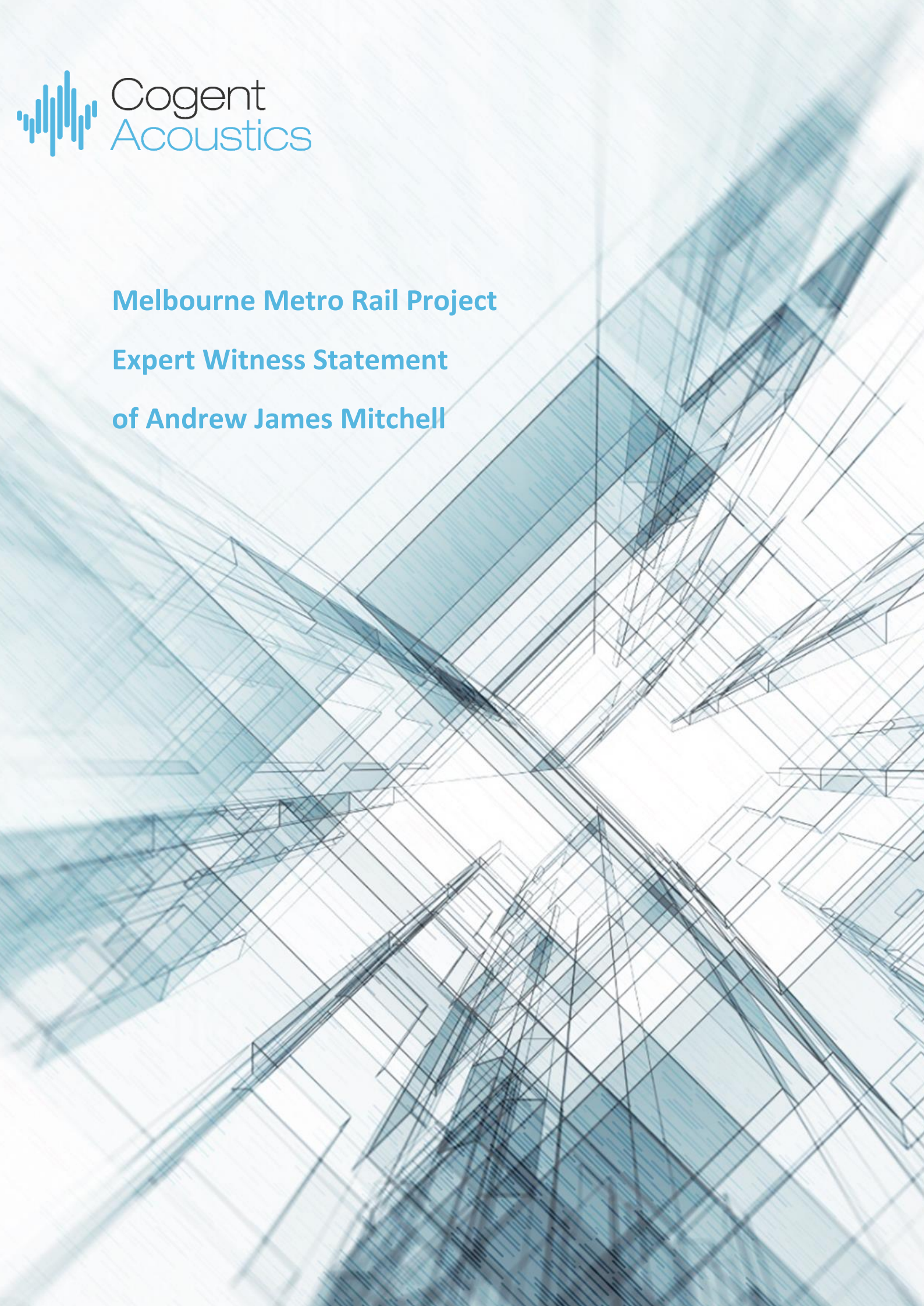
Cogent Acoustics

Melbourne Metro Rail Project

Expert Witness Statement

of Andrew James Mitchell



Melbourne Metro Rail Project

Expert Witness Statement of Andrew James Mitchell

Prepared for:

Melbourne Grammar School
355 St Kilda Road
Melbourne VIC 3004

Prepared by:

Cogent Acoustics Pty Ltd
ABN: 13 610 344 986
11/27 Thornton Crescent,
Mitcham VIC 3132
03 9874 1371

