Moama intersection upgrades

Noise impact assessment

March 2021

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Executive Summary

Transport for NSW in partnership with Major Road Projects Victoria (MRPV) are building a second Murray River bridge crossing at Echuca-Moama. The Echuca-Moama Bridge project (the project) is situated 405 kilometres south-west of Canberra and 185 kilometres north of Melbourne. Transport for NSW are leading construction of the project north of Boundary Road and MRPV are leading construction of the project south of Boundary Road.

The project is a second Murray River crossing which connects Echuca and Moama and aims to ease congestion on the existing crossing.

The impacts from the project were previously assessed in a Review of Environmental Factors in August 2015 (the REF NIA). SLR Consulting Australia Pty Ltd has been engaged to provide a review of the detailed design and complete a revised assessment of the operational road traffic noise impacts.

The key features of the project that have the potential to change operational noise impacts in the study area include:

- a new elevated road extending from the edge of the flood plain (limit of Transport-led work) to the east of the Murray River and connecting with the existing Cobb Highway.
- the opening of Francis Street as a through road to the Cobb Highway. This changes the functional class of Francis Street from a local road to a collector road and results in this section of Francis Street being categorised as a new road.
- redeveloping the intersection between the Cobb Highway, Perricoota Road and Francis Street.

The operational noise assessment concluded that:

- the project is predicted to result in significant increases in road traffic noise levels (ie greater than 2.0 dB) where new sources of road traffic noise are introduced. This includes:
    - along Francis Street where the project is predicted to result in increases of up to 9 dB due to additional traffic.
    - at receivers to the south of Boundary Road, adjacent to the new elevated road. Increases are predicted in this area as facades of receivers facing the new alignment are generally not exposed to existing road traffic noise.

Based on the predicted impacts, a total of 27 sensitive receiver buildings (28 individual floors) are predicted to have exceedances of the operational noise criteria.

An additional 25 receivers along Francis Street (24 residential and one child-care centre), and one residential receiver on the Cobb Highway have been identified as eligible for additional mitigation measures when compared to the REF NIA. The additional receivers on Francis Street were not previously identified in the REF NIA as that assessment had not considered the opening of Francis Street to the Cobb Highway and the associated change in road function and corresponding increase in traffic volumes. The most appropriate form of mitigation for these newly identified receivers is considered to be at-property treatment.

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Author:	SLR Consulting Australia Pty Ltd
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1 Introduction

Transport for NSW (Transport) in partnership with Major Road Projects Victoria (MRPV) are building a second Murray River bridge crossing at Echuca-Moama. The Echuca-Moama Bridge project (the project) is situated 405 kilometres south-west of Canberra and 185 kilometres north of Melbourne.

The impacts from the project were previously assessed in a Review of Environmental Factors (REF) in August 2015. As part of the REF, a Noise Impact Assessment (the REF NIA) was carried out by Renzo Tonin and Associates (report reference *20150731_Final_EMB_EES_Noise_Impact_Assessment_Report*, dated 31 July 2015).

SLR Consulting Australia Pty Ltd (SLR) has been engaged by Transport to provide a review of the detailed design of the project with respect to the REF NIA and complete a revised assessment of the operational road traffic noise impacts.

