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MELBOURNE METRO ENVIRONMENT EFFECTS STATEMENT

Review and Opinion Regarding Noise and Vibration Aspects in Relation to the Buildings at 67 Swanston Street, Melbourne (Preliminary)

Prepared for:
Legend Properties Pty Ltd
C/-
Tisher Liner FC Law
Level 2, 333 Queen Street
Melbourne VIC 3000

Ref. 11909-1dkg.docx
12 August 2016



Witness Statement

Name:

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Address:

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Professional Qualifications:

Diploma Mechanical Engineering Swinburne 1970
Member of the Australian Acoustical Society
Firm Delegate Australian Association of Acoustical Consultants.

Professional Experience:

- Founding Director of Watson Moss Growcott Acoustics Pty Ltd 1978 – present.
- Ron Carr Consulting 1976 – 1978
- Carr Wilkinson Consulting 1973 – 1976
- Insulation Materials and Services 1969 - 1971

Relevant Experience:

- Noise Effects Assessments and associated Noise Control requirements
- Traffic noise measurement and calculation
- Noise Barrier Design
- Noise Propagation Modelling and Prediction for Trains, Traffic, Industry and Mining
- Ground Vibration Measurement from trains operating in underground tunnels and on surfaces.
- Analysis of ground induced train vibration and Noise.
- Develop of Specifications for building foundation vibration reducing systems to control train vibration induced into residential and commercial buildings.
- Mechanical equipment noise measurement and control
- Application of State Environment Protection Policy (Control of Noise from Commerce, Industry and Trade) No. N-1.

Expertise to Prepare this Report:

My training and experience over 43 years qualifies me to comment on the noise and vibration sources, assessments, and control issues arising from the proposal to extend the underground rail network under Melbourne and particularly adjacent to 67 Swanston Street, Melbourne.

Instructions which defined the scope of this report:

The writer was instructed by Mr Alan Goldstone of Tisher Liner FC Law on behalf of Legend Properties owners of the property at 67 Swanston Street, Melbourne.

The task was to review available Environment Effects Statement documents pertaining to noise and vibration effects and potential controls where deemed relevant in relation to the property at 67 Swanston Street.

The late commissioning and the quantum of material to be reviewed has necessitated that this report will be a preliminary report completed by 12th August 2016. The final report will be issued during the 19th August 2016.

Past Facts, Matters and Assumptions Relied Upon:



- Contents of Chapters 13 of the .April 2016 addition of the Melbourne Metro Rail Authority Environmental Effects Statement and the Appendix I and the associated sub appendices relating to Noise and Vibration.

Identity of Persons Undertaking the, reviews, analysis, and reporting.:

Douglas Growcott and Neville Goddard

We have made sufficient enquiries that we believe were desirable and appropriate, and no matters of significance, which I regard as relevant, have to my knowledge been withheld from the Panel.

DOUGLAS GROWCOTT
WATSON MOSS GROWCOTT
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1. INTRODUCTION

Written submissions forming the Environment Effects Statement (EES) for the Melbourne Metro Underground Rail Project dated April 2016 have been reviewed in regard to the potential Noise and Vibration during construction and operation impacts on the property described as 67 Swanston Street, Melbourne.

The current Environment Effects Statement dated 20th April 2016 has been prepared on the basis that the subject property would likely be sold to become part of the Project. Notations on maps of the area surrounding the subject site indicate the potential for the buildings to be converted or demolished to create an excavation to become an alternative entry for the new underground station to be known as CBD South.

On July 26 2016 the Melbourne Metro Rail Authority (MMRA) Technical Note 14 issued for the Project confirmed a decision not to pursue the purchasing of the Property at 67 Swanston Street.

As a consequence the MMRA will need to update the EES to reflect this change and the associated maps and noise and vibration modelling prediction outcomes that results from this decision.

The Project, in relation to the subject property, will include an underground station constructed within an excavation created on the eastern side of Swanston Street directly opposite the site.

The rail tunnel, which will be excavated from underground using a road header machine and not the Tunnel Boring Machine which will complete the tunnelling at most other locations will be aligned substantially down the centre of Swanston Street.

A construction period will be in the order of 4 years. During the early stages of the construction the construction works will occur in the open above the open square opposite the subject site. As the works proceed the station excavation and the construction process will be located within a custom built large enclosure designed to contain noise emissions.

The CBD South Station construction site will be a location where waste material excavated from underground tunnel and the station excavation will be transported off site by road going "spoil trucks". It is expected that typically 150 truck movements (to and from the site equals 2 x truck movements) will occur during a 24 hour construction cycle for substantial periods of the construction process. Up to 210 truck movements have been described as being necessary during peak times.

