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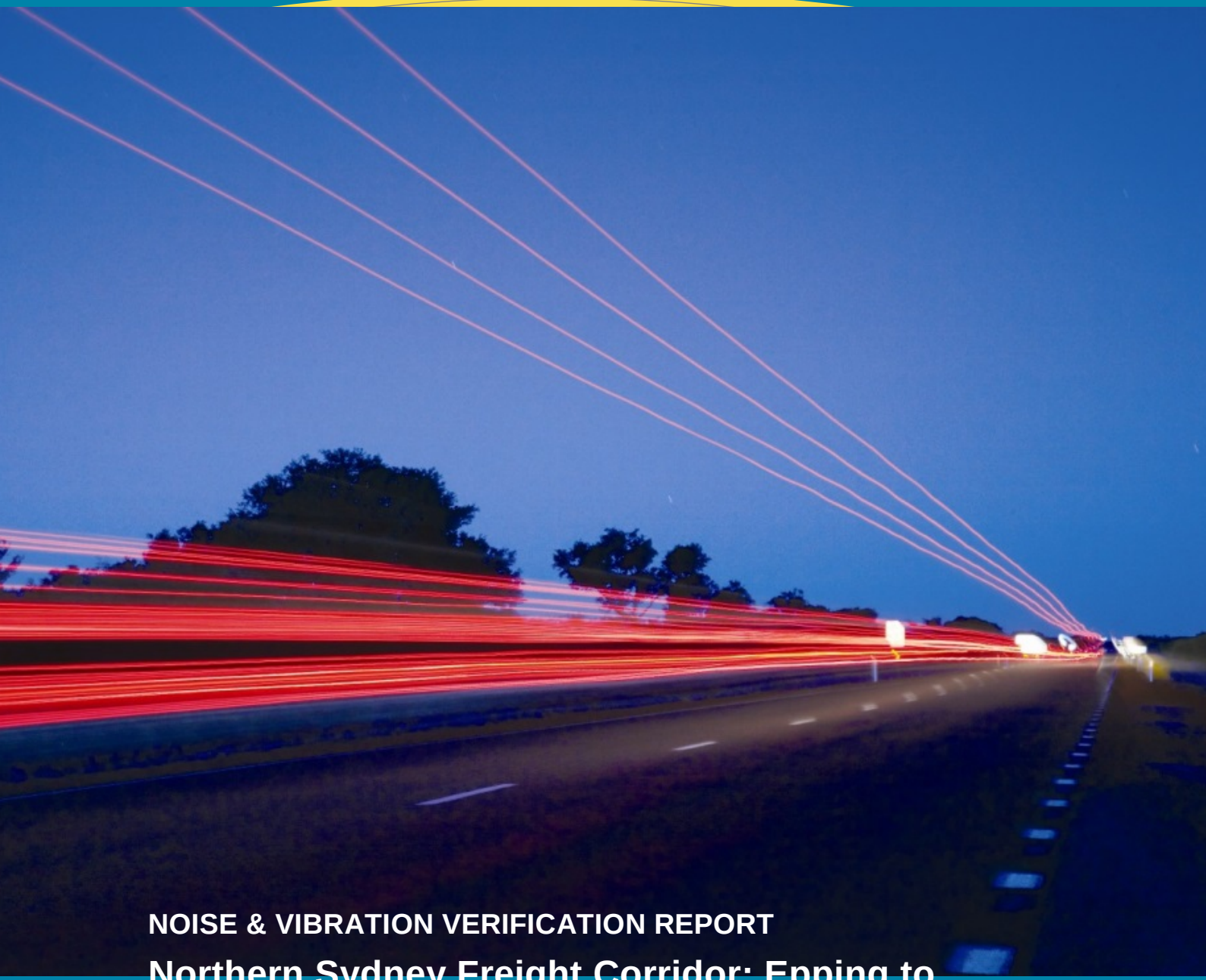

NOISE & VIBRATION VERIFICATION REPORT

Northern Sydney Freight Corridor: Epping to Thornleigh Third Track

Prepared for Transport for NSW

04/08/2014

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REVISION SCHEDULE

Rev No	Date	Description	Signature or Typed Name (documentation on file).			
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1	04/08/14	Draft for Client Review	PK/GW	PK	KD/PK	KD

Transport for NSW

Northern Sydney Freight Corridor: Epping to Thornleigh Third Track

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1 Introduction

1.1 General Background

The Epping to Thornleigh Third Track Project (ETTT) forms part of the Northern Sydney Freight Corridor (NSFC). The NSFC Program is a joint Australian and NSW Government initiative designed to resolve rail network constraints on the Main North Line.

The NSFC program aims to contribute to a more efficient freight rail network, particularly for interstate container freight, connecting Australia's three largest cities by:

- Relieving bottlenecks on the East Coast interstate rail network,
- Improving freight train access through northern Sydney,
- Reducing freight transport operating costs,
- Easing peak hour restrictions on freight services, and
- Improving reliability of passenger services on the Main North Line.

The NSFC Program currently comprises four key projects:

- North Strathfield Rail Underpass,
- Epping to Thornleigh Third Track,
- Gosford Passing Loops, and
- Hexham Passing Loop.