1.1 Project overview

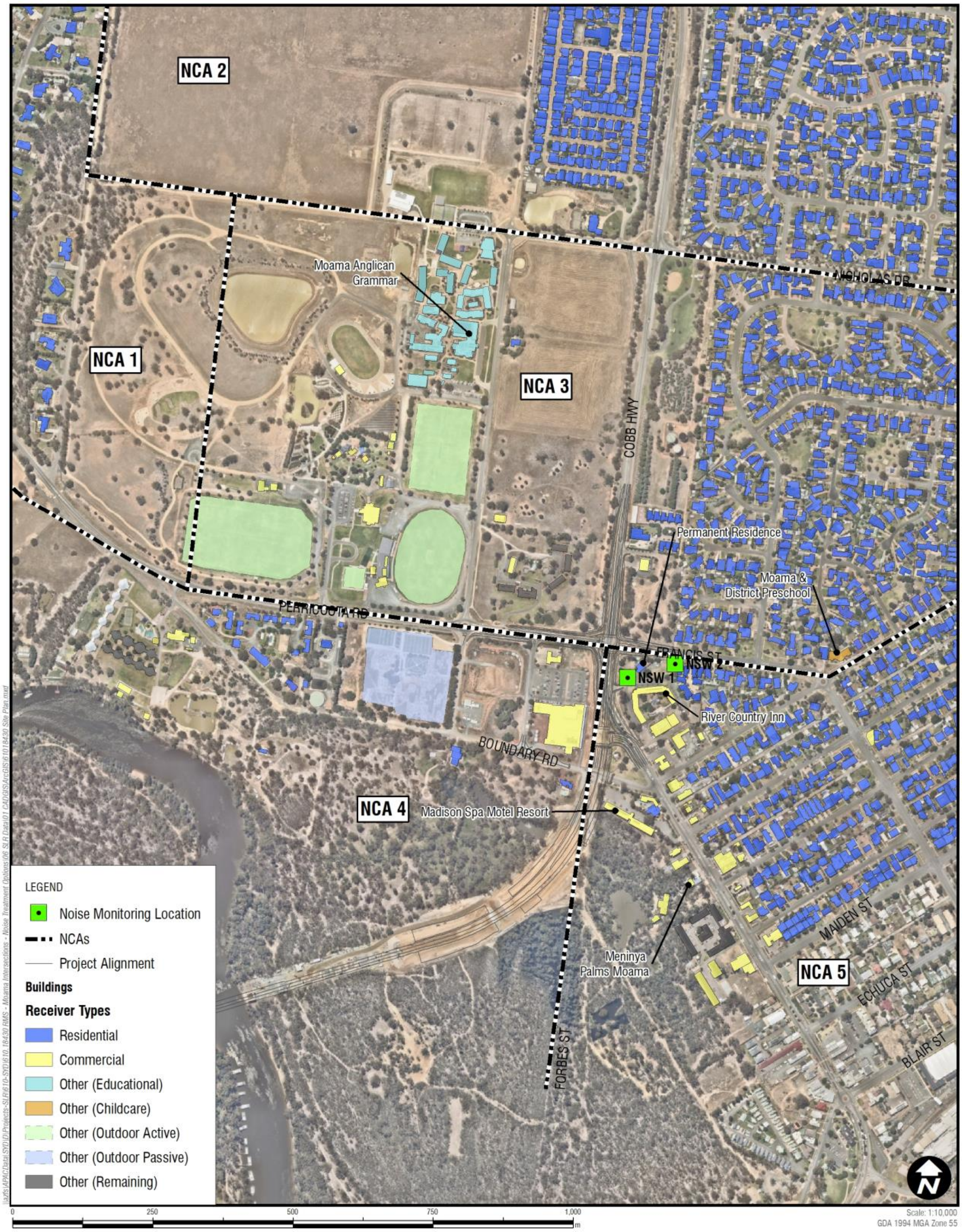
The project is a second Murray River crossing connecting the towns of Echuca and Moama. It aims to ease congestion on the existing river crossing by providing an alternative option. The alignment connects with the existing Cobb Highway at the intersection of Perricoota Road and extends south-west to cross the Murray River. The location of the project is shown in **Figure 1**.

The project within NSW includes:

- extending an elevated road from the edge of the flood plain to the east of the Murray River and connecting with the existing Cobb Highway
- realigning the northern extent of Meninya Street to tie into an intersection with the new road
- opening Francis Street as a through road to the Cobb Highway
- redeveloping the intersection between the Cobb Highway, Perricoota Road and Francis Street

Construction responsibilities for the project change hands at Boundary Road, Moama. Transport for NSW are leading construction of the project north of Boundary Road and MRPV are leading construction of the project south of Boundary Road.

Figure 1. The project – site plan, receivers and noise monitoring locations



2 Existing environment

The project is located in Moama. Major roads in the study area include the Cobb Highway, Meninya Street and Perricoota Road.

The existing noise levels in the study area are generally controlled by road traffic noise on the surrounding road network, with some general environmental noise associated with rural areas.

The area surrounding the project is mainly residential. Commercial receivers are located along Meninya Street as well as a number of hotels near the intersection of Cobb Highway and Perricoota Road, including the River Country Inn and Madison Spa Resort.

This operational assessment uses a number of Noise Catchment Areas (NCAs) that reflect the land uses in the study area. These are shown in **Figure 1** and described in **Table 1**.

Table 1. Noise catchment areas and surrounding land uses

NCA	Typical distance to project	Type/use
NCA 1	To the west of the project and mainly residential. The receivers are over 300m away.	Residential
NCA 2	To the north of the project and mainly residential. The nearest receivers are over 200m away.	Residential
NCA 3	To the west and east of the project. Receivers to the west are educational facilities at Moama Anglican Grammar School. Receivers to the east are mainly residential.	Residential and educational
NCA 4	To the south-west of the project and manly residential. The nearest residential receivers are over 200m away.	Residential and commercial
NCA 5	To the south-east of the project and manly residential with some commercial and hotels. The nearest receivers are adjacent to the works.	Residential, commercial and ‘other sensitive’.

Receivers potentially sensitive to noise and vibration have been categorised as residential dwellings, commercial/industrial buildings, or ‘other sensitive’ land users which includes educational institutions, childcare centres, medical facilities, places of worship, outdoor recreation areas, etc. Receiver types and locations are shown in **Figure 1**.

