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Guide

Overview of the TfNSW Rail Noise Database

Version 1.0

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Standard governance

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Document history

Version	Summary of change
1.0	First issue

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Transport
Asset Standards
Authority

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 guidance document is the first issue and has to be read prior to and in conjunction with the NSW Rail Noise Database 2014 (RNDB). The RNDB is to be used by Authorised Engineering Organisations (AEO) to provide a consistent baseline data set in the development of noise models for rail projects.

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1. Introduction

Transport for NSW (TfNSW) is collaborating with industry to improve engineering governance and assurance of rail projects and to use skilled resources from both government and industry more effectively.

This document provides guidance to the Rail Noise Database (RNDB) 2014, which can be accessed by contacting the ASA.

The RNDB is an initiative to provide a consistent set of noise data from the measurements taken from 2008 to 2014 by SLR Consulting (SLR) for Transport for NSW.

The RNDB takes into account variables in rolling stock types, track alignment, track form and structures, poor track or wheel condition and corrections for speed, distance and microphone heights.

2. Purpose

This document aims to provide an overview and guidance to an AEO using the RNDB for the modelling of railway noise, relevant to providing engineering services to TfNSW, across the lifecycle of an asset, primarily during noise modelling activities.

The purpose of the RNDB is to provide a consistent set of noise data for AEOs engaged by TfNSW to perform noise modelling and mapping for new rail projects by creating a single source of truth. The RNDB defines the source noise levels for identified reference conditions which can then be utilised in commercial noise modelling software packages, rather than to develop a bespoke noise modelling algorithms.

This in turn should result in an increase in competition and value for dollar alike, thus reducing costs to TfNSW while delivering a high grade deliverable.

2.1. Scope

This document is to be used as a guide to the RNDB, with the intent of explaining the relationship of the RNDB to the ASA.

The scope of the RNDB is to provide the results of noise measurements taken around the NSW Heavy Rail network and the Inner West Light Rail network of TfNSW, by SLR Consulting between 2008 and 2014.

2.2. Application

The RNDB is intended for use by AEOs conducting rail noise modelling activities related to the engineering services provided on behalf of TfNSW. It applies to managing noise and vibration

issues that affects the system and environmental performance, which therefore influences the whole life costs of the delivered asset if additional mitigation measures are required.

This guide applies to the managers, designers, and engineers engaged under an AEO to provide new assets to TfNSW or rail upgrades or development projects that result in changes to the level of rail traffic on an existing network. However, some noise and vibration (NV) consideration should also be made for like-for-like replacement projects, to avoid recurrence of past mistakes or introducing the same problems.

The data sets provided in the RNDB can be used by organisations authorised to carry out engineering activities on behalf of TfNSW. Such activities include design of assets and the development of Environmental Impact Statements of rail projects and development projects near the corridor. The use of the data sets in the RNDB is not mandatory, but it is recommended to use as a baseline as it will support the provision of consistent noise data.

3. Reference documents

For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

International standards

ISO 3095:2013(E) Acoustics – Railway applications – Measurement of noise emitted by railbound vehicles

Transport for NSW standards

T MU EN 00002 TI ASA Rail Noise Database 2015

Other references

NSW Rail Noise Database Stage I, 1996

NSW Rail Noise Database Stage II, 2000

4. Terms and definitions

The following terms and definitions apply in this document:

AEO Authorised Engineering Organisation

ASA Asset Standards Authority

RNDB Rail Noise Database

TfNSW Transport for New South Wales

NSW New South Wales

FRD Freight and Regional Development division of TfNSW

RailCorp Network TfNSW owned heavy rail network managed by Sydney Trains

TfNSW networks Collective term for both the light and heavy rail networks owned by TfNSW

TEL transit exposure level A-weighted sound level of a train passage, measured for a time interval 'T' and normalised to the pass-by time 'Tp'.