The Hexham Passing Loop has been built by THE Australian Rail Track Corporation (ARTC) with the remainder of the projects to be delivered by Transport for NSW. The Epping to Thornleigh Third Track (ETTT) project is the subject of this report.

1.2 ETTT Background

The ETTT project involves the construction of six kilometres of new and upgraded track within the rail corridor between Epping and Thornleigh Stations on the western side of the existing tracks. The new (third) track will separate northbound freight from all-stops passenger train movements along the steep incline between Epping and Thornleigh, and assist to provide additional capacity for northbound interstate container freight trains, particularly during the daytime when passenger trains currently have priority.

The Conditions of Approval of the ETTT project require the preparation of an Operational Noise and Vibration Review (ONVR). The ONVR has been prepared by the ETTT Alliance. The Alliance's operational noise and vibration technical advisor is SLR Consulting, who have contributed the technical content for the project including, monitoring, modelling, assessment, selection and design of noise and vibration mitigation measures. The ONVR provides details of predicted operational noise and vibration impacts associated with the ETTT project, and proposed mitigation measures.

1.3 Independent Verification

MWH was commissioned to undertake the role of Independent Verifier for the ETTT ONVR. This opportunity was facilitated through the Transport for NSW SME Planning and Environment Panel.

As Subject Matter Experts, Peter Karantonis and Tracy Gowen, assisted by Glenn Wheatley (also of Renzo Tonin & Associates) were engaged by MWH to provide independent verification of noise and vibration aspects associated with the ONVR.

Peter Karantonis and Tracy Gowen were approved as the Independent Verifier by the Department of Planning and Environment on 27 November 2013.

Approval was granted by TfNSW on 5 June 2014 for the inclusion of Glenn Wheatley on the MWH ETTT Independent Verifier ONVR Technical Services project team.

The ONVR was prepared by the ETTT Alliance with the assistance of SLR Consulting, acting as the operational noise and vibration technical advisor on the ETTT project. The NSW Environment Protection Authority (EPA) was also consulted on the scope of the verification exercise prior to it being finalised.

2 Independent Verification Process

2.1 Scope

The independent verifier's scope of work is set out below:

- Prepare in consultation with Transport for NSW (TfNSW) and the NSW Environment Protection Authority (EPA), a staged approach verification plan.
- Prepare a Verification Issues Register to track the progress and closure of any issues identified during the verification process.
- Review of methodology used to identify reasonable and feasible noise and vibration mitigation measures.
- Confirm that appropriate operational noise and vibration objectives and levels for adjoining development, including sensitive receivers has been considered.
- Review acoustic noise model and confirm appropriate assumptions and inputs and modelling methods have been made in the noise and vibration model.
- Confirm that the predicted noise and vibration levels are reasonable and consistent with the inputs of the acoustic model.
- Confirm that the proposed noise and vibration mitigation is in accordance with the commitments made in the ETTT Environmental Impact Statement and Submissions Report and in the Ministers Conditions of Approvals (MCoAs).
- Consider assumptions made in the reasonable and feasible analysis of noise mitigation and verify that the proposed mitigation measures are justified based on the predicted noise levels and the projects' objectives.
- Review the ONVR consultation strategy, specifically any consultation proposed with property owners directly impacted by mitigation measures proposed by the project.
- Review the procedures for operational noise and vibration complaints management, including investigation and monitoring (subject to complainant agreements) and ensure they are consistent with the relevant guidelines and standards.
- Attend community consultation meetings, stakeholder meetings and ONVR workshops as required.
- Confirm that appropriate consultation has been undertaken as part of the ONVR process.
- Prepare a verification report based on the final ONVR summarising all verification activities for submission to NSW Planning & Environment.

The independent verification process did not involve instructing the ETTT Alliance and / or SLR Consulting, on preferred methods of modelling or assessment, or the provision of noise and vibration mitigation design advice. The independent verification process involved either acceptance of the ETTT Alliance and/or SLR Consulting's proposal or the provision of comments where further information was required or where it was not clear if the process would achieve the desired outcomes.

2.2 Process Planning

At the commencement of the independent verification process, a meeting was held on 19 December 2013, attended by representatives from each of the following organisations: TfNSW, ETTT Alliance, SLR Consulting, Freight and Regional Development and Renzo Tonin & Associates.

The objective of the meeting was to brief Renzo Tonin & Associates on the project overall, discuss the project's noise objectives, criteria and key issues. Some of the key issues discussed included:

- Minister's Conditions of Consent,
- relevant noise policies, namely the Interim Guideline for the Assessment of Noise from Rail Infrastructure Projects (IGANRIP) and the Rail Infrastructure Noise Guideline (RING), and their impact on the project's assessment and potential noise mitigation measures,
- Differences between the EIS assessment and the ONVR assessment,
- Locomotive wheel squeal, curve squeal and braking noise,
- Rail grinding and rail lubrication measures,
- Modelling validation methodology,
- Handling of 'safety factors' on train numbers as required by the MCoA to address potential greater impacts resulting from increased rail traffic on the line,
- Reliance on rail traffic volume data to address average and peak rail traffic conditions,
- EIS and additional noise catchment areas,
- Additional noise monitoring locations for the purpose of model validation, and
- Project milestones and deliverables.

Another objective of the meeting was to agree on a process right from the outset in order to streamline the independent verification process and minimise any unnecessary disputes, rework and lengthy delays by agreeing on strategies early on.

