wind farm and power generation developments, major infrastructure projects, planning policy development and theatre and concert hall design.</p>
	<p>Director, Clarity Acoustics, Kew, VIC 2017 - present</p> <p>Associate, Marshall Day Acoustics, Collingwood, VIC 2012-2017</p> <p>Middle East Manager, Marshall Day Acoustics, Bahrain 2009-2012</p> <p>NSW Manager, Marshall Day Acoustics, Sydney, NSW` 2007-2009</p> <p>Senior Consultant, Marshall Day Acoustics, Sydney, NSW 2004-2007</p> <p>Consultant, Marshall Day Acoustics, Collingwood, VIC 2001-2004</p>
	<p><u>Relevant experience</u></p> <ul style="list-style-type: none"> • Melbourne Metro Rail Project – IAC Hearing • East West Link – Noise and Vibration Assessment • Collingwood Arts Precinct – Government Land Standing Advisory Committee Hearing • Collingwood Arts Precinct – Special Use Zone Planning Panel • Newcombe Sand and Soil – Noise Assessment • Thornhill Estate – Rail Noise assessment • Epping Chatswood Rail Line – In car noise dispute mediation.

APPENDIX B GLOSSARY OF TERMINOLOGY

dB	Decibel (dB) a relative unit of measurement widely used in acoustics, electronics and communications. The dB is a logarithmic unit used to describe a ratio between the measured sound level and a reference or threshold level of 0 dB.
A-weighting	The A-weighting filter covers the full audio range - 20 Hz to 20 kHz and the shape is similar to the response of the human ear at lower levels.
$L_{A90}(t)$	The sound level exceeded for 90 % of the measurement period, A-weighted and averaged over time (t) and commonly referred to as the background sound level.
$L_{Aeq}(t)$	A-weighted equivalent continuous sound Level is the sound level equivalent to the total sound energy over a given period of time (t). Commonly referred to the average sound level.
$L_{A10}(t)$	The sound level exceeded for 10 % of the measurement period, A-weighted and averaged over time (t) and commonly referred to as the average maximum sound level.
PPV	The maximum instantaneous velocity of a particle at a point during a given interval
VDV	The cumulative measurement of vibration over a period