Project Number: 16097

Prepared by

Andrew Mitchell
BE(Hons) Mech, ME
MAAS MASNZ
andrew@cogentacoustics.com.au

Signature

Reviewed by

David Stepanavicius
Dip. Audio Production
Grad Dip. Architectural Science (Audio and Acoustics)
david@cogentacoustics.com.au

Signature

Revision History

Rev.	Date	Purpose	Prepared by:	Reviewed by:
0	09/08/2016	Draft	Andrew Mitchell	David Stepanavicius
1	10/08/2016	For Issue	Andrew Mitchell	David Stepanavicius

Contents

1. Introduction

Name and Address

1.1 My name is Andrew James Mitchell. I am a Director of Cogent Acoustics at 11/27 Thornton Crescent, Mitcham, VIC 3132.

Area of Expertise

1.2 My area of expertise is acoustic engineering.

Qualifications and Experience

1.3 My academic qualifications include a Bachelor of Engineering with Honours (Mechanical) from the University of Canterbury, and a Master of Engineering degree in which I specialised in wind turbine noise. I am a Member of the Australian Acoustical Society and am currently the secretary for the Victoria division.

1.4 I have 12 years of professional experience working in the field of acoustics, noise, and vibration. A brief CV is attached in Appendix A.

Expertise to Make this Statement

1.5 I have been involved in environmental noise and vibration impact assessments, construction noise and vibration monitoring, and operational noise and vibration monitoring, for major projects including road, rail, and port, power generation and distribution, wind farms, residential developments, landfill, mining and quarries. Some of my relevant experience includes:

a) Metro Area Express (MAX) Light Rail, Perth – Undertook noise and vibration modelling and prepared an Environmental Impact Assessment relating to noise and vibration from the proposed 20 km light rail system.

b) Eastlink, Melbourne – Performed construction noise and vibration monitoring and assisted the contractor in management of construction noise and vibration during construction of the 42 km road and two 1.6 km tunnels.

c) Regional Rail Link, Melbourne – Performed construction vibration monitoring at vibration sensitive locations during construction of the City to Maribyrnong section.

d) Wellington Tunnels Duplication Study, NZ – Conducted investigations into potential noise and vibration impacts of proposed options and construction methodologies for a second State Highway tunnel through Mt Victoria, Wellington, NZ.

e) Singapore North South Expressway – Provided advice, checking, and verification in relation to noise and vibration studies performed as part of the Environmental Impact Assessment for a proposed 21 km roadway on a mainly underground route.

f) Bayswater Road and Boronia Road Level Crossing Removals, Melbourne – Prepared an environmental noise and vibration assessment of the construction and operational impacts of the proposed level crossing removals.

Instructions which Defined the Scope of this Statement

1.6 I have been instructed by Best Hooper Lawyers on behalf of Melbourne Grammar School (MGS) to review the noise and vibration impacts of the Melbourne Metro Rail Project on the MGS campus located at the corner of Domain and St Kilda Roads. In particular, I have been instructed to assess to the extent possible:

a) Whether the potential magnitude, likelihood and significance of adverse and beneficial environment effects of the Project on the MGS campus have been identified correctly and appropriately in the Environmental Effects Statement (EES).

b) What, if any, modifications to the Project and/or environmental management measures proposed in the EES are needed to address likely adverse effects or environmental risks.

c) Whether there are likely benefits of the Project for MGS and the significance of any such benefits relative to any adverse effects and environmental risks.

d) Whether any mitigation measures or performance requirements contained in the EES need to be modified or added to identify the environmental effects on MGS.

e) Whether the proposed environmental management framework for the works is adequate or appropriate.

f) Whether there are practical engineering options to limit the extent of the proposed Design and Development Overlay impact on the MGS campus.

Documents and Information Taken into Account

1.7 A list of the documents and information that I have taken into account in preparing this statement is presented in Appendix B.

2. Review of EES in Respect of Noise and Vibration Effects on MGS Campus

Types of Noise and Vibration Impact

2.1 The EES has considered the potential noise and vibration impacts from the Project broadly in terms of the following categories:

a) Construction Noise – Airborne Noise

b) Construction Noise – Ground-borne Noise

c) Construction Vibration

d) Operational Noise – Airborne Noise due to Trains

e) Operational Noise – Airborne Noise due to Fixed Infrastructure

f) Operational Noise – Ground-borne Noise

g) Operational Vibration

2.2 I consider that the above categories appropriately capture the types of noise and vibration impacts that could potentially arise from the project. My comments in relation to the findings of the EES for each of these categories, as they pertain to MGS, are presented in the following subsections.