2.3 Inputs

TfNSW and the ETTT Alliance, with the assistance of SLR Consulting, provided information to facilitate the independent verifier’s role. This included:

- Noise and vibration baseline monitoring results,
- Technical memos detailing project specific noise and vibration objectives and levels,
- The ONVR consultation strategy,
- Proposed noise and vibration mitigation measures, including the reasonable and feasible analysis,
- Development of noise model including assumptions, inputs and modelling methods,
- Procedures for complaints management, and
- Draft and final ONVR reports.

3 Ministers Conditions of Approval

The ETTT Project was assessed as State Significant Infrastructure under Part 5.1 of the Environmental Planning and Assessment Act 1979. The project was determined by the NSW Minister for Planning and Infrastructure on 17 July 2013.

The project was approved subject to a number of Minister's Conditions of Approvals (MCoA). MCoA C4 relates to preparation of the Operational Noise and Vibration Review (ONVR) and is worded as follows:

C4. The Proponent shall prepare an Operational Noise and Vibration Review (ONVR) to confirm noise and vibration control measures that will be implemented for the SSI. The ONVR shall be prepared in consultation with the EPA and relevant Councils and shall:

a) identify the appropriate operational noise and vibration objectives and levels for receiving existing development, including all sensitive receivers;

b) predict the operational noise and vibration impacts at receiving existing development based on the final design and operation of the SSI. This prediction shall include a safety factor on train numbers and re-examination of curve squeal. Noise predictions shall be presented in catchments with each sensitive receiver clearly identified and described (including type and number of storeys) with their appropriate noise predictions. Absolute noise levels shall be presented to the nearest whole decibel, and the 'increase' in noise presented to a single decimal place;

c) assess all feasible and reasonable noise and vibration mitigation measures, with a preferential focus on source control and design consistent with IGANRIP. The feasible and reasonable analysis shall be transparent and fully justified and shall include, but not be limited to the consideration of subjective noise factors, such as the number of noisy events, the duration of noisy events and the characteristics of the noise (e.g. wheel squeal, low frequency noise) and consideration of the following mitigations measures:

- *signal relocation;*
- *composite sleepers;*
- *rail dampeners;*
- *gauge face lubricators for curve track and squeal;*
- *noise barriers/bunds, including low profile rail barriers close to the track; and*
- *property treatments;*

d) include a mitigation plan for each catchment showing all sensitive receivers where IGANRIP triggers are exceeded and a strategy to mitigate the noise, including the identification of specific physical and other mitigation measures for controlling noise and vibration at the source and at the receiver including location, type and timing for the implementation of mitigation measures;

e) include a consultation strategy to seek feedback from directly affected property owners on the noise and vibration mitigation measures;

f) include procedures for operational noise and vibration complaints management, including investigation and monitoring (subject to complainant agreement); and

g) incorporate results from the Source Noise Monitoring Plan (condition C5).

Notwithstanding the feasible and reasonable noise mitigation assessment, gauge face lubricators for curve squeal shall be implemented as part of the SSI. Should operational noise monitoring (conditions C5 and F2) identify lubricators not effective in reducing curve squeal, property treatments or other mitigation measures if deemed more practicable, are to be implemented for sensitive receivers immediately adjacent (generally within 50m from the newly constructed track) to rail curves on the downside (western side) of the rail corridor, irrespective of IGANRIP/RING noise trigger level exceedances.

The ONVR (and any subsequent amendment) is to be independently verified by a noise and vibration expert. The scope of the verification exercise undertaken by the noise and vibration expert is to be developed by the Proponent in consultation with the EPA. The verification will be undertaken at the Proponent's expense and the independent expert shall be approved by the Director-General. The ONVR and independent review is to be submitted to and approved by the Director-General prior to the commencement of the laying of rail track or the construction of physical noise mitigation structures, unless otherwise agreed to by the Director-General.

The Proponent shall implement the identified noise and vibration control measures prior to operation and make the ONVR publicly available.

4 Review work

4.1 Work undertaken

During the independent review process the following work was undertaken:

- Attendance at several face-to-face meetings and teleconferences with TfNSW / ETTT Alliance / SLR Consulting (see Table 1) to review the operational noise and vibration objectives used, the methodology followed, the noise modelling undertaken and the noise / vibration mitigation measures proposed,
- Comments were made along the way on each draft of the ONVR and associated documents reviewed (see Table 2), most of which were captured in a Verification Issues Register which also contains the ETTT Alliance's responses,
- Attendance at community consultation meetings, stakeholder meetings and ONVR workshops as required (see Table 1),
- Attendance at one site visit (see Table 1), and
- Review of several drafts and final ONVR report (see Table 2).

The final ONVR report reviewed is dated July 2014 and electronically referenced 'ETTT-ETTTAL-PE-001841.1.1.NOREV.pdf', and contains Part 1 (16 pages of PDF file) and Part 2 (256 pages of PDF file) comprising text, tables and figures.

4.2 Meetings, community consultation & site visit

Renzo Tonin & Associates attended a series of face-to-face meetings with ETTT Alliance, SLR Consulting and / or TfNSW. Also a series of community consultation meetings and a site visit was attended. These are listed in Table 4-2 below.

