
Reference number:	DM1
Advice from:	Douglas A Munro
Date of response:	11 August 2017
This advice is in response to request:	<p>Provide an interim report to the IAC to be tabled at the commencement of the Hearing on 14 August 2017 which sets out, within your area of expertise:</p> <ol style="list-style-type: none">The matters required by the PPV Practice Note – Expert Evidence including all facts matters and assumptions upon which you have proceeded;The key issues, including whether the key issues you identified prior to the circulation of evidence have changed, and if so, how;Your expert view on the matters raised by paragraph 13(e)(i)-(iv) of the Terms of Reference in so far as they relate to the key issues you have identified;Any areas in which you consider that there is insufficient information, having regard to the current and proposed future stages of the project (eg detailed design); andRecommended changes to the approval documentation (if any). <p>Where referring to evidence, the EES or submissions please provide specific references.</p>

List of Abbreviations

IAC	Inquiry and Advisory Committee (for the West gate Tunnel Project)
EPA	Environment Protection Authority Victoria
CNVMP	Construction Noise and Vibration Management Plan
IREA	Independent Reviewer and Environmental Auditor
WGTP	West Gate Tunnel Project
EES	Environment Effects Statement
EPR	Environmental performance requirement

1 Response to Practice Note Information

(i) Name and address of the expert.

Douglas Munro

(ii) Expert's qualifications and experience.

Dip App Chem, Dip Chem Eng, MRACI, MIEAust, CPEng(ret)

(iii) The expert's area of expertise to make the report.

Previous employment with EPA including involvement with major road development EESs, the VicRoads Traffic Noise Reduction Policy, in-service vehicle noise compliance, and the national development of new vehicle noise standards.

Planning Panels Victoria role in noise assessment matters for several wind farms, a rezoning adjoining an airport, a major road project and a railway project.

(iv) Any other significant contributors to the report and where necessary outlining their expertise.

There were no other contributors.

(v) All instructions that define the scope of the report (original and supplementary and whether in writing or oral).

IAC request to prepare this report on noise and vibration issues as per letter of 29 June 2017.

(vi) The identity of the person who carried out any tests or experiments upon which the expert has relied on and the qualifications of that person.

None.

(vii) The facts, matters and all assumptions upon which the report proceeds.

The West Gate tunnel project EES, expert witness reports, submissions.

Email via Ms To to Ms Kate Partenio of 13 July 2017 requesting advice on location of any projected 2022 and 2031 traffic data. Reply on 14 July 2017 providing links to Technical Reports A and G.

(viii) Reference to those documents and other materials the expert has been instructed to consider or take into account in preparing his or her report, and the literature or other material used in making the report.

WGTP EES Main Report Volumes 1 to 4

WGTP EES Technical Report H, Noise and vibration (surface)

WGTP EES Technical Report I, Vibration and regenerated noise (tunnel)

WGTP EES Technical Report A, Transport Part 1

WGTP EES Technical Report G, Air Quality

WGTP EES Attachment V, Works Approval application.

WGTP EES Map book

VicRoads Traffic Noise Reduction Policy (2005)

AS/NZS 2107:2016 Acoustics – Recommended design sound levels and reverberation times for building interiors.

(ix) A summary of the opinion or opinions of the expert.

That construction noise, vibration, and regenerated noise impacts can be managed by adherence to objectives, care in exceeding those objectives and measures to review and audit any such exceedences.

For traffic noise I have expressed an opinion on a number of changes to that proposed which I believe lead to an improved outcome.

(x) A statement identifying any provisional opinions that are not fully researched for any reason (identifying the reason why such opinions have not been or cannot be fully researched).

I have not expressed an opinion on compliance assessment of ventilation system noise pending response to a question asked of the proponent.

(xi) A statement setting out any questions falling outside the expert's expertise, and whether the report is incomplete or inaccurate in any respect.

For construction noise, vibration, regenerated noise and traffic noise I have advised of the importance of community engagement as a vital part of managing these impacts. I have acknowledged that developing these is outside my area of expertise and have avoided further comment.

(xii) Declaration

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 IAC.

Douglas A Munro

11 August 2017

2 Further Information

(i) Question

Has the information that you previously requested in your letter dated 11 July 2017 been provided? (Noting that some responses are not due until the commencement of the Hearing).

(ii) Response

Not all.

(iii) Question

Please list any further requests for information that have arisen from your further review of the documents

(iv) Response

In the section on traffic noise I have asked for clarification of the proposed NVP1, particularly the definitions of freeways and local roads and the application of noise objectives to those.

3 Key Issues

(i) Question

Please list the issues that you consider to be the key issues arising from the proposed West Gate Tunnel project relevant to your expertise and falling within the scope of the IAC's Terms of Reference.

(ii) Response

The key issues fall under a number of headings viz.:

- construction noise;
- construction vibration both from surface works and tunnelling;
- regenerated noise from tunnelling;
- traffic noise from the operational project; and
- noise from the operational fixed facilities (tunnels ventilation) systems.

For those there is the need to have:

- quantitative objectives to protect amenity and, in the case of vibration, physical assets;
- systems for ensuring compliance;
- compliance auditing;
- for vibration, an asset condition survey procedure that assesses asset condition prior to, during if necessary, and after works with rectification of any construction vibration caused damage;
- community engagement including for construction works, effective communications protocols to provide information on expected impacts including extent, timing and duration;
- a performance reporting system; and
- a responsive contact and complaints system.

The key issues that I identify are:

- **for construction noise:**

- 1.(a) the adequacy of the numerical construction noise objectives to protect the amenity of noise sensitive receptors;
 - (b) the identification of classes of noise sensitive receptors and the location of those within the impact area of the project construction works;
 - (c) the intended compliance with those objectives vis-à-vis possible exceedances of those under some circumstances;
 - (d) decision making for assessing the justification of and approval for such exceedances;
 - (e) monitoring construction noise at appropriate sites to ensure compliance by managing works and to provide public information;
 - (f) noise management in the vicinity of the southern portals;
 - (g) noise from construction machinery and heavy vehicles; and
 - (h) any cumulative and aggregate noise impacts from construction works that might exceed the noise impact from one activity alone.
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- 2.(a) effective communication with construction noise impacted communities and councils on proposed works causing noise impacts including timing, duration and noise character;
 - (b) public reporting of summary construction noise measurements against objectives; and
 - (c) a responsive construction noise complaints system.

- **for construction vibration:**

- 3.(a) the adequacy of the numerical construction vibration objectives to protect amenity of vibration sensitive receptors;
- (b) the identification of classes of vibration sensitive receptors and the location of those within the impact area of the project construction works;
- (c) the uncertainty of the actual vibration levels that might result from some construction works, particularly tunnelling, and the uncertainty in the sensitivity of some assets to vibration;
- (d) compliance with those objectives vis-à-vis possible exceedances under some circumstances;

- (e) decision making with regard to managing the justification and characteristics of any such exceedances;
 - (f) vibration monitoring at appropriate sites to ensure compliance by managing those works and to provide public information;
 - (g) condition monitoring of assets that may be damaged by vibration;
 - (h) vibration management in the vicinity of the southern portals and the tunnels; and,
 - (i) any cumulative and aggregate vibration impacts from construction works that might exceed the vibration impact from one activity alone.
- 4.(a) effective communication with construction vibration affected communities and councils on proposed works causing vibration impacts including the timing, duration and likely level of expected vibration;
- (b) carrying out surveys of the condition of structures and assets , before, during and after works, and making good any damage reasonably attributed to construction vibration;
- (c) public reporting of summary construction vibration measurements against objectives; and
- (d) a responsive contact and complaints system for construction vibration.
- **for regenerated noise:**
 - 5.(a) the adequacy of the numerical construction regenerated noise objectives to protect the amenity of noise sensitive receptors;
 - (b) the identification of classes of regenerated noise sensitive receptors and the location of those within the impact area of the project construction works;
 - (c) the uncertainty of the actual regenerated noise levels that might result from some construction works, particularly tunnelling;
 - (d) possible exceedances of those objectives under some circumstances;
 - (e) decision making on responding to any such exceedances;
 - (f) monitoring regenerated noise at appropriate sites to assess compliance and to guide the works; and
 - (g) any cumulative and aggregate regenerated noise impacts from construction works that might exceed the noise impact from one activity alone.