The ‘other sensitive’ non-residential receivers identified in the study area are shown in **Table 2**.

Table 2. 'Other sensitive' receivers (non-residential)

NCA	Description	Address	Type
NCA03	Moama Anglican Grammar	2 Kirchhofer St, Moama NSW 2731	Educational
	Moama & District Preschool	Regent Street, Moama NSW 2731	Childcare
NCA05	River Country Inn	79-81 Meninya St, Moama NSW 2731	Hotel
	Madison Spa Motel Resort	80 Meninya St, Moama NSW 2731	Hotel
	Meninya Palms Moama	54/56 Meninya St, Moama NSW 2731	Hotel

2.1 Existing noise surveys and monitoring

Noise monitoring data from the REF NIA (completed by Renzo Tonin in 2014) has been used in this assessment. The data has been used to validate the noise model together with the traffic counts in the REF NIA.

The noise monitoring locations are shown in **Figure 1** and the results are summarised in **Table 3**.

Table 3. Summary of unattended noise monitoring results

Noise monitoring location	Measured noise level (dBA)				
	Background noise (RBL)			Average noise (L_{Aeq})[1]	
	Daytime	Evening	Night	Daytime	Night time
NSW1 – River Country Inn, 79-81 Meninya Street, Moama	50	49	37	59	50
NSW2 – River Country Inn, Francis Street, Moama	45	37	32	52	47

Note 1: Operational road traffic noise is assessed during the daytime which is 7am to 10pm and night-time which is 10pm to 7am. See the NSW EPA Road Noise Policy.

3 Operational noise and vibration guidelines

The guidelines used to assess the potential operational road traffic noise impacts from the project are listed in **Table 4.** The guidelines aim to protect the community and environment from excessive noise and vibration impacts from the long-term operation of the project.

Table 4. Operational road traffic noise and vibration guidelines

Guideline/policy name	When guideline is used
Road Noise Policy (RNP) (DECCW, 2011)	Operational road traffic noise assessment
Noise Criteria Guideline (NCG) (Roads and Maritime, 2015)	Defines Transport for NSW's interpretation of the RNP and details how criteria are applied to sensitive receivers
Noise Mitigation Guideline (NMG) (Roads and Maritime, 2015)	Details how additional mitigation measures are to be applied to road infrastructure projects
Model Validation Guideline (Roads and Maritime, 2018)	Contains procedures for validating operational road traffic noise models
Preparing an Operational Noise and Vibration Assessment (Roads and Maritime, 2011)	Defines how to complete operational road traffic noise and vibration assessments
Recommended design sound levels and reverberation times for building interiors	Provides recommended design sound levels for internal areas of occupied spaces
At-Receiver Noise Treatment Guideline (Roads and Maritime, 2017)	Provides an overview and discussion of feasible and reasonable at-receiver noise mitigation measures

3.1 Airborne noise – road noise policy and noise criteria guideline

The NSW *Road Noise Policy* (RNP) is used to assess and manage potential airborne noise impacts from new and redeveloped road projects.

This assessment is carried out with guidance from the *Noise Criteria Guideline* (NCG) which is Transport for NSW's interpretation of the RNP and provides a consistent approach to identifying road noise criteria for infrastructure projects.

The RNP and NCG provide non-mandatory criteria for residential and 'other sensitive' land uses. Where a project results in road traffic noise levels which are predicted to be above the criteria, the project should investigate feasible and reasonable noise mitigation measures to minimise the impacts.

The RNP and NCG use the following terms to describe and assess the impacts from road projects:

- '**No build**': the assessment scenario used to predict noise levels if the project were not to go ahead

- ‘**Build**’: the assessment scenario used to predict noise levels with the project.

The difference between the ‘build’ and the ‘no build’ noise levels is used to determine the impact of the project.

Residential receivers

The project is a mixture of both ‘redeveloped’ roads and ‘new’ roads. A road is ‘redeveloped’ where works are in an existing road corridor and the existing road is not substantially realigned. Roads are classed as ‘new’ where the road construction is in an undeveloped corridor, where an existing road is substantially realigned or where the functional class of a road changes, such as where a local road becomes a larger collector road. The relevant noise criteria for residential receivers are shown in **Table 5**.