The EES has considered the following noise and vibration issues:

1. Airborne Construction and Operational Noise generated above the ground.
2. Ground borne Construction and Operational Noise radiated by building surfaces resulting from construction and operational processes which generate vibration which will be transferred into the ground and into foundations of nearby buildings.
3. Ground Borne Construction and Operational vibration transferred into buildings where the residual magnitude of vibration in nearby building will be sufficient to create feelable vibrations in the buildings as well as the possibility of creating superficial damage.

The EES document doesn't provide definitive design details or in detail management protocols to ensure that the project will minimize potential impacts.

The EES document sets design objectives and on occasions criteria for assessing the above effects.



2. NOISE AND VIBRATION ASSESSMENT TERMINOLOGY

The following terms are used in this report:

- dB(A) Decibels recorded on a sound level meter, which has had its frequency response modified electronically to an international standard, to quantify the average human loudness response to sounds of different character.
- L_{90} the level exceeded for 90% of the measurement period, which is representative of the typical lower levels in a varying noise environment. It is the noise measure defined by the EPA as the measure of the background noise level to use in determining noise limits.
- L_{10} the level exceeded for 10% of the measurement period. It is representative of the typical higher noise levels occurring on a repeatable basis. L_{10} in octave frequency bands is the measure of music noise to use in assessing compliance with SEPP N-2 noise limits during the night period.
- L_{eq} the equivalent continuous level that would have the same total acoustic energy over the measurement period as the actual varying noise level under consideration. It is the noise measure defined by the EPA as the measure of the noise to use in assessing compliance with noise limits.

In short, L_{90} is the measure of background noise (in the absence of intrusive commercial/industrial/trade/music noise) used in determining noise limits, and L_{eq} or L_{10} as relevant is the measure of commercial/industrial/trade/music noise used in assessing compliance with noise limits.

- VDV Vibration Dose Value a calculated number which has been developed to quantify the human response to vibrations of different magnitudes which continue for differing periods of time.
- Velocity Vibration expressed as the speed of ground or building surface movement and commonly used for ranking building or ground vibrations with regard to potential damage or human perception. Units millimetres per second (mm/s)
- Acceleration Vibration expressed as the acceleration of ground or building surface movement and commonly used for as a component for the ranking of building or ground vibrations with regard to potential damage or human perception. The main parameter used in the calculation of the VDV. Units millimetres per second squared (mm/s^2)

3. CONSTRUCTION STAGE: AIRBORNE NOISE

3.1 STANDARDS AND CRITERIA

The review has indicated that the adopted standards and criteria will generally be appropriate.

There is some concern in relation repeated references in the EES to the EPA 1254 Guidelines that allow for 'unavoidable works' to continue through the night if required without noise restrictions.

It is highly likely that what the EPA had in mind when they adopted this description was an occasional concrete pour that would continue overnight, not works continuing for weeks.



3.2 PREDICTION METHODOLOGY AND RESULTS

The review has indicated that the prediction methodology will be generally appropriate, which provides some confidence in the results.

However, some of the source noise data appear to be unrealistically low.

In the tabulation of source noise levels, the following items have been assigned sound power levels that in the experience of WMG Acoustics are approximately 10dB too low (twice as loud) :

- Material delivery trucks, listed with a sound power level of 95dB(A), in WMG's experience would typically be closer to 105dB(A) sound power level.
- Spoil trucks, listed with a sound power level of 91dB(A), in WMG's experience would typically be closer to 105dB(A) sound power level.
- Loaders/backhoe listed with a sound power level of 96dB(A), in WMG's experience would typically be closer to 105dB(A) sound power level.

With such a large number of truck movements per day in close proximity to 67 Swanston Street, under-stating the sound power level of each truck by something in the order of 10dB could have a significant impact on the re predicted construction noise levels outside 67 Swanston Street.

There has not been a good indication given of the duration per working day or in terms the number of days, weeks or months that the significant truck noise during critical times of building occupancy would occur.

3.3 MITIGATION AND ASSESSMENT OF IMPACT

It is considered that the full extent of truck noise impacts has not been acknowledged by the EES. A significant aspect of truck noise mitigation is source noise control, ensuring that trucks make no more noise than absolutely necessary in carrying out their tasks.

Despite the fact that the EES noise data for trucks understates the noise contribution of trucks, there is the potential for truck noise to be an even more significant issue than it need be if trucks are allowed to work on the project making more noise than necessary.

Two significant components of this are exhaust noise and reversing beepers. The following are recommended for adoption as part of a construction management plan:

- Trucks to be used to access the construction site for deliveries or removal of spoil must be fitted with broadband reverse alarms that vary their noise output.
- Contractors wishing to be part of the project must provide evidence that trucks to be used on the project comply with the EPA in-service noise requirements, with respect to exhaust noise.