- 6.(a) effective communication with regenerated noise impacted communities and councils on proposed works likely to cause regenerated noise impacts including timing, duration and likely level and character of the noise; and
 - (b) a responsive contact and complaints system for regenerated noise from project construction.
- **for operational traffic noise:**
 - 7.(a) the adequacy of the numerical objectives to protect amenity of noise sensitive receptors;
 - (b) the identification of classes of noise sensitive receptors adjacent to the project including active and passive recreation areas;
 - (c) traffic noise and development sites;
 - (d) traffic noise protection on local roads adjoining the project;
 - (e) off-reservation acoustic treatment of noise sensitive receptors.
 - 8.(a) compliance assessment following project commissioning;
 - (b) the role of the *design year (2031)* in continuing compliance;
 - (c) compliance with traffic noise objectives at the *design year (2031)* and beyond; and
 - (d) impulsive vehicle noise.
- 9.(a) effective communication with potential traffic noise affected communities and councils on traffic noise and mitigation measures;
 - (b) public reporting of summary traffic noise measurements against objectives; and
 - (c) a responsive traffic noise complaints system.
- **for operational fixed facility (tunnels ventilation) noise:**
 - 10.(a) assessment of ventilation system noise per WAA No. S0100269;
 - (b) compliance with SEPP N-1 State Environment Protection Policy (Control of Noise from Commerce, Industry and Trade); and,
 - (c) noise from other fixed facilities.

(iii) Question

In a document dated 18 July 2017, you identified a number of issues which you considered to be the key issues arising from the proposed West Gate Tunnel project relevant to your expertise and falling within the scope of the IAC's Terms of Reference.

If your list above differs from the list previously provided, please provide a brief explanation for the change.

(iv) Response

A number of the key issues have been varied to improve clarity.

For construction noise I have added an issue about identifying likely noise sensitive receptors because of that arising from some submissions. I have included noise from machinery and vehicles used for construction since that is an element of construction noise.

I have separated regenerated noise from vibration. Regenerated noise is caused by vibration, but it is noise.

I have developed *operational fixed facility (tunnels ventilation) noise* into a number of key issues.

For each of construction noise, vibration, regenerated noise and traffic noise I have added a sub-section on community engagement to identify the importance of that in complementing the technical controls. To add detail to that goes beyond my area of expertise. I expect that the IAC may include these noise and vibration effects in a comprehensive approach to community engagement. Noise and vibration expert witnesses may have experiences in community engagement on those matters that may benefit the IAC.

4 Construction noise

4.1 Construction noise objectives and their application

This sub-section responds to the key issues for construction noise identified in 3(ii) above and marked 1.(a) to (h).

(i) Question

Please include a brief summary of the key issues raised by submitters. If you refer to a particular submission please refer to the submission by number and not by the name of the submitter.

(ii) Response

Construction noise is presented in *Technical Report H, Noise and vibration (surface)* (AECOM). Witness statements have been provided by Mr Matthew Stead of Resonate Acoustics for the proponent, Mr Shane Elkin of SLR Consulting Australia Pty Ltd for Hobsons Bay City Council, and Mr Darren Tardio of Octave Acoustics for the City of Melbourne.

A number of submitters, including councils, raised concerns with construction noise and the impact that that might have on residential amenity, child care facilities, community centres and other noise sensitive uses. In a number of cases these concerns coalesced with possible substantial heavy vehicle construction traffic on local streets.

No submissions commented specifically on the adequacy or otherwise of the proposed construction noise objectives by suggesting alternatives. Some emphasised the need for limitations on night time works.

There was some indication of concern about the identification of noise sensitive receptors. Construction noise impacts at the Altona Memorial Park Chapel, knowledge industries/business incubators/creative industries (Docklands Cotton Mill), and recreational facilities were raised as issues.

The construction noise objectives are a compilation from various sources, specifically being drawn from the EPA guidelines, the NSW Interim Construction Noise Guidelines and appropriate Standards. These established protocols are applicable to major construction projects.

These objectives are premised on providing protection of amenity and avoidance of annoyance whilst being consistent with facilitating a major construction project, albeit with measures to reduce noise on what would otherwise be the case. They are not based on

inaudibility for all the time. Of particular importance is the provision to manage night-time noise to avoid sleep disruption.

Construction noise control will need to be implemented with regard to both the noise intensity of various activities and the proximity to noise sensitive receptors. Excavation for the construction of the access to the southern portals may require close attention because of the works in competent rock and the proximity to residential areas, particularly if blasting is required.

The proposed construction noise objectives are set out in EPRs at NVP4, and in NVP13 for blasting should that be required.

The identification of construction noise sensitive areas has been done by identification of those in the EPR at NVP4 by reference to applicable objectives for each category, and with somewhat less specificity at NVP13 for blasting.

Some variation has been suggested by submitters. The Altona Memorial Park Chapel seems to be afforded no particular consistent level of construction noise protection whilst NVP4 accords protection to educational institutions and places of worship. Business incubators/knowledge intensive industries/creative industries such as the Docklands Cotton Mill may warrant greater noise amenity than the traditional 'Industrial premises' of NVP4. Construction noise objectives for both active and passive recreation are included in NVP4.

The EES Technical Report H, in part, explicitly suggests intended compliance with the objectives. Elsewhere the text implicitly suggests the likelihood of some noise exceedances in some circumstances, which would be moderated through management decisions by various measures such as temporary noise barriers, selection of machinery and time of activity. It is acknowledged that strict compliance with the construction noise objectives may sometimes be neither feasible nor reasonable.

There is a need to ensure that decisions on exceedances are justified and that the conditions of those events are specified. In the absence of a position otherwise it seems that the EES position would have the contractor make those decisions. To ensure that any such decisions are well justified and will not have an unreasonably adverse effect it may be appropriate to have those decisions made by the IREA or EPA.

Numerical construction noise objectives require noise monitoring in affected areas with real time information to construction site managers. Such monitoring installations may be able to be relocated as construction works proceed. The IREA should have oversight of the construction noise monitoring program.

The EES acknowledges the need for construction machinery to be well maintained and operated. Measures could include exhaust muffler maintenance and broadband reversing beepers.

It is appropriate that road registered heavy vehicles accessing the construction sites also be encompassed by this requirement for maintenance and operation, including avoiding the use of engine compression brakes.

It may be appropriate for the IREA to audit this matter of minimal intrinsic noise from construction plant and vehicles.

Cumulative and aggregate vibration impacts may have to be considered, but that would depend on the proposed construction plan.

The detail on these issues needs to be developed in the CNVMP.

(iii) Question

Where your opinion(s) materially differ from the relevant circulated evidence statements, please briefly outline the difference and reasons for it.

(iv) Response

My opinions either do not materially differ from relevant circulated evidence statements or are not discussed in those statements.

(v) Question

Please discuss the magnitude, likelihood and significance of adverse and beneficial environmental effects.

(vi) Response

I am of the opinion that;

- there are no beneficial effects of construction noise for noise affected sites;
- the likelihood of some construction noise being evident in the community is high; but,
- with compliance with the objectives in the EPRs, strict limitations on any unavoidable works that might cause exceedances of those, independent oversight, and effective communication, the magnitude of adverse impacts on amenity and annoyance should be able to be effectively managed.

(vii) Question

Please address the adequacy of the proposed environmental management framework, including the proposed environmental performance requirements and environmental management measures contained in the EES, with reference to applicable legislation and policy.

(viii) Response

I am of the opinion that;

- having used recognised guidelines the construction noise objectives in NVP4 and NVP13 are appropriate for managing construction noise with the proviso that for ease of compliance enforcement setting external noise objectives may be better than using an internal noise objective (see first two classes in NVP4 part1) and subject to the matters hereafter;
- a construction noise objective should be considered for inclusion in NVP4 for the Altona Memorial Park Chapel commensurate with that for educational institutions and places of worship;
- a construction noise objective should be considered for inclusion in NVP4 for the Docklands Cotton Mill that recognises the nature of the industry at that site – 60dB(A) is suggested;
- the justification for exceedances of construction noise objectives and the conditions for those be subject to approval by the IREA or EPA, or IREA with advice from EPA;
- a construction noise monitoring system should be established to guide management of construction works;
- the IREA should have an overseeing role in that noise monitoring of construction works, possibly with advice from EPA;
- particular attention may have to be given to the excavation for the southern portals because of the competent rock, and specifically to the eastbound portal because of the proximity to residential areas;
- aggregate and cumulative construction noise impacts may need to be considered as the construction plan is developed;
- construction machinery intrinsic noise and noise from heavy vehicles serving the construction sites should be minimised and that could be audited by the IREA; and,
- these matters should be developed in a detailed CNVMP.

(ix) Question

Please address the adequacy of WAA No. S0100269, with reference to applicable legislation and policy.

(x) Response

N/A

(xi) Question

Please address the adequacy of the impact assessment and whether the proposed environmental performance requirements are capable of being met.