Table 5. NCG criteria for residential receivers

Road category	Type of project/land use	Assessment criteria	
		Daytime (7am 10pm)	Night time (10pm 7am)
Freeway /arterial/ sub-arterial roads	1. Existing residences affected by noise from **new** freeway/arterial/sub-arterial road corridors	$L_{Aeq(15\text{-hour})}$ 55 (external)	$L_{Aeq(9\text{-hour})}$ 50 (external)
	2. Existing residences affected by noise from **redevelopment** of existing freeway/arterial/sub-arterial roads 3. Existing residences affected by **additional traffic** on existing freeways/arterial/sub-arterial roads generated by land use developments	$L_{Aeq(15\text{-hour})}$ 60 (external)	$L_{Aeq(9\text{-hour})}$ 55 (external)
	4. Existing residences affected by both new roads and the redevelopment of existing freeway/arterial/sub-arterial roads in a **transition zone**[1]	Between $L_{Aeq(15\text{-hour})}$ 55-60 (external)	Between $L_{Aeq(9\text{-hour})}$ 50-55 (external)
	5. Existing residences affected by increases in traffic noise of 12dB or more from **new** freeway/arterial/sub-arterial roads[2]	Between $L_{Aeq(15\text{-hour})}$ 42-55 (external)	Between $L_{Aeq(9\text{-hour})}$ 42-50 (external)
	6. Existing residences affected by increases in traffic noise of 12dB or more from **redevelopment** of existing freeway/arterial/sub-arterial roads[2]	Between $L_{Aeq(15\text{-hour})}$ 42-60 (external)	Between $L_{Aeq(9\text{-hour})}$ 42-55 (external)

*Note 1: The criteria assigned to the entire residence depend on the proportion of noise coming from the new and redeveloped roads. Transition zones are discussed further in **Section 4.2**.*

Note 2: The criteria at each facade are determined from the existing traffic noise level plus 12dB.

The criteria are lower in the night-time due to communities being more sensitive to noise impacts during this period.

The RNP and NCG require noise to be assessed at project opening and for a future design year, which is typically 10 years after opening. For this project, the at-opening year is 2022 and the future design year is 2032.

The NCG requires transition zones to be applied at the point where road categories change to provide a smooth transition in noise criteria.

‘Other sensitive’ land uses

Several ‘other sensitive’ non-residential land uses have been identified in the study area. The noise criteria for these receivers are shown in **Table 6.** The NCG does not consider commercial and industrial receivers as being sensitive to operational airborne road traffic noise impacts.

Table 6. NCG criteria for other sensitive receivers

Existing sensitive land use	Assessment criteria		Additional considerations
	Daytime (7am 10pm)	Night time (10pm 7am)	
1. School classrooms	$L_{Aeq(1\text{-hour})}$ 40 (internal)[1]	-	In the case of buildings used for education or health care, noise level criteria for spaces other than classrooms and wards may be obtained by interpolation from the ‘maximum’ levels shown in Australian Standard 2107:2000 (Standards Australia 2000).
2. Hospital wards	$L_{Aeq(1\text{-hour})}$ 35 (internal)	$L_{Aeq(1\text{-hour})}$ 35 (internal)	
3. Places of worship	$L_{Aeq(1\text{-hour})}$ 40 (internal)[1]	$L_{Aeq(1\text{-hour})}$ 40 (internal)[1]	The criteria are internal, ie the inside of a church. Areas outside the place of worship, such as a churchyard or cemetery, may also be a place of worship. Therefore, in determining appropriate criteria for such external areas, it should be established what is in these areas that may be affected by road traffic noise.
4. Open space (active use	$L_{Aeq(15\text{-hour})}$ 60 (external)	-	Active recreation is characterised by sporting activities and activities which generate their own noise or focus for participants, making them less sensitive to external noise intrusion.
5. Open space (passive use)	$L_{Aeq(15\text{-hour})}$ 55 (external)	-	Passive recreation is characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion (eg playing chess, reading).
6. Childcare facilities	Sleeping rooms $L_{Aeq(1\text{-hour})}$ 35 (internal)[1] Indoor play areas $L_{Aeq(1\text{-hour})}$ 40 (internal)[1] Outdoor play areas $L_{Aeq(1\text{-hour})}$ 55 (internal)	-	Multipurpose spaces (eg shared indoor play/sleeping rooms) should meet the lower of the respective criteria. Measurements for sleeping rooms should be taken during designated sleeping times for the facility, or if these are not known, during the highest hourly traffic noise level during the opening hours of the facility.

Existing sensitive land use	Assessment criteria		Additional considerations
	Daytime (7am 10pm)	Night time (10pm 7am)	
7. Aged care facilities	-	-	The criteria for residential land uses should be applied to these facilities.

Note 1: The criteria are specified as an internal noise level for this receiver category. As the noise model predicts external noise levels, it has been conservatively assumed that all schools and places of worship have openable windows and external noise levels are 10 dB higher than the corresponding internal level, which is representative of windows being partially open to provide ventilation.

A number of hotels are located close to the project. Hotels can have staff who reside permanently on site and the NCG residential criteria have been applied where permanent residences have been identified at each hotel.