Construction Noise – Airborne Noise

2.3 The risk assessment and airborne construction noise predictions presented in the EES indicate that the MGS buildings potentially most affected by airborne construction noise would be The Lodge and the Wadhurst buildings adjacent to St Kilda Road. These buildings contain noise and vibration sensitive uses including junior school classrooms, a music room, and offices.

2.4 The EES predicts unmitigated construction noise levels in excess of 75 dB(A) outside the above buildings during works associated with construction of the Domain Station. This phase of the works is indicated to be approximately two and half years in duration. After the initial construction works, the EES indicates that acoustic construction sheds would be constructed prior to preparation and launch of the tunnel boring machine (TBM), and the acoustic construction sheds would significantly reduce airborne construction noise impacts thereafter.

2.5 It should be noted that the modelling represents a static snapshot of the construction noise based on anticipated construction operations and equipment locations. It is likely that actual construction noise levels would vary during construction and could at times be higher or lower depending on the equipment operating and its location with respect to the MGS campus.

2.6 There is a wide body of research into the effects of noise in schools, which has found that the general effects of prolonged exposure to high levels of noise can include deficits in sustained attention and visual attention, poorer auditory discrimination and speech perception, difficulty with tasks that require higher levels of concentration.

2.7 Australian Standard AS/NZS 2107:2000 (Standards Australia, 2000) recommends internal ambient noise levels of 35 to 45 dB(A) inside primary and secondary school classrooms. Further to this, the NSW Interim Construction Noise Guideline (ICNG) (DECC, 2009), which has been referred to in the EES for ground-borne construction noise criteria, also recommends maximum internal noise levels for classrooms of 45 dB(A).

2.8 Ambient noise levels above those recommended by AS/NZS 2107:2000 and the INCG would be likely to critically affect speech intelligibility and adversely affect learning activities.

2.9 Noting the long term nature of construction associated with the Project, I consider that sustained or frequent exceedance of the internal noise levels recommended by AS/NZS 2107:2000 and the INCG would have an unacceptable impact on the operation of MGS.

2.10 Based on the predicted external construction noise levels, it is my opinion that the internal noise levels recommended by AS/NZS 2107:2000 and the INCG could potentially be exceeded.

2.11 No investigations have been undertaken in the EES to assess the noise reduction that is provided from outside to inside the MGS buildings. I consider that such investigations are necessary in order to develop adequate mitigation measures to protect MGS from detrimental effects due to airborne construction noise.

Construction Noise – Ground-borne Noise

2.12 The EES identifies ground-borne noise due to tunnelling in the Domain Precinct and excavation of the Domain Station as a generally low risk. However, the EES does not assess ground-borne noise levels at the MGS campus, and only provides ground-borne noise predictions for the night period at residential locations in the vicinity. MGS would be most sensitive to ground-borne noise from the Project during the daytime when classes are in progress.

2.13 The EES indicates that the ground-borne noise levels are likely to exceed the assessment criteria and trigger management actions at the residential buildings on St Kilda Road near to MGS, which would be a similar distance, or further from the works area and tunnelling than the closest MGS buildings. The information contained in the EES suggests that the expected duration of exceedance would be up to 9 days on two occasions during tunnelling.

2.14 I consider that the sensitivity of the teaching facilities at MGS to ground-borne noise would be similar to that of residential premises. It is therefore my opinion that the likely ground-borne construction noise levels at MGS need to be determined and appropriate ground-borne construction noise criteria need to be prescribed.

Construction Vibration

2.15 The EES predicts that both the proposed structural vibration criteria and the preferred amenity criteria will be satisfied at the potentially most-affected MGS buildings without mitigation.

2.16 I generally agree with the criteria selected and the findings of the EES assessment. However, I would note that higher levels of construction vibration could be potentially be experienced for short periods during construction if plant and equipment is required to operate closer to the school than anticipated. I consider that the impacts of such occurrences would be temporary and relatively minor, however measures should be put in place to address vibration impacts to the school, in the event that this occurs.