(xii) Response

I am of the opinion that the impact assessment adequately identifies receptors likely to be effected by construction noise other than those further ones that I have identified, nominates appropriate construction noise objectives, presents likely noise from construction activities, and proposes measures to control construction noise including temporary noise barriers, selection of machinery and times of operation. Further, real time construction noise monitoring is appropriate.

Construction noise will have to be managed to respect the highly developed urban environment in which the works are to be carried out.

In most circumstances I believe that the environmental performance requirements can be met. Meeting those will have to be a response to the construction program developed by the contractor. I have suggested a measure to minimise and deal with possible exceedances of those objectives involving independent review and audit.

(xiii) Question

Please address the question of feasible modifications to the design of the Project within or reasonably proximate to the project boundary that could offer demonstrably overall superior outcomes.

(xiv) Response

I am of the opinion that;

- construction of a major project such as this will create noise; and,

- changes to the project design within the project boundary would be unlikely to obviate the need for effective management of construction noise; but
- a clear role for the IREA as detailed before, and in conjunction with EPA where possible, is a feasible modification that offers the prospect of improved construction noise management and, possibly enhanced community confidence that construction noise is being limited to respect amenity.

4.2 Construction noise community engagement

This sub-section responds to the key issues for construction noise identified in 3(ii) above and marked 2.(a) to (c).

(i) Question

Please include a brief summary of the key issues raised by submitters. If you refer to a particular submission please refer to the submission by number and not by the name of the submitter.

(ii) Response

The provision of information to the community was not a major focus of individual submissions, but it was raised in council submissions.

Although construction noise is controlled through numerical objectives that are capable of being measured to assess compliance, the effective control of this impact goes beyond purely technical matters. The response to noise varies from person to person. Community information is an important aspect of managing noise.

This sub-section is to suggest the importance of communicating expected construction noise impacts including likely intensity, timing and duration, the reporting of construction noise from the recommended noise monitoring, and having an effective construction noise contact and complaints system.

I anticipate that a construction noise community information program will be part of an integrated environmental community engagement program, including construction vibration and regenerated noise. That may be considered by the IAC in EPR SP2 – Communications and Community Engagement Plan.

Development of this sub-topic is beyond my area of expertise.

(iii) Question

Where your opinion(s) materially differ from the relevant circulated evidence statements, please briefly outline the difference and reasons for it.

(iv) Response

N/A

(v) Question

Please discuss the magnitude, likelihood and significance of adverse and beneficial environmental effects.

(vi) Response

N/A

(vii) Question

Please address the adequacy of the proposed environmental management framework, including the proposed environmental performance requirements and environmental management measures contained in the EES, with reference to applicable legislation and policy.

(viii) Response

N/A

(ix) Question

Please address the adequacy of WAA No. S0100269, with reference to applicable legislation and policy.

(x) Response

N/A

(xi) Question

Please address the adequacy of the impact assessment and whether the proposed environmental performance requirements are capable of being met.

(xii) Response

I am of the opinion that the construction noise impact assessment does not itself sufficiently address the need for community engagement on construction noise, nor might it be expected to. I accept that that matter may be covered comprehensively elsewhere in the EES as part of an integrated communication, reporting, and contact and complaints system across all environmental impacts.

(xiii) Question

Please address the question of feasible modifications to the design of the Project within or reasonably proximate to the project boundary that could offer demonstrably overall superior outcomes.

(xiv) Response

N/A

5 Construction vibration

5.1 Vibration objectives and their application

This sub-section responds to the key issues for construction noise identified in 3(ii) above and marked 3.(a) to (i).

A number of aspects of construction noise and construction vibration are similar. This sub-section will largely report on areas of difference.

(i) Question

Please include a brief summary of the key issues raised by submitters. If you refer to a particular submission please refer to the submission by number and not by the name of the submitter.

(ii) Response

Construction vibration is presented in two technical reports viz. *Technical Report H, Noise and vibration (surface)* (AECOM), and *Technical Report I, Vibration and regenerated noise (tunnel)* (Heilig Partners). Witness statements have been provided by Mr Matthew Stead of Resonate Acoustics and by Dr John Heilig of Heilig Partners for the proponent, by Mr Shane Elkin of SLR Consulting Australia Pty Ltd for Hobsons Bay City Council, and Mr Darren Tardio of Octave Acoustics for the City of Melbourne.

Councils and some submitters commented specifically on vibration from construction activities.

No individual submissions commented specifically on the adequacy or otherwise of the proposed vibration objectives by suggesting alternatives.

The construction noise objectives are a compilation from a number of sources, especially standards documents. These established protocols are applicable to major construction projects. Their use is based on extensive experience.

These objectives are premised on providing protection of amenity, avoiding annoyance, and preventing damage to assets whilst being consistent with facilitating a major construction project. They are not based on an absence of detectable vibration at all times.

Vibration control will need to be implemented with regard to both the intensity of various vibration generating works, the proximity of sensitive receptors and the time of vibration

generating works. Excavation for the construction of the access to the southern portals may require close attention because of the works in competent rock and the proximity to residential areas, particularly if blasting is required.

The proposed vibration objectives are provided in the EPRs in NVP5, NVP6, NVP7, NVP9 and NVP12. It is noted that NVP6 is specifically about protecting human amenity, NVP7 about protecting the integrity of building structures, NVP9 about preventing damage to utility assets whether buried or above ground, and NVP12 about vibration from blasting.

It should be noted that lower vibration levels are needed to protect human amenity (awareness of vibration) than to prevent damage to buildings.

On the advice of Heilig Partners in response to a question the ambiguity in NVP6 of having two columns of objectives ('preferred' and 'maximum values') can be resolved by removing the *Preferred value* column and retaining the *Maximum value* one. Further, a note may need to be developed about the need to establish 'peak particle velocities' from the 'vibration dose values' of that NVP for managing vibration levels

The identification of categories of construction vibration sensitive receptors has been done by identification of them in EPR at NVP6, NVP7 and NVP9 by reference to applicable objectives, and in NVP12 with less discrimination.

The technical reports have identified an element of uncertainty in predicting vibration generation and hence impacts from construction works, particularly tunnelling, because of geological conditions. Further, some uncertainty has been expressed on the effects of vibration on some structures, particularly those of a heritage nature.

These issues suggest a need for detailed consideration in the CNVMP, and the development of adjustments to the objectives if needed during construction. It is suggested that the IREA has a review role in ensuring that any needed adjustments are made to protect amenity, structure and assets.

As with construction noise it appears that there may be some circumstances where there is justification for some excursion above the vibration objectives. The involvement of the IREA in ensuring that those decisions are appropriate is suggested

Vibration monitoring must be carried out to ensure compliance, manage the project and to provide public information. *Technical Report 1, Vibration and regenerated noise (tunnel)* (Heilig Partners) is clear on the importance of this and how it can be done. That approach might usefully be adopted across the project for vibration monitoring.

A distinct variation from the construction noise sub-section is the requirement for condition surveys of structures and assets before, during, and after vibration to assess any damage,

guide the works if damage becomes apparent, and to make good any damage that occurs. I understand that such surveys may also be required in areas such as close to the tunnel alignment if ground subsidence has to be considered (see EPR GMP3). This might best be addressed by detailed planning in the CNVMP and the involvement of the IREA in reviewing the plan and auditing its implementation.

In the case of utility assets I expect that many owners would be able to advise the proponent and contactor of acceptable vibration levels.

Evidence and inspection suggests that particular attention may have to be given to excavation for the southern portals where competent rock is expected to be encountered and sensitive residential sites are nearby. Blasting has been identified as a possibility to aid excavation there.

Cumulative and aggregate vibration impacts may have to be considered, but that would depend on the proposed construction plan. It should be developed in the CNVMP.

(iii) Question

Where your opinion(s) materially differ from the relevant circulated evidence statements, please briefly outline the difference and reasons for it.

(iv) Response

My opinions either do not materially differ from relevant circulated evidence statements.

(v) Question

Please discuss the magnitude, likelihood and significance of adverse and beneficial environmental effects.

(vi) Response

I am of the opinion that;

- there are no beneficial effects of construction vibration for sensitive sites;
- there is a likelihood of some people being aware of vibration; but,
- with compliance with the objectives, strict limitations on any justifiable and limited exceedances of those, independent oversight, experience with other similar projects,

and effective communication, the magnitude of adverse impacts on amenity and annoyance should be able to be managed; and,

- offering residents temporary alternative accommodation is a practice that has been used elsewhere.

(vii) Question

Please address the adequacy of the proposed environmental management framework, including the proposed environmental performance requirements and environmental management measures contained in the EES, with reference to applicable legislation and policy.