Table 4-1 Meetings, Community Consultation & Site Inspection

Item No.	Description	Date	Location
1	Meeting - with ONVR Steering Group	19/12/2013	Zenith Centre, Level 5, 821 Pacific Highway, Chatswood
2	Meeting - to discuss ONVR Modelling	27/02/2014	Zenith Centre, Level 5, 821 Pacific Highway, Chatswood
3	Meeting - ETTT discussion and model review	05/03/2014	SLR Consulting, 2 Lincoln Street, Lane Cove West
4	Teleconference - ETTT Review & Comments	02/05/2014	-
5	Teleconference - ETTT ONVR final IV comments	22/05/2014	-
6	Site Inspection	28/05/2014	Entire ETTT corridor
7	Teleconference - ETTT ONVR Update	30/05/2014	-
8	Community Consultation - ETTT ONVR Community Information Session #1	31/05/2014	Beecroft Community Centre, 111 Beecroft Road, Beecroft
9	Community Consultation - ETTT ONVR Community Information Session #2	04/06/2014	Pennant Hills Community Centre (small hall) corner Yarrara Road and Ramsey Road, Pennant Hills

In addition, many teleconferences were held between Renzo Tonin & Associates and ETTT Alliance, SLR Consulting and / or TfNSW during the course of the entire review process, however only the key ones are listed in the table above.

4.3 Document issues tracking & comments

The ETTT ONVR related documents reviewed are listed in the table below.

Table 4-2 Documents Reviewed

Item No.	Document Title	Date	Revision	Reference
1	'Epping to Thornleigh Third Track Operational Noise and Vibration Review Modelling Assumptions for Confirmation'	23 January 2014	0	610.13080 Modelling Assumptions 20140123
		26 February 2014	1	610.13080 Modelling Assumptions 20140226
2	Epping to Thornleigh Third Track, Operational Noise and Vibration Review (ONVR)	16 April 2014	Draft 4	ETTT-ETTTAL-PE-001841.D.NOREV
		14 May 2014	Draft 7	ETTT-ETTTAL-PE-001841.G.NOREV
		17 July 2014	Rev 1 DRAFT 2	ETTT-ETTTAL-PE-001841.1.NOREV
		28 July 2014	Rev 1 DRAFT 3	ETTT-ETTTAL-PE-001841.1.1.NOREV

At the initial stages of the independent verification process, a register was created by Renzo Tonin & Associates to track each issue of the documents provided to them for review and comment. The register was created which provided information on the document the issue was concerned with, the section and specific details of the issue. An issue status (such as open or closed etc.) and last updated date was also included. Appendix A presents the Verification Issues Register for the document described as Item No.1 in the table above.

This approach was followed until the ONVR reports were produced. At that stage it was considered more efficient to insert comments within the ONVR reports rather than provide comments in a separate register, as this was easier for the ETTT Alliance to refer to directly, discuss if necessary and subsequently address within the next revision of the ONVR.

At times issues were too complex to be addressed through the comment register and/or inserted comments within the ONVR document. So depending on the nature of the issue either it was discussed directly over the phone or in person at a meeting between Renzo Tonin & Associates, SLR Consulting, ETTT Alliance and / or TfNSW representatives. A resolution would typically be agreed, and ultimately the issue or comment would be closed out upon review of the subsequent revision of the ONVR report.

5 Main ONVR Issues & Resolutions

The responses provided by the ETTT Alliance and SLR consulting adequately addressed the comments and issues raised, with the exception of a few issues which required much discussion prior to finalising the ONVR. These are summarised below:

5.1 Noise Barrier Cost-Effectiveness Analysis:

The issue related to the approaches used to assess barrier cost-effectiveness, namely the '100dB per $1M' rule and the '0.2 dBA/m^2'.

Upon review of a draft ONVR's reference to the approach used in Practice Note IV (b) 'Acoustic treatment of individual dwellings' in the 'Environmental Noise Management Manual' (ENMM), further justification and explanation was found to be necessary on how the ONVR's approach to the noise barrier cost-effectiveness analysis is in fact suitable for this project. For example, according to the ENMM approach, at-property treatment of a dwelling may readily provide a 10 dB(A) noise reduction by treating windows and providing mechanical ventilation for the quoted $20,000, which equates to $2,000/dB(A). The ONVR's '100dB per $1M' equates to 10 dB(A) / $100,000, which subsequently equates to 5 dB(A) /$100,000, if dB(A) benefits are counted once and not twice [ie a 5dB(A) reduction is a 5dB(A) reduction whether it is in terms of Leq or Lmax, as is done in the ENMM]. This finally equates to $20,000 / dB(A) which is identical to the cost per dB(A) expected out of at-property treatment.

A suitable response was provided by SLR Consulting which stated that the way they calculated it was that they had allowed for $100,000 per dwelling for a noise barrier justification versus $20,000 for at property treatment. This provides for a ratio of 5:1 versus 2:1 ratio for noise barriers to at-property treatments as used in the ENMM.

Additional comment was provided to the ETTT Alliance which stated that too short and insufficient explanation was provided in the ONVR as to why the ENMM approach wouldn't be used when this is also a linear transportation project. Also, if a separately derived methodology would be used, then this would need further referencing and support to ensure the approach taken provides for a more conservative design / more noise barriers than the ENMM methodology.