3.2 Potential road traffic noise impacts on the surrounding road network

Where a project results in traffic redistribution, noise impacts can occur on the surrounding road network due to vehicles using different routes after the project is complete. The NCG criteria (see **Table 5**) are therefore to be applied to the surrounding road network where a road project generates an increase in road traffic noise of more than 2.0dB.

3.3 Operational vibration

Vehicles operating on roadways are unlikely to cause vibration impacts at adjacent receivers unless there are significant road irregularities, such as poorly maintained bridge joints. As the new and upgraded roads in the project area would be designed and constructed to avoid significant irregularities, impacts from operational vibration are not expected and have not been assessed any further.

4 Operational road traffic methodology

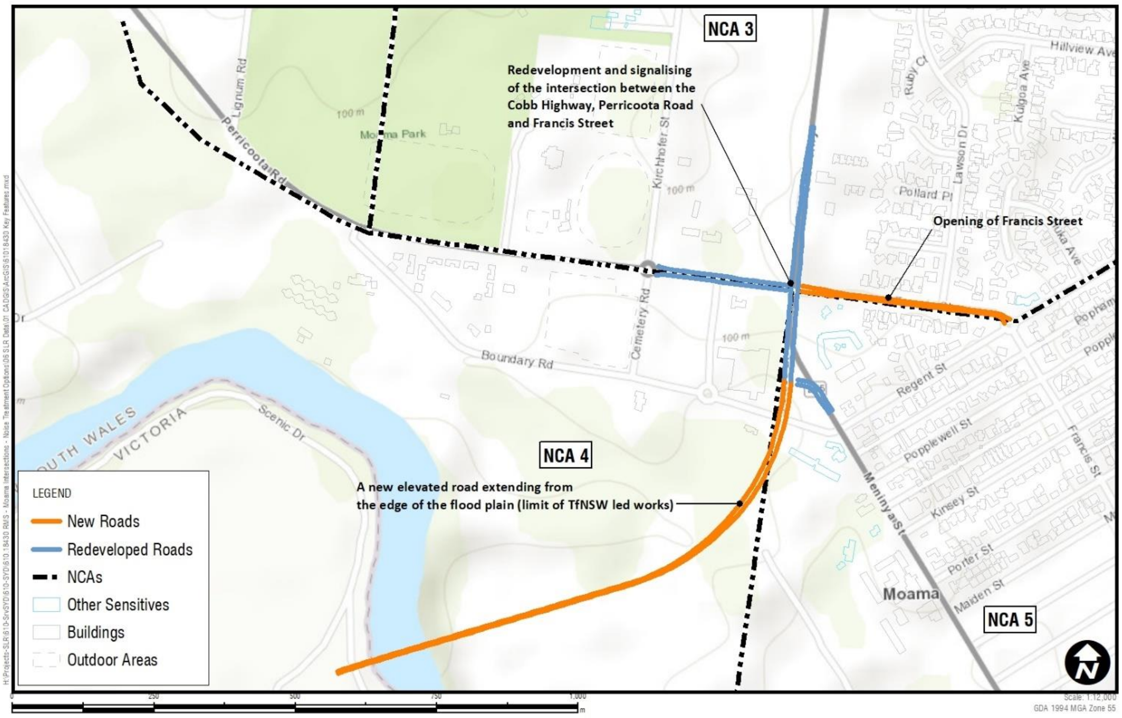
4.1 Key operational features of the project

The key features of the project that have the potential to change operational noise impacts in the study area include:

- New elevated road extending from the edge of the flood plain (limit of Transport-led work) to the east of the Murray River, connecting with the existing Cobb Highway.
- Opening Francis Street as a through road to the Cobb Highway. This changes the functional class of Francis Street from a local road to a collector road and results in this section of Francis Street being considered as a new road.
- Redeveloping the intersection between the Cobb Highway, Perricoota Road and Francis Street.

The key features of the project are shown in **Figure 2**.

Figure 2. Key features of the project and road classifications



4.2 Noise model

A noise model of the project area has been constructed using SoundPLAN noise modelling software. The model uses *Calculation of Road Traffic Noise* (CoRTN) (UK Department of Transport, 1988) algorithms to predict noise levels from operational road traffic.

Local terrain, receiver buildings and structures were digitised in the noise model to develop a three-dimensional representation of the project and surrounding areas.

The ‘**no build**’ scenarios use the existing road alignment geometry, including all existing structures and features within the road corridor included.

The ‘**build**’ scenarios use the design of the project which includes all widening works and road changes.

Project and non-project roads

Roads where design or engineering changes are proposed as part of the project are considered as ‘project’ roads. Existing roads with no work are considered ‘non-project’.