2.17 I also note that MGS has a number of heritage buildings that may be affected by vibration. A condition assessment of these buildings has not been performed as part of the EES. I consider that a pre-construction condition assessment should be performed to confirm that the proposed vibration criteria are appropriate for these buildings.

Operational Noise – Airborne Noise due to Trains

2.18 The EES identifies airborne noise due to the operation of trains as a low risk for the project in the area of the MGS campus.

2.19 For the section of the project in the vicinity of the MGS campus, the trains are proposed to operate entirely in underground tunnels, and airborne noise emissions to the MGS facilities would be negligible. I therefore agree with the EES assessment, based on the current design.

Operational Noise – Airborne Noise due to Fixed Infrastructure

2.20 The potential sources of operational airborne noise due to fixed infrastructure that are identified by the EES are the ventilation structures associated with the Domain Station. The potential for noise from the public address (PA) system at the Domain Station is not mentioned in the EES, however, it is assumed that the PA system would be contained in the underground station and any noise impacts would therefore be negligible.

2.21 The proposed Domain ventilation structures are located adjacent to The Lodge at MGS (Reception, Development Office and Admissions), and to the north of the Domain Road / St Kilda Road intersection.

2.22 The EES has assessed noise emissions from the ventilation system in relation to State Environment Protection Policy (Control of Noise from Commerce, Industry and Trade) No. N-1 (SEPP N-1) (State of Victoria, 1989). The SEPP N-1 noise limits apply only to defined Noise Sensitive Areas, which in broad terms are dwellings and other places where people may sleep. Therefore, noise emissions to MGS are not directly assessed.

2.23 Provided that the ventilation structures are constructed at the locations depicted in the EES, and that the noise emitted from the ventilation structures complies with SEPP N-1 at the nearby residences, I consider that noise emitted from the ventilation structures will not adversely impact on MGS.

2.24 I consider that the mitigation measures cited in the EES to control airborne noise from fixed infrastructure to within the SEPP N-1 noise limits are reasonable and feasible.

Operational Noise – Ground-borne Noise

2.25 I consider that compliance with the ground-borne noise criteria used in the EES will adequately protect amenity within the MGS buildings from the effects of ground-borne noise.

2.26 The EES states that a 'very high attenuation' track form will be required in order to comply with the ground-borne noise criteria in the area of MGS. This would include measures such as vibration isolated rails and track slab / sleepers.

2.27 I agree with the findings of the operational ground-borne noise assessment and consider that the proposed mitigation measures are appropriate and feasible based on the current design.

Operational Vibration

2.28 The assessment presented in the EES predicts that the vibration criteria will be satisfied without mitigation for all MGS buildings.

2.29 I agree with this assessment, based on the current design.

3. Benefits of the Project for MGS

3.1 I do not anticipate the Project to result in any significant future benefits to MGS in terms of noise and vibration.

4. Effects and Risks to be Addressed

Construction Noise – Airborne Noise

4.1 The primary Environmental Performance Requirement (EPR) that has been proposed to mitigate and manage airborne construction noise impacts (EPR NV1) requires that construction work be undertaken in compliance with the EPA Noise Control Guidelines (EPA Victoria, 2008). The EPA Noise Control Guidelines do not specify noise limits for the day period, when construction noise would have most impact on MGS.

4.2 I consider that construction noise limits need to be specified for teaching spaces and other noise sensitive areas within MGS in order to ensure that appropriate construction noise mitigation measures are implemented to avoid adverse effects on the learning environment.

Construction Noise - Ground-borne Noise

4.3 The EPR relating to ground-borne construction noise (EPR NV11) does not provide any protection to MGS from the potential effects of ground borne construction noise, as it applies to residential dwellings only.

4.4 I consider that ground-borne construction noise limits need to be specified for teaching spaces and other noise sensitive areas within MGS in order to ensure that appropriate measures to mitigate the effects of ground-borne construction noise are implemented.

4.5 Additionally, the potential mitigation measures identified by the EES to reduce ground-borne construction noise impacts are limited, and primarily involve consultation and communication measures. In the event that ground-borne construction noise during school terms is likely to be unacceptable, it may be necessary, if possible, for classes to be temporarily relocated from affected buildings. I consider that this possibility needs to be accounted for in development of the environmental management plans for the Project, and therefore MGS should be involved in this process.