Further to this a more detailed description of the cost-effectiveness methodology applied was provided in Chapters 8.3 'Process for Reasonable and Feasible Assessment of Noise Barriers' and 8.8 'Noise Barrier Reasonable and Feasible Analysis by NCA' in the ONVR report.

5.2 Acutely Affected Properties

'Acutely affected properties' refers to those properties at which LAeq noise levels (ie average noise levels) are predicted to exceed guideline target levels by 5dB(A) or more. That is, regardless of any increase due to the project, the noise levels are predicted to be 5dB(A) higher than IGANRIP / RING target levels.

There is no MCoA requirement to treat 'acutely affected properties' and that the ONVR merely identifies these properties. It is also understood that out of the 80 residential properties identified, all but 35 properties remain untreated, whether they be from in-corridor noise mitigation measures or from at-property treatment. The comment was that the community may be seeking mitigation or at the very least a discussion with reasons why the project would not apply at-property treatments to the remaining 35 properties that are acutely impacted.

Some possible approaches and options (incomplete list) that were discussed are presented below:

- One approach was to clearly state that the treatment of acute properties is outside the project's scope and budget (which is the understanding). However despite this, all acutely affected properties are identified and shall be referred to Freight and Regional Development and/or SydneyTrains for consideration of mitigation in future, should a mitigation program and suitable funding be made available in future.

- Another approach was to look at the predicted noise levels at each of the 35 or so properties to determine whether or not the project actually provides a net noise benefit or at the very least not provide an increase to existing levels. For the balance of the acute properties identified to experience an increase in existing noise levels, explain why it may not be feasible/reasonable to mitigate noise at these properties eg the reasons described in the first approach above and/or others.

- A further consideration was that the ONVR identifies acute properties but whether or not these properties will in fact experience acute noise would be confirmed during post-opening noise compliance monitoring.

The resolution to the above issue and discussion was to compare the number of acutely affected properties with and without the ETTT project going ahead. It was found that without the ETTT project, in 2016, 50 properties would be acutely affected. As a result of the project, in 2026 (10 years after commencement of operation), the number is reduced to 35 properties, mainly due to ETTT installing noise barriers. Without the proposed ETTT noise barriers, this figure would have increased to 80 properties. These figures were based on an assessment that does not include a safety factor on train numbers.

Furthermore it was added to the ONVR that TfNSW has a program of works underway to reduce existing rail noise. The program of works includes:

- Working with freight operators to improve the design and maintenance of their rolling stock to reduce wheel squeal and locomotive noise,

- Installing modern electronic lubricators throughout the Beecroft and Cheltenham area,

- Using dedicated maintenance teams to ensure the lubricators are always fully operational, and

- Working with Sydney Trains to improve track maintenance practices.

6 Community Consultation

Two community information sessions were held in May and June 2014, and Renzo Tonin & Associates attended these to discuss specific community concerns with the community and to ensure that the community had the opportunity to ask questions related to the independent verification process.

Comments and feedback collected from the community were passed on to the ETTT Alliance team and discussed where necessary. These comments have been incorporated into and addressed with responses in Appendix H of the final ONVR report.

7 Conclusion

Renzo Tonin & Associates has concluded that, despite some minor differences in approach and some varying opinions found during the independent verifier process, these make no material difference to the noise and vibration outcomes presented in the ONVR report.

The ONVR report satisfactorily addresses the important issues regarding likely noise and vibration impacts to surrounding receivers, addressing those impacts with appropriate mitigation measures in accordance with both the Rail Infrastructure Noise Guideline (RING) and the Interim Guideline for the Assessment of Noise from Rail Infrastructure Projects (IGANRIP).

In conclusion, the ONVR report has been prepared to satisfactorily meet the Minister's Conditions of Approval C4 and the commitments made in the ETTT Environmental Impact Statement and Submissions Report.

Appendix A ETTT ONVR Review Verification Issues Register

Item No.	Report / Report Chapter / Section	Comments 1	Response 1	Comments 2	Response 2	Open / Closed
'Epping to Thornleigh Third Track – Operational Noise and Vibration Review – Modelling Assumptions for Confirmation' SLR Consulting						
1.	1. Introduction	-	-	-	-	-
2.	2.1 Passenger Fleet Mix	Express services and all stops services – modelling to be checked for consistency.	Noted – model to be checked by RT&A	-	-	Closed
3.	2.2 Freight Fleet Mix	Freight trains have been consolidated in the ONVR to a single type and modelling has been based on average lengths and loco numbers. While this approach may be reasonable at the EIS stage and for LAeq assessment, actual maximum train lengths and number of locomotives should be used at the ONVR stage and for the LMax assessment. Further justification should otherwise be given for this action.	Additional justification added to the modelling assumptions memo. Note the EA modelling did not assume different source levels for bulk and intermodal trains, so this consolidation does not change the modelling outcomes.	How is the 'approximate number of locos on average' calculated? That is, how is the Existing scenario for freight trains calculated to have 750m wagons with 3 locos and the Future scenario to have 1,100m wagons with 3.6 locos? How can a 3 loco freight train (typically NR class) have the same noise source level as a 4 loco freight train (typically an 82 class)? Also how can a 1500m long freight train have the same noise source level as a 800m long freight train? In line with RING *"the reasonable maximum use, or the 'worst-case' typical day rather than average use"* should be modelled and assessed. Therefore, more effort should be put into establishing the worst-case typical day freight train types that use the line at present and future, and those particular train type's noise source levels should be used in the model.	Response provided by SLR Consulting at meeting	Closed
4.	2.3 Train Numbers	Confirm conditions regarding wording on use of safety factors for freight movements.	Revised wording following TfNSW review of weekly forecast capacity.	-	-	Closed