(viii) Response

I am of the opinion that;

- having used recognised standards the vibration objectives in NVP4, NVP5, NVP6, NVP7, NVP9 and NVP12 are appropriate for managing construction vibration;
- some adjustment should be made to NVP6 to have a single column for vibration targets and provision to translate the 'vibration dose values' to 'peak particle velocities';
- the justification for any exceedances of construction vibration objectives and the conditions for those be subject to review and audit by the IREA;
- as far as possible uncertainties in understanding likely vibration levels and effects on assets should be considered in the CNVMP development and adjusted with experience informed by monitoring and condition inspection;
- a vibration monitoring system should be established to guide management of construction works;
- the IREA should oversee that vibration monitoring of construction works;
- an asset condition survey must be carried out before, during, and after vibration generated construction works. That must consider structure integrity and utility assets. Any damage found to be construction vibration caused must be repaired;
- the IREA should have a review role in condition assessment and detailed plans must be part of the CNVMP;
- particular attention may need to be given to controlling vibration during construction of the tunnels given the proximity of the alignments to sensitive receptors, and at the excavations for the southern portals, particularly the eastbound portal, because of competent rock and proximity to residential areas;
- aggregate and cumulative vibration impacts may have to be considered; and,

- a detailed CNVMP should be developed for controlling vibration from construction, which must be modified from experience and as circumstances change.

(ix) Question

Please address the adequacy of WAA No. S0100269, with reference to applicable legislation and policy.

(x) Response

N/A

(xi) Question

Please address the adequacy of the impact assessment and whether the proposed environmental performance requirements are capable of being met.

(xii) Response

I am of the opinion that the impact assessment adequately identifies receptors likely to be effected by vibration, both for surface works and tunnelling, that vibration objectives are generally appropriate, that the assessment of vibration impacts is adequate given inevitable uncertainties, that asset condition surveys are acknowledged, and that generally measures are available to minimise vibration if needed. Further, the impact assessment recognises the detailed development needed in a flexible CNVMP.

The assessment responds to the need to manage vibration in the highly developed urban environment in which the works are to be carried out.

I believe that the environmental performance requirements can, in most circumstances, be met. Achieving that compliance will have to be a response to the detailed construction program developed by the contractor. I have suggested a measure to minimise and respond to possible exceedances of those objectives.

(xiii) Question

Please address the question of feasible modifications to the design of the Project within or reasonably proximate to the project boundary that could offer demonstrably overall superior outcomes.

I am of the opinion that;

- there will be vibration generated from the construction of a major project such as this;
- changes to the project design within the project boundary would be unlikely to obviate the need for effective management of vibration; and
- an identified role for the IREA offers the prospect of improved vibration management and, importantly, enhanced community confidence that vibration from the construction works is being limited to respect community amenity, structure integrity and assets to the extent reasonably possible.

5.2 Vibration community engagement

This sub-section responds to the key issues for construction noise identified in 3(ii) above and marked 4.(a) to (d). It is similar to sub-section 4.2 on *construction noise community engagement*.

(i) Question

Please include a brief summary of the key issues raised by submitters. If you refer to a particular submission please refer to the submission by number and not by the name of the submitter.

(ii) Response

Community engagement on vibration from construction works was not a particular focus of individual submissions.

However, *Technical Report 1, Vibration and regenerated noise (tunnel)* (Heilig Partners) and the witness statement of Dr John Heilig of Heilig Partners strongly advocates the importance of effective community engagement on vibration impacts from tunnelling.

Although vibration is controlled through numerical objectives and measurement to ensure compliance, the effective control of this impact goes beyond purely technical matters. Community engagement is an important complement to those technical issues.

This sub-section is to suggest the importance of public engagement by communicating likely vibration effects that might be expected including probable intensity, timing and duration; reporting of monitored vibration levels; advising of condition surveys of structures; and putting in place an effective contact and complaints system. That engagement needs to also include offers of temporary alternative accommodation for residents affected by vibration.

I anticipate that a vibration communication program will be part of an integrated environmental community engagement program, including construction noise and regenerated noise. That may be considered by the IAC, possibly in EPR SP2 – Communications and Community Engagement Plan.

Further development of this sub-topic is beyond my area of expertise.

(iii) Question

Where your opinion(s) materially differ from the relevant circulated evidence statements, please briefly outline the difference and reasons for it.

(iv) Response

N/A

(v) Question

Please discuss the magnitude, likelihood and significance of adverse and beneficial environmental effects.

(vi) Response

N/A

(vii) Question

Please address the adequacy of the proposed environmental management framework, including the proposed environmental performance requirements and environmental management measures contained in the EES, with reference to applicable legislation and policy.

(viii) Response

N/A

(ix) Question

Please address the adequacy of WAA No. S0100269, with reference to applicable legislation and policy.

(x) Response

N/A

(xi) Question

Please address the adequacy of the impact assessment and whether the proposed environmental performance requirements are capable of being met.

(xii) Response

I am of the opinion that the construction vibration impact assessment for surface work does not itself sufficiently address the need for community engagement; that on tunnelling does. I accept that that matter may be covered comprehensively elsewhere in the EES as part of an

integrated communication, reporting and contact and complaints system across all environmental impacts.

(xiii) Question

Please address the question of feasible modifications to the design of the Project within or reasonably proximate to the project boundary that could offer demonstrably overall superior outcomes.

(xiv) Response

N/A

6 Regenerated noise

6.1 Regenerated noise objectives and their application

This sub-section responds to the key issues for construction noise identified in 3(ii) above and marked 5.(a) to (g).

A number of aspects of regenerated noise overlap with construction noise and construction vibration. It is often considered along with tunnelling and the vibration from that activity; I have considered it as separate topic here.

(i) Question

Please include a brief summary of the key issues raised by submitters. If you refer to a particular submission please refer to the submission by number and not by the name of the submitter.

(ii) Response

Regenerated noise is presented in *Technical Report 1, Vibration and regenerated noise (tunnel)* (Heilig Partners). A witness statement has been provided by Dr John Heilig of Heilig Partners.

Regenerated (ground-borne) noise seems not to have been specifically raised by submitters; it may be embraced implicitly by submissions on construction noise and construction vibration.

Regenerated noise is noise generated within a structure, usually a dwelling, from vibration caused by tunnelling. Regenerated noise can accompany noticeable vibration, but can also be apparent when the vibration level is sufficiently low not to be noticeable. It is described as a rumbling noise. In his witness statement Mr Darren Tardio infers that regenerated noise may be an issue with the acoustics of Festival Hall, and that from surface vibration from construction works. Otherwise no material seems to have been provided suggesting causation from surface generated vibration.

The EPR is provided at NVP8.

The targets in NVP8 seem to have been drawn from the NSW Interim Construction Noise Guidelines (2009).

The sensitive receptors at which they apply are the residential areas, and other sensitive uses, above and immediately adjacent to the alignment of the tunnels.

The report acknowledges some uncertainty in predicting regenerated noise, because of uncertainty in predicting vibration with varying geological conditions and in the response of dwellings of varying constructions.

There appears to be limited scope for altering tunnel boring machine parameters to reduce regenerated noise.

Given the constraints of what is reasonable to be done through variations to construction practices and monitoring of those a response that had been used previously is to offer affected residents relocation for a short time, typically for several days.

It would seem appropriate for the IREA to review regenerated noise monitoring, resident responses to such noise, and decisions on offering temporary alternative accommodation.

The EES has indicated that where dwellings would be impacted by regenerated noise from the boring of the two tunnels the impact would not be coincident and hence the regenerated noise would not be cumulative. That seems to suggest that in some cases two periods of relocation may have to be offered

(iii) Question

Where your opinion(s) materially differ from the relevant circulated evidence statements, please briefly outline the difference and reasons for it.

(iv) Response

No material difference.

(v) Question

Please discuss the magnitude, likelihood and significance of adverse and beneficial environmental effects.

(vi) Response

I am of the opinion that;

- there is no beneficial effect of regenerated noise;
- there is likely to be an impact at a number of dwellings and other sensitive locations along and near the tunnels alignment, and in some cases, twice; and,
- the significance is likely to vary, depending not only on what changes might be made at source, but on dwelling construction and individual response.

(vii) Question

Please address the adequacy of the proposed environmental management framework, including the proposed environmental performance requirements and environmental management measures contained in the EES, with reference to applicable legislation and policy.