The EES includes provision for additional mitigation measures under circumstances when significant construction noise impacts cannot reasonably and feasibly be controlled.

When reasonable and feasible mitigation measures do not achieve compliance with the construction Guideline Targets or when no limits apply then Additional Mitigation Measures may be appropriate to manage impact. There is no guidance in Victoria with respect to Additional Mitigation Measures, however guidance is provided in Construction Noise Strategy PE-ST-157/1.0 2011 prepared by the NSW Transport Construction Authority.

*The Additional Mitigation Measures include:
x Alternative accommodation (AA)*



- x Monitoring (M)*
- x Individual briefings (IB)*
- x Letter box drops (LB)*
- x Project specific respite offer (RO)*
- x Phone calls (PC)*
- x Specific notifications (SN)*

All of these 'additional mitigation measures' except Alternative Accommodation and Project Specific Respite Offers (whatever form that might actually take) are really no more than appropriate actions to take in conducting a project that could reasonably be expected to impact significantly on residents.

There are no described trigger levels in the EES which would determine when alternative accommodation maybe implemented. Trigger levels need to be described ideally using relatively simple velocity measuring instruments . This is a case where an independent arbiter could avoid unnecessary frustration on the part of the Contractor and those impacted.

4. CONSTRUCTION STAGE: GROUND BORNE NOISE AND VIBRATION

4.1 STANDARDS AND CRITERIA

The review has indicated that the adopted standards and criteria are generally appropriate.

4.2 PREDICTION METHODOLOGY AND RESULTS

Yet to be completed

4.3 MITIGATION AND ASSESSMENT OF IMPACT

Yet to be completed

5. OPERATIONAL STAGE: AIRBORNE RAIL NOISE

5.1 STANDARDS AND CRITERIA

The review has indicated that the adopted standards and criteria are generally appropriate.

5.2 PREDICTION METHODOLOGY AND RESULTS

Yet to be completed

5.3 MITIGATION AND ASSESSMENT OF IMPACT

6. OPERATIONAL STAGE: FIXED INFRASTRUCTURE AIRBORNE NOISE

6.1 STANDARDS AND CRITERIA

The review has indicated that the adopted standards and criteria are generally appropriate.

6.2 PREDICTION METHODOLOGY AND RESULTS

The EES acknowledges that equipment selections have not been made which would allow indicative noise control requirements to be defined, but anticipates that compliance with the use of conventional sound attenuation technology.

However, given that things such as ventilation systems are likely to be of significant magnitude it should be a priority sooner rather than later to do at least some preliminary equipment selections and sound power level determinations to work through the noise attenuation sufficiently to gain an appreciation of the magnitude of sound attenuation required, and the feasibility of incorporating this into the spatial allowances that have been made for the project.

6.3 MITIGATION AND ASSESSMENT OF IMPACT

Yet to be completed

7. OPERATIONAL STAGE: GROUND BORNE NOISE AND VIBRATION

7.1 STANDARDS AND CRITERIA

The review has indicated that the adopted standards and criteria are generally appropriate.

7.2 PREDICTION METHODOLOGY AND RESULTS

A thorough process of obtaining source data from the existing Melbourne Underground Rail Loop has been undertaken, with equally thorough investigations to enable estimation of vibration propagation through the ground and transmission into buildings, leading to estimates of likely vibration and ground borne noise at locations where they may be perceived by residents.

7.3 MITIGATION AND ASSESSMENT OF IMPACT

The EES has foreshadowed several likely forms of rail vibration reducing systems, in principle, including in the vicinity of 67 Swanston Street.

Based on the experience of the writer these predictions will be estimates based on science and art and it will be important as soon as possible to validate using prototype testing that the predictions will be valid. It will likely be impractical to provide vibration isolation upgrades if the predictions prove to underestimate the actual noise and vibration. Any predictions must make allowance for practical roughness conditions for both rail and train wheel surfaces.

Based on provided tunnel depth alignments it is expected that the foundations of the buildings on the site will be in the order of 25 metres from the base of the tunnels. Based on previous projects it would be expected that one of the track isolation systems proposed will provide sufficient control of ground transferred vibration to result in acceptable residual noise and vibration conditions in the buildings located on the subject site.

8. DISCUSSION

8.1 NOISE AND VIBRATION ARBITER

The EES has been written as an over view document. It doesn't profess to provide any detail design solutions for the exact way the construction and operations will proceed to achieve adequate control of the potential adverse noise and vibration effects from the development.

The EES documents describe various noise and vibration design objectives and criteria. There was mention for the need to develop noise and vibration management plans particularly during construction and then the final operational phase.

Accepting for the moment that the noise and vibration standards adopted are fair and reasonable there will continue to be pressure on the Contractor to build.