Item No.	Report / Report Chapter / Section	Comments 1	Response 1	Comments 2	Response 2	Open / Closed
5.		Presumably Table 2 presents Average not Peak train movements? If so this should be stated in table's title.	Table 2 contains forecast average and forecast peak numbers, as well as capacity average and capacity peak numbers. Title changed as “overall” was not clear. Table 3 now edited to only include passenger train breakdown for simplicity.	-	-	Closed
6.		Potential slight error - best if difference caused by the 1 year gap between 2015/2025 to 2016/2026 is quantified in the Train Numbers Memo and in turn in the ONVR.	Table note should have read “2015/2025 passenger numbers in the train numbers memo assumed equivalent to 2016/2026”. However, this note is no longer relevant due to updated information on passenger numbers received in detailed design stage. Freight forecasts in the Train Numbers Memo are for 2016/2026.	-	-	Closed
7.	2.4 Source Noise Levels	References should be provided to confirm the Freight noise levels adopted in the modelling.	Note added to refer to the model validation exercise later in the assumptions memo.	-	-	Closed
8.	2.5 Potential changes in locomotive fleet mix over time	Presumably Figure 1's LAmax noise levels are all measured or corrected to the same distance of 15m from track centreline - if so please include this in Figure's title or as a footnote similar to Figures 2 and 3.	Correct – note included in figure	-	-	Closed

Item No.	Report / Report Chapter / Section	Comments 1	Response 1	Comments 2	Response 2	Open / Closed
9.	2.6 Potential improvements in Wagon Maintenance	It is stated 'The noise modelling does not assume any reduction in freight wagon wheel-rail source levels over time in the unmitigated situations'. Does that mean that a noise reduction is assumed in modelling any mitigated situations?	The mitigation is yet to be determined – the ONVR will discuss and examine the potential noise benefit of reductions over time, however this "modelling assumptions" letter is purely to establish the base case model parameters and model validation. Suggest the "Mitigation assumptions" in relation to changes in source level over time (if any are assumed) be reviewed by the IV in their review of the ONVR at a later stage.	-	-	Closed
10.	2.7 Other Noise Modelling Inputs including Curve Corrections	Different curve corrections for freight trains based on RailCorp report *'TR NV 20120809 Investigation into curve gain at Beecroft', 15 August 2012.* Copy of RailCorp report to be provided to RT&A. Report states '*that severe squeal noise around the Beecroft curves is not proportional to speed. This means that the correction factors for curve squeal used in the model should be adjusted in the event that higher or lower speeds are examined.*' If the squeal isn't proportional to speed, then why would there be a need to adjust for speed? Further explanation needed.	Copy of RailCorp report to be provided. The rail noise modelling algorithm in SoundPLAN treats noise from the wheel rail interface as being proportional to speed. Any corrections added to the wheel-rail source, such as that added to model curve squeal, are then only valid at the speed they were determined at. Keeping the same correction, but increasing the train speed in the model would result in prediction of a higher maximum noise level. In practice, the maximum squeal noise level is not dependent on speed, so care is required in modelling curve noise so as not to under or over-predict the impacts when modelling different speeds. Additional explanation added to this section.	RT&A to check link of fixed or constant corrections applied to sections of track only rather than the correction being applied in a way that links it to speed.	Response provided by SLR Consulting at meeting	Closed

Item No.	Report / Report Chapter / Section	Comments 1	Response 1	Comments 2	Response 2	Open / Closed
11.	2.8 Track Alignment and Ground terrain within Rail Corridor	*'SLR policy is to lower the Top of Rail (TOR) source height by 0.5 m to obtain additional screening from the surrounding terrain and noise barriers. Lowering the top of rail is cancelled out when SoundPlan adds 0.5 m to the rail string, resulting in a source height at TOR for the noise emission prediction.'* Justification through model validation measurement should be provided by SLR to justify deviation from the Nordic method.	SLR has used this approach to rail noise modelling since investigations in the RAC Pollution Reduction Program (2000) indicated that rail noise models validated better with measurements at locations near grazing incidence. Subsequent investigations and comparisons of different modelling algorithms (Nordic, CoRTN, FTA method, frequency dependent algorithms) confirm that the Nordic algorithm does not provide any barrier attenuation effect at grazing incidence (other algorithms give a 5 dB reduction at grazing incidence). Suggest that RT&A check SLR's comparison of barrier attenuation modelling algorithms (when checking model as a whole). The model validation exercise described later in the assumptions letter is considered to further justify this approach.	Measurements back in 2000 did not typically include concurrent acoustic rail roughness tests, therefore somewhat unreliable in terms of basing a model validation on that aspect. Were the areas / locations where noise monitoring was conducted with direct view of the rail line or were they in areas shielded with noise barriers, cuttings etc? Assuming that the model validation presented in this ONVR assessment relies mostly upon locations without shielding (eg noise barriers, large cuttings etc), ie with direct line of sight to sources, then how can the validation presented 'further justify' the approach of lowering the ToR source to obtain additional shielding. Also when a source is placed at ground (or very close to it) ground effects are affected which can adversely influence the modelling results. Nordics noise barrier algorithm differs based on distance from the barrier, which implies possible allowance of reflections off train car body gives 0dB loss at grazing incidence (up close) and a few dB loss at grazing incidence when further apart.	Response provided by SLR Consulting at meeting. A copy of the RAC Pollution Reduction Program (2000) was provided subsequent to the meeting.	Closed