(viii) Response

I am of the opinion that;

- the objectives for regenerated noise in NVP8 are appropriate;
- some monitoring of regenerated noise should be carried out to guide any optimisation of tunnel boring that is reasonable. I note that such monitoring would seem to require monitoring in dwellings and this would require the approval of the owner/occupier;
- it should be noted that if reducing the advance of the tunnel boring assists in decreasing the level of regenerated noise the consequences include the effect on construction, but the possibility that a dwelling will experience regenerated noise at a lower level, but for a longer time;
- the IREA should have a role reviewing the response to regenerated noise;
- information on the possible generation from vibration arising from surface construction works might be sought; and,
- as far as is feasible the CNVMP should develop detailed requirements to minimise regenerated noise impacts and identify responses to levels of regenerated noise that effect amenity.

(ix) Question

Please address the adequacy of WAA No. S0100269, with reference to applicable legislation and policy.

(x) Response

N/A

(xi) Question

Please address the adequacy of the impact assessment and whether the proposed environmental performance requirements are capable of being met.

(xii) Response

I am of the opinion that the impact assessment identifies well the likely regenerated noise impacts, the location of receptors by mapped contours in *Technical Report 1, Vibration and regenerated noise (tunnel)*, and possible responses within the limitations articulated in the report.

The assessment responds to the need to manage regenerated noise in the highly developed urban environment in which the project works are to be carried out, notably tunnelling beneath a residential area.

I have some reservation about meeting the objectives in NVP8 at all relevant dwellings, a point acknowledged in the report and EPR NVP8, but I am satisfied that measures based on experience exist to respond to effects on amenity by offering residents short term alternative accommodation.

(xiii) Question

Please address the question of feasible modifications to the design of the Project within or reasonably proximate to the project boundary that could offer demonstrably overall superior outcomes.

(xiv) Response

I am of the opinion that there are no feasible or reasonable modifications to the project design that could make any material difference to regenerated noise impacts.

6.2 Regenerated noise community engagement

This sub-section responds to the key issues for regenerated noise identified in 3(ii) above and marked 6.(a) to (b). It is similar to sub-section 4.2 on *construction noise community engagement*.

(i) Question

Please include a brief summary of the key issues raised by submitters. If you refer to a particular submission please refer to the submission by number and not by the name of the submitter.

(ii) Response

Community engagement on regenerated noise from construction works seemed not to be an issue for submitters.

The *Technical Report 1, Vibration and regenerated noise (tunnel)* (Heilig Partners) and the witness statement of Dr John Heilig of Heilig Partners strongly advocates the importance of effective community engagement.

As described before numerical objectives for regenerated noise have been proposed in NVP8 but it is acknowledged that there may be circumstances where these trigger levels are exceeded with limited scope for compliance. That may result in offers to provide residents with short-term alternative accommodation, a measure that has been used elsewhere according to reports and evidence.

This sub-section is to suggest the need for effective public engagement of residents likely to be impacted. That might include communicating regenerated noise effects that could be expected including the likely intensity, timing and duration, and putting in place an effective contact and complaints system. Unlike public engagement for construction noise and vibration, in this case monitored noise data and responsive actions may not be able to be reported since this involves internal noise measurements in private dwellings rather than external measurements.

I anticipate that a regenerated noise communication program will be part of an integrated environmental community engagement program, including construction noise and construction vibration. That may be considered by the IAC, possibly in EPR SP2 – Communications and Community Engagement Plan.

Further development of this sub-topic is beyond my area of expertise.

(iii) Question

Where your opinion(s) materially differ from the relevant circulated evidence statements, please briefly outline the difference and reasons for it.

(iv) Response

N/A

(v) Question

Please discuss the magnitude, likelihood and significance of adverse and beneficial environmental effects.

(vi) Response

N/A

(vii) Question

Please address the adequacy of the proposed environmental management framework, including the proposed environmental performance requirements and environmental management measures contained in the EES, with reference to applicable legislation and policy.

(viii) Response

N/A

(ix) Question

Please address the adequacy of WAA No. S0100269, with reference to applicable legislation and policy.

(x) Response

N/A

(xi) Question

Please address the adequacy of the impact assessment and whether the proposed environmental performance requirements are capable of being met.

(xii) Response

I am of the opinion that the regenerated noise impact assessment addresses the need for community engagement well. I accept that that matter may be covered comprehensively elsewhere in the EES as part of an integrated communication, reporting and contact and complaints system across all environmental impacts.

(xiii) Question

Please address the question of feasible modifications to the design of the Project within or reasonably proximate to the project boundary that could offer demonstrably overall superior outcomes.

N/A

7 Traffic noise

7.1 Traffic noise objectives and their application

This sub-section responds to the key issues for construction noise identified in 3(ii) above and marked 7.(a) to (e).

(i) Question

Please include a brief summary of the key issues raised by submitters. If you refer to a particular submission please refer to the submission by number and not by the name of the submitter.

(ii) Response

Traffic noise is presented in *Technical Report H, Noise and vibration (surface)* (AECOM). Witness statements have been provided by Mr Matthew Stead of Resonate Acoustics for the proponent, Mr Shane Elkin of SLR Consulting Australia Pty Ltd for Hobsons Bay City Council, and Mr Darren Tardio of Octave Acoustics for the City of Melbourne.

Many submitters commented on traffic noise for the operational project.

A number, those adjoining the West Gate Freeway, noted the benefit of a lower traffic noise objective than that currently in place. Others, such as receptors in Footscray and West Melbourne commented on increased traffic noise. A substantial number, such as along Hyde Street, Williamstown Road, Millers Road and a number of streets in West and North Melbourne expressed concern about increased noise with additional traffic in those streets.

A subset specifically commented specifically on night-time noise.

Submissions included the effect of traffic noise on active and passive recreation areas and on the Docklands Cotton Mill creative industries facility.

Councils, notably those abutting the West Gate Freeway component, requested the proponent to provide noise barriers at development sites, Bradmill to the north and Precinct 51 to the south.

Regardless of interpretations of the *VicRoads Traffic Noise Reduction Policy (2005)* about the application, or otherwise, of the 63dB(A)L₁₀ traffic noise objective I believe that it is consistent with contemporary practice on other major road projects to apply that objective for the day time and evening to the roads defined as comprising this project.

However, it is my opinion that that objective should not be 63dB(A)L₁₀(18h) (6am to 12pm) as proposed for the project and used in the *VicRoads Traffic Noise Reduction Policy* for Category A noise sensitive receptors under specified circumstances. Rather, it is my opinion that that objective should be 63dB(A)L₁₀(15h) (7am to 10pm) and that day-time and evening objective should be complemented by an explicit night-time objective.

The current position seems to be premised on the position that, because of the typical diurnal traffic pattern, setting a traffic noise objective for the day and evening period is sufficient to ensure lesser traffic noise during the night.

In this case the project roads are being designed for heavy vehicle traffic (road gradients commensurate with heavy vehicle use, road curvatures); and a particular project objective is to provide road transport improvements to the Port of Melbourne which is a 24 hour operation, the largest container port in Australia, and with substantial envisaged growth.

The avoidance of sleep disturbance is among the aims that might be identified for traffic noise control; perhaps a primary aim. It would seem to be preferable to protect against sleep disturbance explicitly rather than implicitly. It is noted that two other noise EPRs, viz. those for construction noise and that for ventilation noise regulation (NVP4 part 2 and NVP10) both recognise a night-time noise restriction, and from 10pm to 7am.

A project-specific night-time traffic noise objective of 58dB(A)L_{10(9h)} (10pm to 7am) for VicRoads Category A receptors is suggested.

The 63dB(A)L_{10(12h)} (6am to 6pm) for Category B receptors would be retained.

The issue of traffic noise protection for active and passive recreation areas has been raised by submitters and in witness statements. The EES position is, in line with the VicRoads Policy, that protection is not proposed to be specifically provided. However, in some cases partial noise barrier coverage is provided, and some recreation areas benefit from noise barriers protecting residential amenity. Given the value of such recreation areas, given that the project plans to provide further open space adjoining the project corridor, and that substantial existing recreation areas abut the project I believe that providing some level of noise protection as a project-specific measure might be considered to enhance the amenity of this resource. However, I suggest that IAC consider the social and planning aspects of noise protection in this circumstance.

Should the IAC be inclined to recommend traffic noise protection for these recreation areas I suggest that they might be considered to be Vic Roads Category B receptors and the 63dB(A)L_{10(12h)} (6am to 6pm) noise objective would therefore be applied.

Previous discussion on construction noise has suggested that protection be provided to the Altona Memorial Park Chapel and knowledge industries/business incubators/creative industries (Docklands Cotton Mill). My view is that noise protection should also extend to traffic noise, and these too should be Category B receptors.

