



Transport
for NSW

T MU EN 00006 GU

Guide

AEO Guide to Noise and Vibration

Version 1.0

Issued date: 28 October 2015

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Standard governance

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Approver: Executive Director, Asset Standards Authority on behalf of the ASA Configuration Control Board

Document history

Version	Summary of Changes
1.0	First issue

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Preface

The Asset Standards Authority (ASA) is an independent unit within Transport for NSW (TfNSW) and is the network design and standards authority for defined NSW transport assets.

The ASA is responsible for developing engineering governance frameworks to support industry delivery in the assurance of design, safety, integrity, construction, and commissioning of transport assets for the whole asset life cycle. In order to achieve this, the ASA effectively discharges obligations as the authority for various technical, process, and planning matters across the asset life cycle.

The ASA collaborates with industry using stakeholder engagement activities to assist in achieving its mission. These activities help align the ASA to broader government expectations of making it clearer, simpler, and more attractive to do business within the NSW transport industry, allowing the supply chain to deliver safe, efficient, and competent transport services.

The ASA develops, maintains, controls, and publishes a suite of standards and other documentation for transport assets of TfNSW. Further, the ASA ensures that these standards are performance-based to create opportunities for innovation and improve access to a broader competitive supply chain.

This document is a resource for current and prospective Authorised Engineering Organisations (AEOs) to use as guidance for the provision of noise and vibration (NV) services to TfNSW.

This document is a first issue.

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1. Introduction

Noise and vibration (NV) is a diverse field that can affect all phases of an asset's life cycle and can involve many engineering disciplines. NV integration aims to ensure that the environmental noise impacts of a project are considered and mitigated, whilst applying so far as is reasonably practicable (SFAIRP) principles.

T MU MD 00009 ST *AEO Authorisation Requirements* states mandatory requirements for Authorised Engineering Organisation (AEO) authorisation. This document provides guidance on complying with the requirements of T MU MD 00009 ST for NV services.

2. Purpose

This document aims to provide an overview and guidance to current and prospective AEOs on the identification of the NV scope of services and NV integration. It also provides examples of the types of evidence for AEOs to demonstrate their capability to perform NV services in line with the requirements of T MU MD 00009 ST.

T MU MD 00009 F1 *AEO Engineering Services Matrix Template* defines a range of engineering services that AEOs can provide TfNSW, including NV services. This guide expands on the definitions for NV services and provides instruction on how to use the template for NV services.

2.1. Scope

This document provides guidance to AEOs on NV integration. It also provides examples of the type of evidence that is required to demonstrate compliance with the AEO framework. It is not within the scope of this guide to mandate documents for an AEO assessment.

2.2. Application

This document is intended to be used by current and prospective AEOs for guidance on meeting requirements to satisfy the provision of NV services to TfNSW. This document is informative only and should be read in conjunction with T MU MD 00009 ST, which sets out mandatory requirements for AEO services; and T MU MD 00009 F1 which defines those services.

This guide primarily relates to the heavy rail and light rail environments; however, its principles can be applied to other transport modes.

3. Reference documents

The following documents are cited in the text. For dated references, only the cited edition applies. For undated references, the latest edition of the referenced document applies.

Transport for NSW standards

T MU MD 00009 ST AEO Authorisation Requirements

T MU MD 00009 F1 AEO Engineering Services Matrix Template

TS 10504 AEO Guide to Engineering Management

TS 10503 AEO Guide to Engineering Competence Management

Other reference documents

ASA Charter

Department of Environment and Conservation NSW 2006, Assessing Vibration: a technical guideline

NSW Environment Protection Authority 2000, NSW Industrial Noise Policy

NSW Environment Protection Authority 2007, Interim Guideline for the Assessment of Noise from Rail Infrastructure Projects (*note this document has been superseded by the Rail Infrastructure Noise Guideline*)

NSW Environment Protection Authority 2013, Rail Infrastructure Noise Guideline

4. Terms and definitions

The following terms and definitions apply in this document:

AEO Authorised Engineering Organisation; (as defined in the ASA Charter) means a legal entity (which may include a Transport Agency as applicable) to whom the ASA has issued an ASA Authorisation

SFAIRP so far as is reasonably practicable

TfNSW Transport for New South Wales

NV noise and vibration

5. Noise and vibration in the asset life cycle

An AEO contracted to supply applicable engineering services to TfNSW should apply appropriate NV considerations and processes to applicable contracts. All NV activities need to be undertaken by competent personnel. Refer to TS 10503 *AEO Guide to Engineering Competence Management* for requirements on competence.

The AEO should be able to demonstrate how its NV processes (this includes providing supporting evidence of such processes) will be deployed for any NV work they wish to provide to TfNSW.

NV engagements occur during all stages of the asset life cycle. For example, engagements may occur during the following phases:

- planning phase - the development of an environmental impact statement (EIS) will contain a NV assessment
- operate and maintain phase - a NV investigation if concerns have been expressed by the community

NV processes form part of the AEO's engineering management. For information on engineering management see TS 10504 *AEO Guide to Engineering Management*.

NV requirements and processes should be scalable in their application and be based on the risk, novelty, potential for change to the NV footprint of TfNSW assets (including both fixed infrastructure and moving assets), and the complexity of each specific scope of works to ensure the effectiveness and efficiency of their application. The AEO should integrate the activities and specified delivery times into the relevant plans.

For any scope of works, the AEO should demonstrate evidence of how they have carried out their NV considerations and processes. Demonstration and justification of NV processes should form part of the assurance of the project or service. AEOs should be able to report on NV activities at each of the baseline stage gateways, as per TS 10504.

If, through the application of its NV process, an AEO determines that no NV activities are required, the AEO should document and present this decision and reasoning as part of the overall assurance argument for the project or service at the first gateway, and re-evaluate at each subsequent gateway, as per the process detailed in TS 10504.

6. Noise and vibration integration process

The NV integration process is based on established risk management principles and as a minimum requires an AEO to carry out the following tasks:

- establish the context of the project or service. This may include identification of the following:
 - how the project or service will be used
 - how integration into the existing network will occur
 - whether there is potential for change to the existing noise footprint
 - stakeholders and all applicable standards and regulatory requirements and policies, for example:
 - i. *Rail Infrastructure Noise Guideline*
 - ii. *NSW Industrial Noise Policy*
 - iii. *Assessing Vibration: a technical guideline*
 - level of criticality of NV integration in the project
- identify, record and manage NV issues and interactions throughout the phases of the asset life cycle
- analyse, manage and control the identified NV profile issues including:
 - conducting analysis on the nature of the specific NV issue and its risks using appropriate techniques and the relevant level of detail. This will determine the complexity of the project and potential controls.
 - demonstrate that NV has been integrated in all risk and engineering design analyses
- assess, based on the output of the NV analysis, if any changes to the design are required, including the adoption of any identified NV controls
- adopt and test the NV profile and controls within an iterative design process, including:
 - monitoring the effectiveness of the modelled profile and controls as part of the verification and validation process
 - closing out NV issues. This requires commitments from other parties, which should be agreed and documented prior to the close out of issues.
- communicate and consult with all stakeholders throughout the design development
- monitor and review the effectiveness of its NV integration process within a specific project and across the organisation

- capture and record lessons learnt regarding the operability and maintainability of the design from each project, to support the application of lessons learnt on other projects or services

AEOs should use their own systems to manage the NV integration process. A NV management plan is one recognised method for documenting the NV integration process.

7. **AEO noise and vibration services and the Engineering Services Matrix**

The NV service portfolio stretches across the full asset life cycle and should be considered when designing, upgrading or procuring infrastructure and assets such as new lines, tunnels or rolling stock. Consideration should also be given to construction noise, operational noise investigations and asset disposal activities.