Item No.	Report / Report Chapter / Section	Comments 1	Response 1	Comments 2	Response 2	Open / Closed
12.		*The report states 'hard ground has been assumed in the noise model'. Does the model adequately take into account any additional ground absorption provided by trees removed to allow the ETTT to go ahead for the 'no build' scenario compared with the 'build' scenario?* *Use of hard ground for the unmitigated case can lead to over prediction of mitigated cases where noise barriers are constructed. The Nordic barrier attenuation algorithms, like other Standards, subtract ground absorption when larger barriers are present. The base model should therefore be formed based on best estimates of actual ground type.* *Justification through measurement and verification should be provided for any deviation from the Nordic Method.*	The Nordic algorithm requires ground to be modelled as either fully hard or fully soft, intermediate values are not possible with this algorithm. Modelling the detailed effects of ground absorption changes is therefore not possible with the Nordic algorithm. It is recognised that a noise model requires some approximations and has limitations – the effects of changes in ground absorption due to tree removal is not something that can be modelled accurately. SLR policy is to assume hard ground for rail models in all cases, as this is consistent with the assumptions used to develop and validate our rolling stock source levels over many years. In practice at distances set back at greater distance from the alignment, noise levels would be less than predicted due to increased ground absorption. Ultimately the model validation against the measurements is relied on to be confident the assumptions around hard ground are valid.	See Comment 2 under Item 11 regarding on the reliance of model validation to justify the assumptions for hard ground. Increased ground absorption would lead to over predicting the noise benefits of putting in noise barriers, when in reality they may not be as beneficial.	Response provided by SLR Consulting at meeting.	Closed
13.		The resolution of ground topography outside the rail corridor needs to be provided. Given the 'complicated terrain' of this area, is the topographic data outside the rail corridor in 0.5m intervals or better?	Within corridor and in areas where ETTT are doing civil works, 0.2m intervals. This area ranges between 15m and 40m from the tracks. Outside this area, 2m intervals.	-	-	Closed
14.	2.9 Notch Settings	-	-	-	-	-

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15.	2.10 Train Speeds	With regard to freight, the following is noted: *'Assuming a lower speed for freight is the worst case assumption for engine / exhaust noise (as the source is present for longer) but has the potential to under predict freight wheel/rail impacts at higher speeds.* *Recognising this variability, it is proposed to model freight trains in the detailed design stage at a speed of 50 km/h on the Up Main and at a speed of 40 km/h on the existing Down Main and new Down Relief tracks. These speeds are consistent with the average Up and Down speeds observed on site in recent studies undertaken by Freight and Regional Development and SLR Consulting'*. Report notes that these assumptions will be tested, however there should be a statistical basis for selecting 50km/h for UP and 40km/h for DOWN in order to justify and provide a technical basis for selecting these speeds. Confirmation is required whether a speed sensitivity analysis was also carried out for passenger trains. RT&A to further review train speed profiles presented in Figures 8 to 11.	No speed sensitivity has been carried out for passenger trains, as their speeds are typically more consistent than freight speeds. Also because the future scenarios that control the ONVR outcomes are dominated by freight noise, so there is inherently less sensitivity to passenger speeds. Summary of statistical freight speeds observed on site added to assumptions letter.	-	-	Closed
16.	2.11 Traffic Distribution between tracks	-	-	-	-	-
17.	2.12 Braking Wagon and Bunching Noise	-	-	-	-	-

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18.	2.13 Diesel Locomotives Idling at Signals	Table 7's stationary idling freight locomotive noise levels have been taken from EPL's noise limits, however these need to be confirmed with actual measurements to close out any pending questions regarding how it is known whether existing freight locomotives actually meet the EPL limits or not.	Measured data from locomotive idling measurements and type tests added to discussion of validity of the EPL limits.	-	-	Closed
19.		Report states *'Idling locomotives have been included in the noise model as point sources distributed along the track in the 100 m leading up to the signal location'*. Idling noise sources have been included in the daytime "build" scenarios only, ie they are not included in the prior to opening and "Future 2026 No Build" scenarios, or in night time scenarios.	Noted – this is a new signal location introduced as a result of the project. Therefore this source is not included in the "no build" scenarios. See response to item 20 for the daytime/night-time assumption.	-	-	Closed
20.		How certain is the ETTT Alliance that there will not be any freight locomotives idling stationary during night-time hours and that when they do during the daytime it will be for 15mins?	The numbers of locomotives idling was provided by TfNSW Transport Services (responsible for timetable development and integration) in developing the inputs to the detailed design model. The 15 minute assumption follows from the operational reason for idling, being to wait allow a passenger service to take priority ahead of a freight train. The frequency of passenger services means that this should typically be a wait of up to 15 minutes, and often less.	How certain is the ETTT Alliance / TfNSW that there will not be any freight locomotives idling stationary during night-time hours?	Response provided by SLR Consulting at meeting was that at night there is less likelihood of congestion on the mainline.	Closed