A-weighting a weighting applied to a measured sound, depending on its frequency, to approximate the loudness of the sound as heard by the human ear

dB the level of a sound

dBA the level of a sound, measured using A-weighting

LpAFmax maximum A-weighted sound pressure level The maximum sound pressure level in dB(A) associated with the rail bound vehicle, with time weighted response set to F (fast).

5. Rail Noise Database Overview

The ASA in collaboration with Freight and Regional Development (FRD) of TfNSW commissioned SLR Consulting to develop the RNDB. The RNDB is a collection of noise levels from rail operations. The RNDB consists of the measurement of noise from rolling stock travelling on various types of track forms and structures.

5.1. Background of RNDB 2014

The RNDB 2014 is Stage III of the database project with previous stages each adding a level detail and development to be aligned with the contemporary understanding of the influences of railway noise.

Stage I was developed by Rail Access Corporation in 1996 and involved the measurement of noise from rolling stock on straight, level, continuously welded track in good condition and in open country, supplemented by additional measurements at crossover and turnout sites. In total, the Stage I database included 542 train pass-by events at 16 sites.

Stage II was prepared by Wilkinson Murray Pty Ltd in 2000. The measurements included 843 events recorded at 12 sites. In addition to providing a detailed summary of the overall noise levels, a detailed analysis of the third-octave noise spectra was undertaken. The report describes a noise prediction model which was developed to fit the reported measurements and to provide a methodology for predicting noise levels at other sites.

Stage III, (this version) is prepared by SLR and incorporates the results of noise measurements undertaken by SLR, at 10 sites across the RailCorp heavy rail network and the Inner West Light Rail network, by SLR between 2008 and 2014. It takes into account the contemporary understanding of the key influences and variables to railway noise. This version is to be used as a standalone document from stages I and II due to the large gap in time between Stage II

and this edition and the changes and development that have taken place in rolling stock and understanding of railway noise during this period.

5.2. Contents

The RNDB will provide AEOs with base data to investigate the impact of various factors that influence rail noise levels, while identifying differences of rolling stock noise signatures to allow modelling to adequately identify the variables associated with rail operations in NSW. The RNDB is split into three parts – the main body of the report and the two appendices.

5.3. Rail Noise Database – Main Body (Part 1)

The main body of the report consists of 8 chapters as described in Section 5.3.1 through Section 5.3.8.

5.3.1. Section 1

Section 1 provides an overview of the Rail Noise Database and history of previous versions.

5.3.2. Section 2

Section 2 provides a summary of the noise assessment requirements in NSW and the applicable noise measurement parameters.

5.3.3. Section 3

Section 3 provides a summary of the applicable noise measurement standards and the noise measurement parameters included in the Rail Noise Database.

5.3.4. Section 4

Section 4 provides a summary of the data analysis procedures and the correction values applied to adjust the measured noise levels to the standard reference conditions.

5.3.5. Section 5

Section 5 provides an overview of the 10 measurement sites and a summary of the rail roughness levels and track decay rate measurements (where available).

5.3.6. Section 6

Section 6 includes the noise measurement results for each class of rolling stock and the calculated statistical noise levels at the standard reference conditions and other correction factors for turnouts, small radius curves and bridge noise.

5.3.7. Section 7

Section 7 provides a concise summary of the statistical noise levels for each class of rolling stock and a summary of the current European TSI noise limits.

5.3.8. Section 8

Section 8 includes a brief conclusion and recommendations for further updates of the Rail Noise Database.

5.4. Rail Noise Database – Appendix A (Part 2)

Appendix A contains a summary of the noise measurement data collated at each measurement site, including a detailed description of the measurement site, operating conditions, monitoring equipment and measurement results. The format of these reports will be utilised as templates for adding additional measurement results to the NSW Rail Noise Database over time.

5.5. Rail Noise Database – Appendix B

Appendix B contains a summary of the Nordic Rail Prediction Method and equations for calculating the reference noise level.

5.6. Rail Noise Database – Appendix C (Part 3)

Appendix C comprises an Excel spreadsheet which includes the full set of noise measurement data for the NSW Rail Noise Database.