There may be technical (and visual) merit in providing noise barriers at development sites that are compatible with these proposed for the project, and barriers will most likely be needed if these sites are developed, as expected, for noise sensitive (residential) use. However, this is not a technical issue and is beyond my expertise. The responsibility for providing these noise barriers is best considered by the IAC as a planning matter.

A further aspect of the application of the traffic noise objectives is the height above ground level at which a noise sensitive receptor is impacted. The VicRoads Policy determines through the *VicRoads Traffic Noise Measurements for Acoustic Consultants - September 2011* that compliance is to be at the lowest habitable level; the EES follows that approach. This approach may have been suitable in the past; I consider that it is no longer appropriate. The proximity of multi-storey buildings with sensitive receptors adjacent to major roads and the construction of elevated carriageways have changed this approach.

I believe that the requirement for design and the measurement location for assessment should be either the *most traffic noise affected habitable level* or *all levels above the roadway*. The latter might be used for modelling to locate the region of likely greatest impact and measurement carried out at several adjoining levels to find that most affected habitable level, which then becomes the location for compliance. Mr Darren Tardio in his witness statement expresses a view of the inadequacy of the lowest habitable level approach (ref. point 19, pp.9-10 of his statement).

The draft NVP1 is, in my opinion, not clear in describing the application of traffic noise objectives, particularly in describing the exclusions from its application and the inclusions relating to *local roads*. The text in the EES is of little additional assistance. I believe that if it is difficult to comprehend, or ambiguous, it may also be challenging to implement, and ensuring compliance may be uncertain.

It appears that my difficulty is shared by expert witness Mr Shane Elkins of SLR Consulting for Hobsons Bay City Council (ref. points 71-78, pp.11-12 of his statement).

A figure in the expert witness report of Mr Matthew Stead of Resonate Acoustics for the proponent throws some light on understanding this EPR (ref. p.37 of his statement).

The proponent should be asked to explain this draft EPR so that its' intent is clearly understood and that it can be redrafted to be clearer.

The EES indicates that traffic, particularly heavy vehicle traffic, is expected to decrease on some local roads and increase on others. The changes, assessed by the usual traffic noise metrics, vary from one road to the other, but frequently are about 1-2dB(A)L₁₀ decrease or increase. Such a change is usually regarded as indiscernible, as either an increase or decrease. For an increase in heavy vehicle traffic, including the noise associated with the passage of individual vehicles, it is suggested that this might most productively be considered as a traffic, social and noise issue rather than a purely technical noise issue.

Off-reservation noise mitigation is proposed by the EES in circumstances where it may be judged not reasonable or feasible to meet satisfactory external noise levels. This measure involves treatments to the building fabric to reduce the level of interior noise. Such treatments might include double-glazing of windows, improved insulation and the like. The aim would be to achieve an indoor acoustic amenity at the level prescribed by AS/NZS

2107:2016 Acoustics-Recommended design sound levels and reverberation times for building interiors for the particular building occupancy or activity. That should provide an indoor noise level somewhat comparable to what would be achieved by the suggested outdoor objectives.

Shortcomings with this approach include that it does not improve the external amenity, it depends on the building owner's approval, the building has to be amenable to such treatments, and it could require a multiplicity of structures to be treated.

This is not the preferred approach to managing traffic noise, but rather the approach if suitable amenity is not achievable by feasible and reasonable on-reservation treatments. I suggest that decision making about on-reservation treatments being unable to deliver the required amenity outcomes and that off-reservation treatments should to be offered, should involve review by the IREA.

(iii) Question

Where your opinion(s) materially differ from the relevant circulated evidence statements, please briefly outline the difference and reasons for it.

(iv) Response

My opinions either do not materially differ from relevant circulated evidence statements or are not discussed in those statements, other than the statement from Mr Matthew Stead of Resonate Acoustics for the proponent.

Mr Stead submits that the current 18h traffic noise objective provides for lower night time traffic noise by virtue of traffic patterns. Further, he submits that commercial premises and recreation areas are not considered sensitive in accordance with the Project EPRs and VicRoads Traffic Noise Reduction Policy.

(v) Question

Please discuss the magnitude, likelihood and significance of adverse and beneficial environmental effects.

(vi) Response

I am of the opinion that;

- there are no beneficial effects of traffic noise for noise affected sites; and,
- there is a high likelihood of a noticeable reduction in traffic noise in residential areas abutting the West Gate Freeway and in some local roads; but a likelihood of some traffic noise increases in other areas.

(vii) Question

Please address the adequacy of the proposed environmental management framework, including the proposed environmental performance requirements and environmental management measures contained in the EES, with reference to applicable legislation and policy.

(viii) Response

I am of the opinion that;

- as a project-specific response to the particular characteristics of the project the traffic noise objectives of NVP1 should be varied as follows:
 - an objective of 63dB(A)L_{10(15h)} (7am to 10pm) for the day-time and evening period for VicRoads Category A receptors;
 - an objective of 58dB(A)L_{10(9h)} (10pm to 7am) for night-time for VicRoads Category A receptors; and
 - the objective of 63dB(A)L_{10(12h)} (6am to 6pm) for existing VicRoads Category B receptors would be retained.
- the IAC should consider the application of traffic noise protection for active and open areas, both existing and that arising from the project itself, that borders the project. If it is inclined to recommend that, I suggest those receptors be included as VicRoads Category B receptors;
- the Altona Memorial Park Chapel and knowledge industries/business incubators/creative industries (Docklands Cotton Mill) be classified as VicRoads Category B receptors;
- the IAC consider the issue of the provision of noise barriers at development sites as a planning, rather than technical, matter;
- the reference in NVP2 to monitoring being undertaken in accordance with *VicRoads Traffic Noise Measurement Requirements for Acoustic Consultants* – September 2011 be varied to change the measurement location from *the lowest habitable level* of a noise sensitive receptor to the *most traffic noise affected habitable level*;
- the application part of NVP1 should be rewritten to make it clear;
- the IAC should consider increased traffic noise on some local roads arising from increased traffic, particularly of heavy vehicles, as a planning and social matter in conjunction with the technical aspects;
- the IREA should have a role in deciding if off-reservation treatments of noise sensitive receptors is justified as an alternative to the preferred on-reservation traffic noise control;
- the noise objectives of off-reservation treatments should be internal noise levels at the upper level of the range specified in the column titled *Design sound level (L_{Aeq,t}) range* at Table 1 of *AS/NZS 2107:2016 Acoustics-Recommended design sound levels and*

reverberation times for building interiors for Houses and apartments in inner city areas or entertainment districts or near major roads, and appropriate to the particular building occupancy or activity.

(ix) Question

Please address the adequacy of WAA No. S0100269, with reference to applicable legislation and policy.

(x) Response

N/A

(xi) Question

Please address the adequacy of the impact assessment and whether the proposed environmental performance requirements are capable of being met.

(xii) Response

I am of the opinion that the traffic noise impact assessment should more directly consider night-time traffic noise. It is generally adequate in identifying noise affected sensitive receptors and the likely noise impact, however, I have advocated the inclusion of further noise sensitive receptors and a revision to traffic noise objectives.

I believe that the environmental performance requirements proposed in the EES are capable of being met although I note that at 2031 some of the estimated traffic noise levels are marginal vis-à-vis the proposed objective. I expect that the variations to traffic noise objectives that I have suggested are capable of being met, although possibly at some greater effort. As traffic volumes increase over time the suggested night-time traffic noise objective may become more demanding. Meeting the suggested objective at the Docklands Cotton Mill may be challenging.

(xiii) Question

Please address the question of feasible modifications to the design of the Project within or reasonably proximate to the project boundary that could offer demonstrably overall superior outcomes.

(xiv) Response

I am of the opinion that;

- a major road project such as this will generate traffic noise;

- changes to the project design within the project boundary would, at most, have a minor effect on traffic noise and would not remove the need for extensive traffic noise mitigation measures;
- the inclusion of a specific night-time traffic noise objective could offer a demonstrably overall superior outcome, particularly in the longer term as traffic volumes increase;
- incorporation of other receptors as VicRoads Category B noise sensitive receptors and requiring traffic noise compliance at the *most traffic noise affected habitable level* of receptors are acknowledgement of specific circumstances of the project;
- off-reservation acoustic treatments at noise sensitive receptors should be regarded as a less preferable option to controlling noise at the source, and should be entertained only when practicable options have been exhausted; and,
- the IREA should have the role of deciding the justification for off-reservation noise mitigation treatments by ensuring that feasible and reasonable measures are taken to control traffic noise at source.