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21.	3. Noise Model Validation	How was the SKM data analysed by SLR? Were the recordings from SKM's Ngara monitors analysed to collect individual train pass by noise levels or were the overall LAeq15hr and LAeq9hr for each 24hour period over the entire monitoring duration used and compared against the train pass bys that actually occurred concurrently with the noise monitoring?	A combination of methods was used. Where SKM were able to provide the raw data in csv format (4 locations), this was processed to extract individual passby events to validate the freight contribution. At all locations, overall LAeq results were also used to check the overall model results.	How was type, number of locos and length of train determined?	Response provided by SLR Consulting at meeting.	Closed
22.		Is there train pass by information (ie passenger and freight locomotives, train types, lengths and speeds) available which was collected concurrently with the noise monitoring conducted by both SLR and SKM?	Passenger numbers and train types from the working timetable at the time were used. Freight numbers were as shown in Table 2. Assumptions around freight train numbers, number of locomotives, lengths and speeds have been checked against FRD data from 2013 and SLR data from 2012. This data was not collected concurrently with the validation measurements.	Potential errors in approximations here….	Response provided by SLR Consulting at meeting.	Closed
23.		Spread and range of monitoring locations appears adequate. Regarding over predictions at V03 - could this over prediction be due to no ground absorption in the model? Significant trees would be removed to make way for ETTT. These trees were still in place in July 2013 when monitoring was carried out. Regarding over-predictions at V05, V12 and V14. Will there be further investigation into the mitigation trial to see if this is the cause of the significant over prediction, eg at V05?	We think it is unlikely to be a ground absorption issue, as if it were we would expect to see problems with the validation throughout the project area in vegetated areas. Further investigations and longer term measurement results into the benefit of the lubrication will be included in the ONVR. Results indicate that the benefit of the lubrication corresponds to the over-prediction at V05.	In that case, how many validation monitoring locations are in vegetated areas?	Response provided by SLR Consulting at meeting.	Closed

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24.	3.1 Discussion of Electric Passenger Train Contribution	Given that acoustic rail roughness was not measured on the Main North Line (MNL) at time of the noise monitoring, this could be a cause of some of the differences found between measured and modelled noise levels in Tables 10 and 11. If previous measurements of acoustic rail roughness on the MNL have shown low roughness levels, then that may be a reason why the electric train measured pass by Leq / LAE levels are lower than expected. Please explore and provide a response.	This is considered the most likely explanation. RailCorp measured roughness on the Main North in October 2011, soon after the attended passenger noise monitoring (September 2011). Roughness would not be expected to change significantly in this timeframe under normal traffic, and the low measured roughness indicates grinding did not occur between the noise measurements and roughness measurements. The RailCorp report showing measured roughness levels is available and reference to this has been added to the assumptions letter.	How will this be accounted for?	Response provided by SLR Consulting at meeting.	Closed
25.	3.2 Discussion of Freight Train Contribution	-	-	-	-	-
26.	3.3 Discussion of Overall Noise Predictions	Refer to comments raised under '3. Noise Model Validation' above.	Refer response under above item.	-	-	Closed
27.	4. Speed Sensitivity	The 'Maximum' freight locomotive speed used in the speed sensitivity analysis for the DOWN direction is 60km/h. This is in conflict with the freight speed data points presented in Figure 7 which shows two pass bys at approx. 70km/h and one pass by at approx. 75km/h.	It is acknowledged that some trains travel at higher speeds. For noise modelling, these outlier events are not representative of the typical situation. The noise parameter of key concern for this project is LAeq, which relates to average impacts. LAmax is also of concern, and the guidelines consider 95th percentile levels to remove outlier events. Furthermore, LAmax levels due to both locomotive exhaust and curve squeal are not proportional to speed – so modelling these higher speeds would not be representative.	-	-	Closed

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28.		The report states that the critical parameter is the LAeq rather than the LAmax parameter. However, Table 12 shows that for the 'As modelled' and 'Low speed freight' scenarios, there are more residential locations impacted in terms of exceeding the LAmax noise trigger level than there are exceeding the LAeq noise trigger level.	Noted – the reason LAeq is considered critical is because the IGANRIP and RING trigger levels include an "increase due to the project" component. The shift in freight traffic closer to residences as a result of the project is not sufficient to cause a 3 dB increase. So although many properties are above the LAmax overall trigger levels, the increase in LAmax noise levels as defined by the guidelines does not trigger consideration of mitigation. LAeq is critical because the increase in freight numbers as a result of the project means the 2 dB increase trigger is met at some locations, and in this situation consideration of mitigation is required at all locations where the overall levels are also above the LAeq trigger level.	-	-	Closed
29.	5 Conclusion	-	-	-	-	-

Revision History				
Revision Date	**Rev**	**By**	**Check**	**Notes/Changes**
14/02/2014	0	TG / GW	PK	Prepare Draft
18/02/2014	1	TG / GW	PK	Draft #1
19/02/2014	2	TG / GW	PK	Draft #2
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