6. Rail Noise Database – Limitations

The RNDB is a guide only. The AEO is responsible for ensuring the accuracy and appropriateness of all data used in their design.

A variation exists within the data sets. This is because the data has not been refined to remove defects and other extraneous noise sources such as wheel flats and flanging.

The RNDB does not include any information on source levels ground borne noise and/or vibration from tunnels. The RNDB, in its current form is not an exhaustive database of all rolling stock types and operating conditions across the TfNSW networks.

7. Rail Noise Database – Considerations When Modelling

It is at the discretion of the AEO to determine the best approach to noise modelling and to take responsibility for the correct application of the RNDB. The approach to modelling shall be a transparent and documented process.

In an Environmental Impact Statement (EIS), the AEO should clearly state and reference the key points provided in Section 7.1 and Section 7.2 as well as any additional points deemed to be of relevance.

7.1. Noise sources identification

An impact assessment report shall identify which noise sources have been used from the RNDB, with a full reference such as “95th percentile freight locomotives/wagons TEL and LpAFmax at 80 km/h, 15 m distance and 1.5 m above Top of Rail as per Table 1 of the RNDB”. For rolling noise, the assumed rail roughness should be stated, for example, “rail roughness was assumed to be in accordance with ISO 3095:2013 upper limit curve for the acoustic rail roughness level”.

The referencing should be sufficient to allow the noise model to be independently verified, and for the consequences of the underlying assumptions to be made explicit.

7.2. Additional noise source identification

An impact assessment report shall identify which additional source levels have been used, and how, including the following:

- Curve noise, for example “all curves with radii less than 300 m were modelled by using a curve gain of 8 dBA for passenger trains and 12 dBA for freight trains in terms of LAeq, and 8 dBA and 15 dBA in terms of LAmax”.
- Bunching and stretching noise, for example “stretching noise was modelled using a correction of 6 dBA over the section of track between chainage 23.4 km and 23.9 km ahead of signal N 056 on the UP track. This correction was to 50% of modelled freight trains during the day and 30% during the night on the assumption that only 50% and 30% of freight trains would stop at this signal during the day and night, respectively”.
- Idling noise, for example “it was assumed that 20% of freight trains would stop at signal N 056 on the UP Main during the day and night periods, with the average idling time assumed to be 20 minutes. Idling noise was modelled as a point source at chainages 23.51 km and 23.52 km, assumed to represent the exhaust locations of locomotives stopped ahead of the signal. The idling noise levels were assumed to be constant at 70 dBA for all locomotives taken from Table 13.

- Impact noise around crossovers and switches, for example “impact noise was modelled as a point source correction of 6 dBA applied to all modelled trains for 10 m either side of all special track work”.
- Brake squeal, for example “brake squeal was modelled using a correction of 8 dBA over the section of track between chainage 23.4 km and 23.9 km ahead of signal N 056 on the UP track. This correction was to 50% of modelled freight trains during the day and 30% during the night on the assumption that only 50% and 30% of freight trains would stop at this signal during the day and night, respectively”.
- Wheel flats on rolling stock, for example “Wheel flats were modelled as a fixed correction of 3 dBA applied to 50% of freight trains and 20% of passenger trains”.

8. Rail Noise Database – Review Cycle

The RNDB will be reviewed periodically; this will include the removal of rolling stock classes that are no longer operating on the TfNSW rail networks and addition of new datasets and results of recent surveys.

8.1. New measurements

In order to keep the RNDB up to date, when noise surveys and data collection of heavy and light rail for TfNSW are conducted, the AEOs are requested to collate and provide the data collected to the ASA Noise and Vibration Specialist in a compatible format for inclusion in Part 2 and Part 3 of the RNDB.

8.2. Updates

The RNDB will be updated periodically in alignment with the review cycle. This will include the addition of datasets from new measurements conducted around the network and the removal of datasets for rolling stock that are no longer operational on the TfNSW networks.

9. Accessing the Rail Noise Database

The Rail Noise Database is not readily available via the ASA website. For access to the Rail Noise Database please contact standards@transport.nsw.gov.au.