Construction Vibration

4.6 As previously noted a condition assessment of MGS heritage buildings has not been performed as part of the EES. I consider that a pre-construction condition assessment should be performed to confirm that the proposed vibration criteria are appropriate for these buildings.

4.7 Other than the above I consider that construction vibration effects and risks to MGS are adequately addressed by the proposed EPRs.

Operational Noise - Airborne Noise due to Trains

4.8 I consider that operational airborne noise effects and risks to MGS are adequately addressed by the proposed EPRs.

Operational Noise – Airborne Noise due to Fixed Infrastructure

4.9 There is a risk that the design could be altered and the ventilation structures or other fixed infrastructure could be built at a different location that would more significantly affect MGS. I consider that noise limits need to be specified in order to protect MGS from noise due to fixed infrastructure in the event of design changes.

4.10 I consider that an appropriate approach would be to apply the SEPP N-1 'Day' period noise limits at the façade of the MGS buildings.

4.11 No monitoring of background noise levels has been undertaken at MGS as part of the EES. Monitoring of the background noise levels at MGS will be required in order to determine appropriate noise limits.

Operational Noise – Ground-borne Noise

4.12 I consider that operational ground-borne noise effects to MGS will be adequately addressed by the proposed ground-borne noise criteria. However, the EPRs are worded such the criteria are non-mandatory targets. In order to provide adequate protection from operational ground-borne noise I consider that these criteria should be made mandatory.

Operational Vibration

4.13 I consider that operational vibration effects to MGS will be adequately addressed by the proposed vibration criteria. However, the EPRs are worded such that the criteria are non-mandatory targets. In order to provide adequate protection from operational vibration I consider that these criteria should be made mandatory.

5. Modifications to Mitigation Measures and Performance Requirements

5.1 I recommend the following modifications to the proposed mitigation measures and Environmental Performance Requirements in order to adequately protect MGS from the effects of noise and vibration associated with the Project:

a) The airborne construction noise limits recommended by the NSW INCG should be adopted for teaching spaces and office areas within MGS. Specifically, the following noise limits should be applied:

i. 45 dB(A) $L_{Aeq,15min}$ inside classrooms, teaching spaces and music rooms.

ii. 70 dB(A) $L_{Aeq,15min}$ outside offices.

b) A ground-borne construction noise limit of 40 dB(A) $L_{Aeq,15min}$ should be adopted for teaching spaces and office areas. This aligns with the evening period noise limit for ground-borne construction noise recommended by the NSW INCG.

c) Noise limits determined in accordance with SEPP N-1 'Day' period requirements should be applied at the façade of the MGS buildings.

d) The wording of EPR NV17 and NV18 should be strengthened to make the proposed target criteria for operational ground-borne noise and vibration mandatory.

e) The Project also should include requirements for:

i. Pre-construction background noise monitoring at MGS.

ii. A pre-construction condition / dilapidation survey of heritage buildings and potentially vibration sensitive structures at MGS.

iii. The likely ground-borne construction noise levels at MGS to be determined and appropriate mitigation measures to be implemented.

iv. Consultation with MGS in the development of construction noise and vibration mitigation and management measures.

6. Environmental Management Framework

6.1 I consider that the proposed Environmental Management Framework provides an adequate basis for the control of noise and vibration associated with the Project.

7. Proposed Design and Development Overlay

7.1 The proposed Design and Development Overlay includes an objective "to prevent construction methods or development that could generate unacceptable levels of vibration in the Melbourne Metro Infrastructure".

7.2 The technical basis on which the extent of the overlay has been determined is not clear from the EES documents. If vibration considerations are the key driving factor in the extent of the overlay, increasing the depth of the tunnels or realigning the tunnels further to the west could potentially limit the extent of the overlay impact on the MGS campus.

8. Declaration

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

Andrew Mitchell
Director, Cogent Acoustics Pty Ltd

Appendix A Curriculum Vitae

Andrew Mitchell
Director, Cogent Acoustics Pty Ltd

M: +61 488 221 951 E: andrew@cogentacoustics.com.au

Summary

Andrew has over 12 years of experience in acoustics and vibration, with project experience in Australia, New Zealand, Hong Kong, Singapore, USA and UAE.

He has been involved in projects covering a wide range of industry sectors including buildings, transportation, energy and manufacturing.