In the 'Engineering Services Matrix' tab of T MU MD 00009 F1, there is only one line item for NV services. An AEO should complete this line item if the AEO intends to provide any NV services. The notes table at the bottom of the matrix should then be completed to provide more specific details of the NV services to be provided.

NV services have been divided into 14 sub-disciplines or services to which AEO status is authorised for, as detailed in the definitions tab of T MU MD 00009 F1. The information contained in T MU MD 00009 F1, particularly the definitions that are provided for the NV sub-disciplines, can assist in the identification of the type of noise and vibration services an organisation can provide.

Due to the expansive nature of the NV field and the limited scope for definitions in the matrix, it is strongly recommended that organisations wishing to gain AEO status for the provision of NV services identify the streams of NV they offer. Organisations wishing to gain AEO status should also be aware of the supporting evidence, as outlined in Section 8, that they are expected to provide.

8. Provision of noise and vibration documentation

Evidence that is supplied to support an AEO's case for approval to provide NV services should be applied to all TfNSW projects and services. Records should be kept for auditing by the ASA, as required.

It is expected that an AEO providing NV services should be able to demonstrate evidence covering information outlined in this section as a minimum.

The types of evidence may include, but are not limited to the following:

- noise and vibration regulatory framework and standards
- noise and vibration practice – competency and experience matrix
- noise and vibration engagement – data requirements
- quality assurance checklist – modelling software
- model review procedure

8.1. Noise and vibration regulatory framework and standards

The identification and knowledge of applicable standards and regulatory frameworks for NV on projects or services and the application of appropriate NV mitigation should be demonstrated (usually by a documented process). This should include the triggers for NV involvement and the identification of appropriate NV services.

Different NV projects have different triggers and frameworks. The design of a new public address system, for example, would differ to the design of a new rail tunnel. An AEO should consider such differences in the scope and complexity of the NV services they are delivering. Evidence of this can support AEO assessment and audit activities.

AEOs are responsible for ensuring that they remain up-to-date with applicable standards, frameworks and regulations. For example, the Department of Environment and Climate Change's *Interim Guideline for the Assessment of Noise from Rail Infrastructure Projects* has been superseded by the NSW Environment Protection Authority's *Rail Infrastructure Noise Guidelines*.

8.2. Noise and vibration practice – competency and experience

The identification and management of NV resources, including personnel, is a key component of an AEO's ability to deliver NV projects or services. AEOs are required to demonstrate how competence identification and management of both internal and external resources are managed.

Appendix A provides an example of how the management and identification of appropriate NV resources for a project could be presented. This type of document should be kept up-to-date as a dynamic document. Such documents may be used as evidence for AEO assessments and audits.

8.3. Data requirements for acoustic study

The identification and tracking of the required data and inputs for a NV project or service is expected to be captured by an AEO in delivering its services for TfNSW. Appendix B provides an example of a partially completed set of data requirements for a rail infrastructure NV project. This type of information may be used as evidence to support the AEO assessment and audit process.

Data requirements will change for different NV projects or services and it is expected that AEOs will manage and record these appropriately for any works delivered to TfNSW. The AEO assessment and audit may take into account how the AEO's system manages changes to data requirements. The AEO should provide evidence of how its system will manage changes to data requirements for each NV stream. AEOs need to keep records of the identification and tracking of data and inputs for a NV project or service as these will be used to support AEO assessment and audit.

8.4. Quality assurance checklists for modelling

Quality assurance is an essential part of the NV modelling process. Modelling programs require the manual input of many variables and the quality of these inputs needs to be assured. AEOs should be able to demonstrate to TfNSW the management and tracking of inputs to assist in the quality assurance of the noise models that are created. This evidence may be used to support AEO assessment and audit activities.

Examples of variables to input into modelling programs include the following:

- units of measurement
- minimum and maximum distance to receivers
- application of penalties
- topography

- climate data
- noise sources
- review date
- feedback

8.5. Review procedure

An AEO should be able to demonstrate how they review NV models as part of their assurance processes for TfNSW. This may be in the form of an internal or external review. In both cases, the review should demonstrate an appropriate level of competence and independence of the reviewer. This evidence may be used to support the AEO assessment and audit activities.