All major roads in the project area have been modelled together with major roads on the surrounding road network to determine the contributions from ‘project’ and ‘non-project’ roads at individual receivers, as required by the NCG.

Changes to traffic redistribution on the surrounding road network can result in altered noise impacts after a project is complete. The NCG criteria have been applied to the surrounding road network where an increase in road traffic noise of more than 2.0dB is predicted.

Road types

The NCG classifies project roads as either ‘new’ or ‘redeveloped’. The road classifications used in the assessment are shown in **Figure 2.**

Assessment area and transition zones

The RNP defines the operational road traffic noise study area as being 600 metres from the centre line of the outermost trafficable lane on each side of the project alignment.

The NCG also requires transition zones to be applied at the point where road categories change from ‘new’ to ‘redeveloped’ to provide a smooth transition in noise criteria. The transition zone for the project is shown in **Appendix B**.

Traffic data

The traffic data used in the noise modelling was supplied by the project team and is provided in **Appendix B**.

Noise modelling parameters

The modelling parameters used in the noise predictions are detailed in **Table 7**.

Table 7. Summary of model inputs and paramounts

Input parameter	Date source/comment
Ground topography	The noise model includes a ‘digital ground model’ which is an accurate 3D representation of the terrain in the study area. The ground model was made from LIDAR point cloud data. Design details for the project were provided by Transport. Indicative design details for the future bridge to the south of the project were also included in the model.

Input parameter	Date source/comment
Buildings, receiver locations and floors	Buildings can provide screening to more distant locations of the project. The buildings in the noise model were generated from aerial photography, with heights derived from LIDAR data. The model predicts noise to every facade of every identified receiver in the assessment area using the following heights: • ground floor – 1.5 m[1] • first floor – 4.5 m[1]
Study area	The assessment area extends a minimum of 600 metres from the project roads, as required by the NCG.
Assessment timeframes	The project is assessed 'at-opening' in 2022 and in the 'future design' year in 2032.
Traffic volumes	Existing traffic volumes were taken from the REF NIA. This data was used to model the existing situation and validate the operational model. The predicted traffic volumes for the 2022 and 2032 assessment years were provided by the project team. All major roads in the study area were included in the noise model.
Vehicle speeds	Existing vehicle speeds were taken from the REF NIA and used to validate the noise model. Existing and future posted vehicle speeds were used in the operational assessment.
Road noise source heights and corrections	Vehicles generally emit road traffic noise at four source heights. These are represented in the noise model by the following: • cars (at 0.5 m height with a source correction of 0.0 dB) • truck tyres (at 0.5 m height with a source correction of -5.4 dB) • truck engines (at 1.5 m height with a source correction of -2.4 dB) • truck exhausts (at 3.6 m height with a source correction of -8.5 dB)
Road surface corrections	The future road surfaces are assumed to be dense graded asphalt (DGA) in all areas except for an area of around 255 m extending from the edge of the floodplain to near the Moama Marketplace, which will be low noise pavement (stone mastic asphalt) as per the Submissions Report. The source correction for these surface types are: • dense graded asphalt +0.0 dB • stone mastic asphalt -1.0 dB (correction taken from REF NIA) • chip seal +2.5 dB
Ground absorption	Noise levels at receivers can be influenced by the type of ground between the source of noise and the receiver. A ground absorption factor of 0.75 has been used in the noise model to represent the open/rural areas. A factor of 0.5 has been applied to the area to the east of the Cobb Highway, as per the Transport for NSW's *Model Validation Guideline* specification for residential areas.
Noise barriers	The noise barrier detailed in the Submissions Report (ie 3.5 m adjacent to the Madison Spa Resort) has been included in the Build noise model.
General corrections	The model also includes the following corrections: • Facade reflections +2.5 dB • L_{A10} to L_{Aeq} -3 dB

4.2.1 Noise model validation

To validate the road traffic noise model, the 2014 existing scenario was modelled and compared to noise measurements in Appendix D of the REF NIA. The validation process was carried out in the same method used in the REF NIA, which compared model predicted noise levels to those monitored at the western facade of the River Country Inn. A summary of the noise model validation is presented in **Table 8**.

Table 8. Model validation summary

Location	Noise level (dBA)					
	Daytime			Night time		
	Measured	Predicted	Difference	Measured	Predicted	Difference
River Country Inn, 79-81 Meninya Street, Moama	58.8	59.3	0.5	50.3	50.4	0.1

Transport's *Environmental Noise Management Manual* (ENMM) notes *"it should be recognised that noise prediction modelling has some accuracy limitations and will commonly produce acceptable errors of around 2dBA"*.

The predictions show that the noise model is within the expected tolerance and is valid for predicting road traffic noise levels for the project.