7.2 Traffic noise compliance

This sub-section responds to the key issues for construction noise identified in 3(ii) above and marked 8.(a) to (d).

(i) Question

Please include a brief summary of the key issues raised by submitters. If you refer to a particular submission please refer to the submission by number and not by the name of the submitter.

(ii) Response

Traffic noise is presented in *Technical Report H, Noise and vibration (surface)* (AECOM). Witness statements have been provided by Mr Matthew Stead of Resonate Acoustics for the proponent, Mr Shane Elkin of SLR Consulting Australia Pty Ltd for Hobsons Bay City Council, and Mr Darren Tardio of Octave Acoustics for the City of Melbourne.

Whilst many submitters raised traffic noise as an important issue, there were fewer responses on ensuring compliance with objectives.

Mr Darren Tardio of Octave Acoustics for the City of Melbourne presented on this issue in his witness statement (ref. points 13-18, pp.8-9 under heading *Design Noise Levels and Design Life*)

For effective control of traffic noise it is important that objectives be set that are protective of amenity and health and are able to be achieved, that compliance with those is ascertained after project commissioning, and that compliance is sustained well into the future.

There is no disagreement among experts that a post commissioning traffic noise monitoring program is essential. This should be carried out a sufficient time after the project is commissioned as a whole, and traffic volumes are judged to have reasonably stabilised. That might be about six months after opening. Should some components of the project be opened before project completion the traffic noise acceptance monitoring should be delayed until after that completion.

The monitoring locations should be selected to represent the most traffic noise impacted receptors, and of the various classes of receptor. I agree with the witness statement of Mr Shane Elkins of SLR Consulting for Hobsons Bay City Council (ref. point 80, p.12 of his statement) that compliance noise measurements should include those used for measurements for the EES. The program may need to extend beyond that to other receptors, if such are approved for inclusion.

The IREA should review and audit the traffic noise compliance program including measurement sites, monitoring periods, quality assurance (NATA accreditation), data processing, results presentation, and reporting.

Compliance must be achieved at each individual receptor monitored.

Any non-compliance must be made good and demonstrated to be in compliance within a time determined by the IREA after that non-compliance is detected.

It is to be expected that traffic volumes on the project roads will increase over time, particularly for heavy vehicles given the objectives of the project. Increased traffic volumes, given other issues remain unaltered, translate to greater noise at source. *Technical Reports A (Transport Part 1) and G (Air Quality)* present data on predicted traffic volumes on various project roads with the project in 2022 (planned year of project commissioning) and 2031.

The EES presents the concept of a *design year (2031)* as a key aspect of the traffic noise impact analysis. The IAC has asked the proponent for an explanation of that term. I assume that it means that traffic noise is predicted to meet the proponent's proposed traffic objectives from 2022 to 2031, a period of 9 years, and a prediction that would depend on the expected traffic volumes and mixes for those years. Indeed the data presented in *Technical Report H, Noise and vibration (surface)* supports that view (see for example Table 74, p.112). If that is the case, then beyond 2031 traffic noise may exceed the objectives as traffic volumes increase. Indeed, the applicability of traffic noise objectives beyond that year may be unclear.

I note that from the data presented in the EES that at some of the noise sensitive sites adjoining the West Gate Freeway component the predicted noise levels at 2031 are

marginal. That contrasts with present data which seems to show levels often still within the 68dB(A)L_{10(18h)} (6am to 12pm) design objective used many years ago.

I submit that that proposed nine year traffic noise compliance period seems unreasonably short.

The EES advises that the noise barriers provided for the project would have.....*a life-span of at least 40 years. (Technical Report H, 3.5. Table 16. P.47).*

For comparison, the EES advises that the CityLink concession deed requires that compliance with a 63dB(A)L_{10(18h)} (6am to 12pm) traffic noise objective should be achieved during the period of the concession. That is believed to be currently to 2035.

Submission 392 recommends that *The detailed design elements of the WGTP should seek to adopt a planning horizon consistent with the 50 year lease for the Port of Melbourne. (Recommendation 1) and Further traffic modelling be undertaken to assess road and intersection performance over the term of the port lease to 2066. (Recommendation 4).*

In the expert witness report of Mr Matthew Stead of Resonate Acoustics for the proponent it says in response to issues raised in submissions;

Some submissions stated that the noise limits should be met into perpetuity. I understand that the project is required to meet the EPR's for traffic noise during the operational phase. (ref. witness statement, item 22, p.11).

I suggest that it would be appropriate for the traffic noise objectives to be complied with for 20 years from project commissioning ie. to 2042 if completed in 2022.

Achieving traffic noise compliance at a specified time, be it 2031 or 2042 or by some other year, suggests that the acceptance compliance levels post commissioning might prudently need to be set at a level, possible several dB(A), below the objectives. That would allow a margin for traffic growth, open graded asphalt deterioration, the marginal compliance evident for 2031, and the uncertainty in modelling and measurement.

I believe that it is appropriate that traffic noise compliance be demonstrated to the satisfaction of the responsible authority within six to twelve months of commissioning of the complete project, and at two year intervals thereafter until the end of the approved compliance period, unless varied by the responsible authority based on a review of results. Non-compliance should be rectified within a specified period of that being shown, and compliance demonstrated to have been achieved by further measurement.

A number of submitters have referred to impulsive heavy vehicle noise, specifically the use of heavy vehicle engine compression brakes and heavy acceleration, as being particular nuisances. The proponent advises that this issue is not dealt with through traffic noise objectives.

Heavy vehicles slowing for tunnel entry declines and slowing for exit ramps are the most likely locations where engine compression brakes might be used, even if not needed. I note that inspection of the EES Map Book suggests that the entry to the eastbound tunnel appears to have a down gradient of about 5.5%. Accelerating up-grade from tunnel exits and resuming freeway speed, and accelerating on ramps to join the freeway, are the most likely locations where heavy vehicle acceleration noise might be anticipated.

The EES suggests that barriers, such as tunnel entry dive structures, will provide some moderation of these events. Attenuating engine brake noise is difficult. The project operator may be able to discourage the use of engine brakes by implementing some road management and informational measures. How that might be achieved is beyond my area of expertise. Noise from heavy acceleration on ramps onto the freeway may be able to be reduced with noise barriers even if not needed to meet the traffic noise objectives. I note that many ramps are proposed to have noise barriers.

In the event that off-reservation treatments are provided at some noise sensitive receptors it will be necessary for noise measurements to be carried out to ensure compliance with the objectives. If non-compliant then further treatment will need to be undertaken until compliance is established.

(iii) Question

Where your opinion(s) materially differ from the relevant circulated evidence statements, please briefly outline the difference and reasons for it.

(iv) Response

My opinions either do not materially differ from relevant circulated evidence statements or are not discussed in substance in those statements.

(v) Question

Please discuss the magnitude, likelihood and significance of adverse and beneficial environmental effects.

(vi) Response

These issues have been discussed under sub-title 7.1 on traffic noise objectives and their application. This sub-title discusses ensuring that those objectives are delivered.

(vii) Question

Please address the adequacy of the proposed environmental management framework, including the proposed environmental performance requirements and environmental management measures contained in the EES, with reference to applicable legislation and policy.

(viii) Response

I am of the opinion that:

- traffic noise compliance monitoring must be carried out at a representative selection of noise sensitive sites after complete project commissioning and between six and twelve months after that opening;
- the IREA should have a substantial role in reviewing and auditing traffic noise compliance assessment;
- any non-compliance must be rectified and shown to have achieved compliance;
- traffic noise compliance should be achieved for longer than 2031, I suggest 20 years after project commissioning;
- the project proponent or operator, as appropriate, might consider measures that discourage the use of engine compression brakes by heavy vehicles and heavy acceleration for those vehicles;
- where off-reservation treatments are applied to noise sensitive receptors compliance monitoring must be carried out;
- the IREA should review the acoustic treatments provided for off-reservation noise sensitive receptors and audit compliance testing; and,
- NVP2 should be modified to reflect the above off-reservation issues and reference made to the Section 6, *Method of Measurement of AS/NZS 2107:2016 Acoustics-Recommended design sound levels and reverberation times for building interiors for Houses*.

(ix) Question

Please address the adequacy of WAA No. S0100269, with reference to applicable legislation and policy.

(x) Response

N/A

(xi) Question

Please address the adequacy of the impact assessment and whether the proposed environmental performance requirements are capable of being met.

(xii) Response

These issues have been discussed under sub-title 7.1 on traffic noise objectives and their application. This sub-title discusses ensuring that those objectives are delivered.

(xiii) Question

Please address the question of feasible modifications to the design of the Project within or reasonably proximate to the project boundary that could offer demonstrably overall superior outcomes.