The attitude of the Contractor when responding to adverse noise and vibration impact complaints during the construction process, which will inevitably occur, will likely determine the tolerance of residents and retailers nearby to events which may at times exceed the adopted noise and vibration criteria.

The writer suggests that the Project should be encouraged to employ an independent noise and vibration arbitrator set up to respond to and resolve noise and vibration issues considered unreasonable by nearby residents and/or retailers during the construction process. This arbitrator should have some basic knowledge of noise and vibration issues but should be able to obtain professional assistance when deemed necessary.

8.2 SPOIL TRUCKS

A particular issue that may give rise to construction noise complaints which has currently not been addressed in any detail in the current EES noise sections relates to "spoil" truck movements.

The documents describe that spoil truck movements will occur for extended periods during the 24hour seven days per week construction cycle. At some stage during the construction process a noise controlled construction shed will be built above the CBD South Station Excavation.

It is envisaged that the empty trucks will arrive at the construction site, will enter the construction shed via sound lock entry, be loaded with spoil within the shed and then leave the site first onto the external construction site land then onto Swanston Street and then to other public roads beyond.

The EES correctly points out that the noise from the spoil trucks will not be assessed while on public roads using the procedures described in State Environment Protection Policy No. N-1 "*Control of Noise from Commerce, Industry and Trade*".

The documents describe 170 truck movements over 24hours at the CBD South site. This quantity of movements of 10-20 tonne spoil trucks on the road outside the hotel has the potential to disturb the occupants in rooms in the hotel facing Swanston Street particularly those occurring during evenings, night-time and early mornings.

In Appendix A of the ESS document the noise modelling allowance for the spoil trucks is described as having a sound power level of 91dB(A). This value would suggest a sound pressure level of 57dB(A) at 20metres and in the opinion of the writer to be half as loud as the values typically adopted by the writer's firm in similar assessments.



The writer believes this aspect needs to be considered as part of the potential adverse noise effects and also to consider the acceleration phase of leaving trucks, and airbrakes and the rattling of empty trucks arriving during late evenings , night-time and early mornings.

The movement of the truck outside of the acoustic shed must eliminate the likelihood of trucks having to reverse outside because of added aggravation to residents that can be caused by tonal reversing beepers, even a relatively low noise volumes.

If reversing cannot be avoided it should be compulsory for all trucks operating during evenings and night, at least, to be fitted with "broad band" frequency reversing beepers. It is envisaged that the spoil trucks will be owned by individual operators and practical protocols must be developed and implemented so that noisy truck not complying with an agreed maximum value will be excluded from spoil removal. .

8.3 VIBRATION QUANTITY DESCRIPTOR

The vibration guideline limit for assessing comfort for residents or retailers has been based on a complicated calculated term described as the "Vibration Dose Value"(VDV). This term has been developed to provide better correlation with human response to vibrations of different magnitudes and well as durations during any assessment period. In the opinion of the writer this parameter is a valid choice.

There are instruments that can measure the VDV value directly for a vibration event or events. However there are many more instruments that can measure the velocity of vibrations which could be readily available to experienced or semi experienced operators to enable them to at least rate the level of vibration being experienced on a feelability ranking scale before registering assessing a specific complaint.

Hence it is recommended that the guideline and criteria for assessing both construction and operational vibration adjoining the project work add to the criteria values adopted with approximately equivalent vibration Velocity values.

The Inquiry and Advisory Committee in their document Preliminary Matters and Further Information Item 7 Noise and Vibration questioned whether the Peak Particle Velocity measurement parameter for building vibration might not be a more appropriate value for rating and ranking vibration. The writer has no particular lean to either velocity or VDV values on a technical basis but accepts that direct velocity measurement values will likely be more practical on a day to day basis.

Yet to be completed

9. OVERVIEW

In the opinion of the writer the Noise and Vibration Sections for the EES for the Metro Rail Project have identified most of the significant noise and vibration sources.

The creators of the noise and vibration sections for the EES have adopted guidelines and criteria values for assessing and predicting the residual magnitudes of these phenomena on humans and at buildings have chosen from a variety of possible sources as there are few regulated values or techniques described in Victorian legislation.

There would be general agreement with engineers working in the field that the chosen sources for guidelines and criteria would be at least as valid as others that might have been chosen.

Since the issuing of the Environment Effects Statement the land at 67 Swanston Street it has been decided that the subject land will not be acquired for use as part of the project. As a consequence



some aspects of the noise and vibration investigations for the t site will need to be reassessed and updated predictions produced for further review.

In the opinion of the writer the EES has not addressed the potential disturbance to hotel patrons at 67 Swanston Street from the noise of spoil trucks arriving and leaving the CBD South Construction Site during late evenings, night-time and early mornings. Protocols for truck operating procedures and truck and driver selections need to be developed to minimize disturbance to nearby residents.

Yet to be completed

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