4.3 Noise mitigation

Transport's *Noise Mitigation Guideline* (NMG) provides guidance in managing and controlling road traffic noise and describes the principles to be applied when reviewing noise mitigation. The NMG recognises the NCG criteria are not always practicable and it is not always feasible or reasonable to expect they are achieved.

The NMG provides three triggers where a receiver may qualify for consideration of 'additional noise mitigation' (beyond the use of 'integrated noise reduction measures'). These are:

- **Trigger 1** – the predicted 'build' noise level exceeds the NCG controlling criterion and the noise level increase due to the project (ie the noise predictions for the 'build' minus the 'no build') is greater than 2.0 dB
- **Trigger 2** – the predicted 'build' noise level is 5 dB or more above the NCG controlling criterion (ie exceeds the cumulative limit) and the receiver is significantly influenced by project road noise, regardless of the incremental impact of the project
- **Trigger 3** – the noise level contribution from the road project is acute – daytime $L_{Aeq(15\text{-}hour)}$ 65 dBA or higher, or night-time $L_{Aeq(9\text{-}hour)}$ 60 dBA or higher – even if noise levels are controlled by a non-project road.

The eligibility of receivers for consideration of ‘additional noise mitigation’ is determined before the benefit of low noise pavement and noise barriers is included. The requirement for the project is to provide feasible and reasonable additional mitigation to eligible receivers with the aim of meeting the NCG controlling criterion.

For receivers that qualify for consideration of ’additional noise mitigation’, potential noise mitigation measures are to be considered in the following order of preference:

- at-source mitigation:
  - quieter road pavement surfaces
- in-corridor mitigation:
  - noise mounds
  - noise barriers
- at-receiver mitigation:
  - at-property treatments.

4.4 Review of the REF NIA, mitigation and design changes

The detailed design of the project is largely consistent with what was assessed in the REF NIA, with the exception of the road alignment adjacent to Woolworths Moama. At this location both lanes of the Cobb Highway have been adjusted to the east by around 10 metres when compared to the REF NIA. The intersection with Meninya Street has also been adjusted, moving approximately 20 metres south of the previous location.

The REF NIA identified a number of options for mitigating the potential road traffic noise impacts. The Submissions Report expanded on the options and committed to providing the measures shown in **Table 9**.

Table 9. Submissions report environmental safeguards

No.	Impact	Environmental safeguards
42	Noise and vibration – operational noise impacts to 2 Boundary Rd, Madison Spa Resort and River Country Inn	The detailed design of the NSW proposal will incorporate the following noise mitigation measures: • architectural treatment to 2 Boundary Road • adjacent to Madison Spa Resort: 3.5m high noise wall on the eastern side of the road with a length of about 150m (chainage 3200-3350) • low noise pavement (dense graded or stone mastic asphalt) for a length of about 255 m from the edge of the floodplain to near the Moama Marketplace • Transport for NSW would provide architectural fresh air ventilation in the River Country Inn’s Meninya Street-facing rooms (subject to detailed assessment by appropriate acoustic experts), which would allow tenants to maintain ventilation without the need to open windows, reducing noise impacts.

The updated design assessed in this report includes the noise barrier that is on the eastern side of the alignment near Madison Spa Resort and the section of low noise pavement in this area, as recommended in the REF NIA.

5 Operational road traffic noise assessment

The operational road traffic noise impacts from the detailed design of the project have been re-assessed against the requirements of the NCG and NMG.

Operational road traffic noise impacts ‘without mitigation’ (ie without the measures committed to in the Submissions Report in **Table 9**) have been predicted for all sensitive receivers in the study area to determine the base-case impacts of the project. The operational impacts are discussed in the following sections.

5.1 Residential receivers

The predicted operational road noise levels at residential receivers are summarised in **Table 10** for the 2022 at-opening and 2032 future design scenarios. The table shows the worst-case impacts in each NCA, which are typically for receivers nearest to the project area.

Receivers are generally most affected by the project in the daytime period in 2032 with respect to the NCG criteria and NMG triggers, and this scenario is considered to control the assessment in terms of determining the worst-case impacts and requirements for mitigation.

The predicted noise levels for the controlling 2032 daytime scenario are shown in **Figure 3** and the predicted change in noise levels (‘build’ (with project) minus ‘no build’ (without project)) for the same scenario is in **Figure 4**.

Detailed noise predictions at triggered receivers are in **Appendix B**.