Appendix A Noise and vibration practice – competency and experience example

Figure 1 provides an example of what an AEO may produce as appropriate evidence for demonstrating management and identification of NV resources.

XXXXX Acoustics and Noise Practice

Name	Office	Email	Phone	Title	Membership / Certificate	Experience and Allocation			Experience Rating by Sub-discipline															Equipment	Other (Specify)			
						% time on noise	exp. Org (yrs)	total exp. (yrs)	Wheel-Rail Noise and Vibration	Rolling stock Design Noise and Vibration	Track Design Noise and Vibration	Specialist Vibration / Structural Engineering Issue	Construction Noise	Environmental Impact Assessments	Environmental Monitoring Programs	Other Transportation Noise	Industrial Noise	Building Acoustics	Electro-Acoustics	Work Health and Safety	Psycho-Acoustics	Other Related Disciplines	Product			Policy	Training	Underwater Acoustics
John Noise	Sydney			Principal, Noise and Vibration	MAAS, C(Eng AU)	100	18	27	4	4	2	3	3	1	1	1	3	2	1	3	1	2	1	3	4	1	B&K 2250	NoiseMap, CadnaA, SoundPlan
Jane Sound	Melbourne			Senior Noise Specialist	MAAS, INCE	100	12	17	4	3	3	2	3	1	1	1	2	2	2	2	1	2	1	1	3	0		Rollingstock design
Steve Noise	London			Senior Noise Specialist	C(Eng UK)	90	5	9	2	3	3	3	2	2	1	1	1	2	1	1	1	3	1	2	2	2		
Sue Sound	Sydney			Senior Environment Planner		40	6	12	2	2	2	1	3	2	0	2	0	0	0	1	0	0	0	2	2	1		

Experience Rating
4 = Extensive project experience (recognised expert in field)
3 = Considerable experience
2 = Moderate experience
1 = Limited experience or theoretical knowledge/training only
0 = Nil experience or knowledge

Figure 1 - Sample management and NV identification table

Appendix B Data requirements for acoustic study

Figure 2 provides an example of a partially completed set of data requirements for a rail infrastructure NV project.

Data Requirements for Acoustic Study											
Design Management											
Infrastructure - Rail											
Project Information											
Project Name		Client									
Project Number		Client Name									
Project Manager		Client Contact									
Acoustic PM		Site									
		Address									
SITE DETAILS											
Grouping	Required Information	Responsible Party		Life cycle Phase							
		XXXX	Client	Feasibility	Concept	Design	Fabricate / Manufacture	Install	Integrate, Test and Commission	Asset Maintenance	Disposal
Design plans	Trackform: <ul style="list-style-type: none"> - Ballast / non ballast - Slab - Floating slab - Fastener type - Fastener resilience - Sleeper type - Rail roughness - etc Other plans <ul style="list-style-type: none"> - a - b 										
Existing footprint	Traffic volume <ul style="list-style-type: none"> - Timetabled movements - Train details Rolling stock details <ul style="list-style-type: none"> - Rolling stock type - Speeds - etc - etc - Noise data - Rail noise database - Validation - Unspring mass - etc - etc 										
Proposed	Traffic volume <ul style="list-style-type: none"> - Timetabled movements - Train details Rolling stock details <ul style="list-style-type: none"> - Rolling stock type - Speeds - etc - etc - Noise data - Rail noise database - Validation - Unspring mass - etc - etc 										
Relevant data	Reports / data for: <ul style="list-style-type: none"> - Current site - Similar site 										
Construction	Plant and equipment <ul style="list-style-type: none"> - Type - Location - Noise data - Planned usage - Penalties <ul style="list-style-type: none"> - tonal - impulsive - low frequency 										
Topography											
Meteorological											
Existing acoustic environment											
Special project conditions											

Figure 2 – Data requirements for acoustic study