(xiv) Response

These issues have been discussed under sub-title 7.1 on traffic noise objectives and their application. This sub-title discusses ensuring that those objectives are delivered.

7.3 Traffic noise community engagement

This sub-section responds to the key issues for construction noise identified in 3(ii) above and marked 9.(a) to (c). It is similar to sub-section 4.2 on *construction noise public engagement*.

(i) Question

Please include a brief summary of the key issues raised by submitters. If you refer to a particular submission please refer to the submission by number and not by the name of the submitter.

(ii) Response

As indicated in 7.1 there is substantial submitter interest in traffic noise. Hence it seems appropriate that there be a high level of community engagement on proposed traffic noise objectives, where they will apply, over what period they are to be met, how impulsive (engine compression brake) noise might be avoided, and of compliance after project completion. Further, there is expected to be a need to provide an effective contact and complaints system.

I anticipate that a construction noise community information program will be part of an integrated environmental community engagement program, including construction vibration and regenerated noise. That may be considered by the IAC in EPR SP2 – Communications and Community Engagement Plan.

Development of this sub-topic is beyond my area of expertise.

(iii) Question

Where your opinion(s) materially differ from the relevant circulated evidence statements, please briefly outline the difference and reasons for it.

(iv) Response

N/A

(v) Question

Please discuss the magnitude, likelihood and significance of adverse and beneficial environmental effects.

(vi) Response

N/A

(vii) Question

Please address the adequacy of the proposed environmental management framework, including the proposed environmental performance requirements and environmental management measures contained in the EES, with reference to applicable legislation and policy.

(viii) Response

N/A

(ix) Question

Please address the adequacy of WAA No. S0100269, with reference to applicable legislation and policy.

(x) Response

N/A

(xi) Question

Please address the adequacy of the impact assessment and whether the proposed environmental performance requirements are capable of being met.

(xii) Response

I am of the opinion that the traffic noise impact assessment does not itself sufficiently address the need for community engagement on traffic noise, nor might it be expected to. I accept that that matter may be covered comprehensively elsewhere in the EES as part of an integrated communication, reporting, and contact and complaints system across all environmental impacts.

(xiii) Question

Please address the question of feasible modifications to the design of the Project within or reasonably proximate to the project boundary that could offer demonstrably overall superior outcomes.

(xiv) Response

N/A

8 Operational fixed facilities noise; primarily tunnels ventilation noise

This sub-section responds to the key issues for construction noise identified in 3(ii) above and marked 10.(a) to (c).

(i) Question

Please include a brief summary of the key issues raised by submitters. If you refer to a particular submission please refer to the submission by number and not by the name of the submitter.

(ii) Response

Noise from operational fixed facilities is presented in *Technical Report H, Noise and vibration (surface)* (AECOM). Witness statements have been provided by Mr Matthew Stead of Resonate Acoustics for the proponent, Mr Shane Elkin of SLR Consulting Australia Pty Ltd for Hobsons Bay City Council, and Mr Darren Tardio of Octave Acoustics for the City of Melbourne.

EPA Victoria provided a submission on the need for the tunnels ventilation exhaust structures to hold a Works Approval under the *Environment Protection Act 1970* which through *Schedule 1* of the *Environment Protection (Scheduled Premises) Regulations 2007* requires compliance with *SEPP N-1 State Environment Protection Policy (Control of Noise from Commerce, Industry and Trade)*. EPA advised that experience indicated compliance was possible with attention to design.

Few submitters commented on this issue.

The EES refers to fixed facilities that may generate noise as being the two ventilation structures, a water treatment plant and electrical substations.

No further reference could be located for the water treatment plant and electrical substations vis-à-vis noise. I assume that the water treatment plant will be for treating groundwater from construction, and perhaps operation, of the tunnels. I expect that the electrical substation(s) will be for providing power for the tunnel boring machines for tunnel construction, and later for ventilation and lighting operation of the operating tunnels. I anticipate that these facilities would be sensitively located and would not be significant noise sources.

The tunnel ventilations structures, one at the north and one at the south of the tunnels, have been comprehensively assessed for noise compliance as part of the EES and for the EPA Works Approval application. That assessment includes the exhaust from the ventilation exhaust system and the noise at the tunnel portals from ventilation fans designed to prevent portal air pollutant emissions.

The EPRs for the ventilation system for the tunnels are at NVP10 and NVP11. The former specifies the performance objective of meeting the requirements of *SEPP N-1 State Environment Protection Policy (Control of Noise from Commerce, Industry and Trade)*, and the latter for monitoring to determine compliance with that policy.

(iii) Question

Where your opinion(s) materially differ from the relevant circulated evidence statements, please briefly outline the difference and reasons for it.

(iv) Response

No material differences.

(v) Question

Please discuss the magnitude, likelihood and significance of adverse and beneficial environmental effects.

(vi) Response

I am of the opinion that:

- there will be an increase in ambient noise from the ventilation system for the tunnels; but,
- that noise increase will be very small and undetectable to observers; and,
- the adverse effect will be insignificant.

(vii) Question

Please address the adequacy of the proposed environmental management framework, including the proposed environmental performance requirements and environmental management measures contained in the EES, with reference to applicable legislation and policy.

(viii) Response

I am of the opinion that:

- the proposed EPRs are appropriate and consistent with the statutory requirement of compliance with *SEPP N-1 State Environment Protection Policy (Control of Noise from Commerce, Industry and Trade)*, and;
- compliance monitoring is desirable. However, there is a need to resolve how that might be done against a background noise environment, near both ventilation outlets, that may alter with the opening of the project roads. I have provided a question to the proponent on that; and,

- any noise from a water treatment plant and electrical substation(s) for the project are likely to be inconsequential if sensitively sited and well operated.

(ix) Question

Please address the adequacy of WAA No. S0100269, with reference to applicable legislation and policy.

(x) Response

I am of the opinion that WAA. No.S0100269 meets the requirements of *Schedule 1* of the *Environment Protection (Scheduled Premises) Regulations 2007* and has been assessed to comply with the noise requirements of *SEPP N-1 State Environment Protection Policy (Control of Noise from Commerce, Industry and Trade)*.

(xi) Question

Please address the adequacy of the impact assessment and whether the proposed environmental performance requirements are capable of being met.

(xii) Response

I am of the opinion that the impact assessment is comprehensive and adequate in evaluating the likely noise impact of the ventilation system for the tunnels. However, I cannot form an opinion of whether compliance will be able to be established by monitoring because of the coincident changes that will occur on commissioning of the project viz. noise changes from traffic using the project roads and the operation of the ventilation system.

(xiii) Question

Please address the question of feasible modifications to the design of the Project within or reasonably proximate to the project boundary that could offer demonstrably overall superior outcomes.

(xiv) Response

I am of the opinion that there are no feasible options to the project design that could make any material difference to noise from the ventilation systems for the road tunnels.

9 Approval Documents

(i) Question

Please list any recommended changes to the approval documents.

(ii) Response

This summarises areas of suggested change to the EPRs.

For construction noise:

- Altona Memorial Park Chapel as a construction noises sensitive site;
- Docklands Cotton Mill as a construction noise sensitive site;
- System for review and approval for exceedences of construction noise objectives; and,
- System for review of construction noise monitoring.

For construction vibration:

- System for review and approval for exceedences of construction noise objectives;
- System for review of construction vibration monitoring;
- Revision of NVP6 to retain *Maximum Value* columns and translate 'vibration dose values' to 'peak particle velocities';
- Requirement for asset condition surveys, possibly linked to condition surveys for ground settlement; and
- System for review and audit of condition surveys.

For regenerated noise:

- System for monitoring regenerated noise; and
- System for reviewing regenerated noise monitoring and responses in alterations to operational conditions and offering respite accommodation.

For traffic noise:

- A night-time traffic noise objective and adjustment of the day time and evening objective;

- Possible variation of VicRoads Category B noise sensitive receptors to include the Altona Memorial Park Chapel, the Docklands Cotton Mill and passive and active open space;
 - Applying traffic noise objectives at the *most traffic affected habitable level* of a noise sensitive receptor;
 - Rewriting NVP1 to improve clarity; and
 - System for deciding on offering off-reservation acoustic treatments at receptors.
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- System for monitoring traffic noise;
 - System for review and audit of traffic noise compliance assessment;
 - Compliance to extend beyond 2031 to 2042 or 20 years;
 - System for audit of any off-reservation treatments and effectiveness

For tunnels ventilation noise:

- Compliance with WAA No. S0100269;
- Monitoring to assess compliance of tunnels ventilation systems.