Andrew is the Victoria Division Secretary of the Australian Acoustical Society and is actively involved in the acoustics community.

He was awarded the 2008 Australian Acoustical Society Award for Excellence in Acoustics, as part of the acoustics team involved in the design and construction of the Monash University Centre for Electron Microscopy.

Professional Affiliations

- Member of the Australian Acoustical Society (MAAS)
- Member of the Acoustical Society of New Zealand (MASNZ)
- Member of the Victorian Planning and Environmental Law Association

Qualifications

- Bachelor of Engineering with Honours (Mechanical), University of Canterbury, 2002
- Master of Mechanical Engineering (Acoustics), University of Canterbury, 2004

Employment History

Jan 2016 – Present	Director, Cogent Acoustics
Jan 2015 – Jan 2016	Mechanical Engineer, Embelton, Melbourne Research and development of noise and vibration isolation products, noise and vibration isolation projects, selection of isolation products for customers.
Feb 2008 – May2012	Principal Acoustics Engineer, AECOM, Melbourne Worked as a consulting engineer conducting noise surveys, environmental noise assessments, building acoustics design and noise control work.
Feb 2008 – May2012	Senior Acoustics Engineer, AECOM, Christchurch NZ
June 2004 – Feb 2008	Acoustics Engineer, Bassett Acoustics, Melbourne

Appendix B Documents and Information Taken into Account

Documents and Information Taken into Account

1. AS 2436:2010 Guide to noise and vibration control on construction, demolition and maintenance sites
2. AS/NZS 2107:2000 Acoustics - Recommended Design Sound Levels and Reverberation Times for Building Interiors
3. Assessing Vibration: A Technical Guideline, February 2006, NSW Department of Environment and Conservation
4. BS 6472-1:2008 Guide to Evaluation of Human Exposure to Vibration in Buildings. Part 1: Vibration sources other than blasting
5. DIN 4150-3:1999 Structural Vibration Part 3: Effects of Vibration on Structures
6. EPA Publication 1254, Noise Control Guidelines, 2008
7. EPA Publication 480, Environmental Guidelines for Major Construction Sites, 1996
8. Melbourne Grammar School Senior School Campus Map
9. Melbourne Grammar School Wadhurst Campus Map
10. Melbourne Grammar School Wadhurst Parents Handbook 2016
11. Melbourne Metro Rail Project Environmental Effects Statement – Summary Report
12. Melbourne Metro Rail Project Environmental Effects Statement – Chapter 06 Project Description
13. Melbourne Metro Rail Project Environmental Effects Statement – Chapter 09 Land Use Planning
14. Melbourne Metro Rail Project Environmental Effects Statement – Chapter 13 Noise and Vibration
15. Melbourne Metro Rail Project Environmental Effects Statement – Chapter 23 Environmental Management Framework
16. Melbourne Metro Rail Project Environmental Effects Statement – Technical Appendix A – Planning Scheme Amendment and Associated Document
17. Melbourne Metro Rail Project Environmental Effects Statement –Technical Appendix B – Environmental Risk Register Report
18. Melbourne Metro Rail Project Environmental Effects Statement – Technical Appendix I – Noise and Vibration
19. NSW DECC Interim Construction Noise Guideline 2009

20. NSW Rail Infrastructure Noise Guideline, May 2014
21. Shield, B. M., & Dockrell, J. E. (2003). The Effects of Noise on Children at School: A Review. *Journal of Building Acoustics*, 10(2), 97-106
22. State Environment Protection Policy (Control of Noise from Commerce, Industry and Trade) No. N-1
23. Victorian Passenger Rail Infrastructure Noise Policy, April 2013

Site Visit

In the course of my investigations I visited the project area on Monday 27 June 2016.

Documents Cited

DECC. (2009). Interim Construction Noise Guideline. Sydney: Department of Environment and Climate Change NSW.

EPA Victoria. (2008). Noise Control Guidelines, Publication 1254. Melbourne.

Standards Australia. (2000, December). AS/NZS 2107:2000 Acoustics - Recommended Design Sound Levels and Reverberation Times for Building Interiors.

State of Victoria. (1989, June 15). State Environment Protection Policy (Control of Noise from Commerce, Industry and Trade) No. N-1. *Victoria Government Gazette No. S31 as varied No. G37, Gazette 23/9/1992 and No. S183, Gazette 31/10/2001*. Melbourne.