Table 10. Predicted road traffic noise levels at most affected residential receivers in each NCA

NCA	Predicted Noise Level (dBA)[1]								Number of Triggered Buildings[2]			
	At opening (2022)				Future design (2032)							
	No build (without project)		Build (with project)		No build (without project)		Build (with project)					
	Day	Night	Day	Night	Day	Night	Day	Night	Trigger 1 >2.0dB	Trigger 2 Cumulative	Trigger 3 Acute	Total
NCA01[3]	-	-	-	-	-	-	-	-	-	-	-	-
NCA02[3]	-	-	-	-	-	-	-	-	-	-	-	-
NCA03	66	57	66	56	67	58	66	57	11	10	1	12
NCA04	57	47	66	56	57	48	66	57	2	2	2	2
NCA05	62	53	63	54	63	53	64	54	13	13	-	13
											Total	**27**

Note 1: Daytime and night-time are $L_{Aeq(15\text{-}hour)}$ and $L_{Aeq(9\text{-}hour)}$ noise levels, respectively.
*Note 2: The NMG triggers are discussed in **Section 4.3**.*
Note 3: NCA does not contain residential receivers or the receivers are distant from the project.

Figure 3. Worst-case predicted operational noise levels (2032 daytime, 'build')

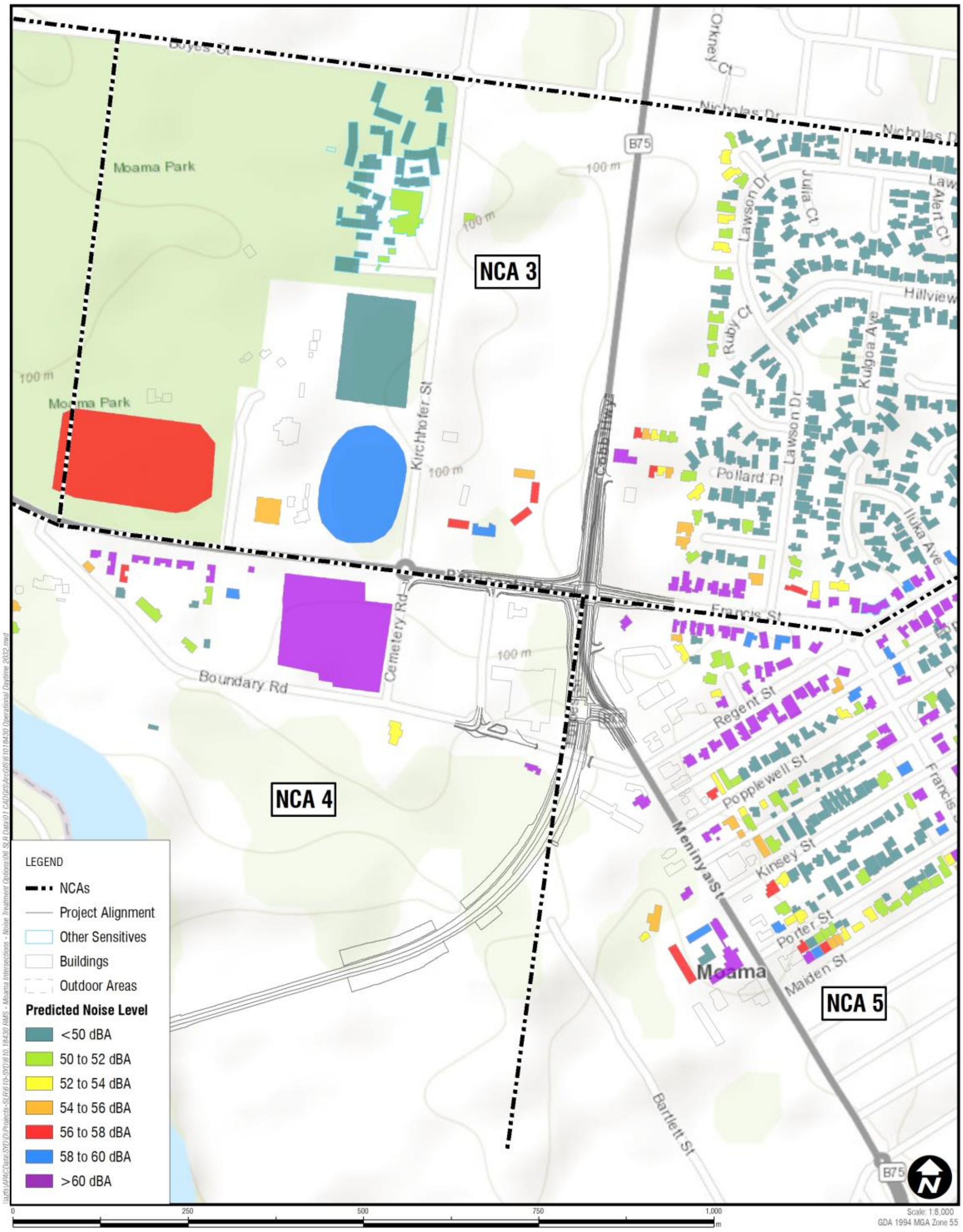
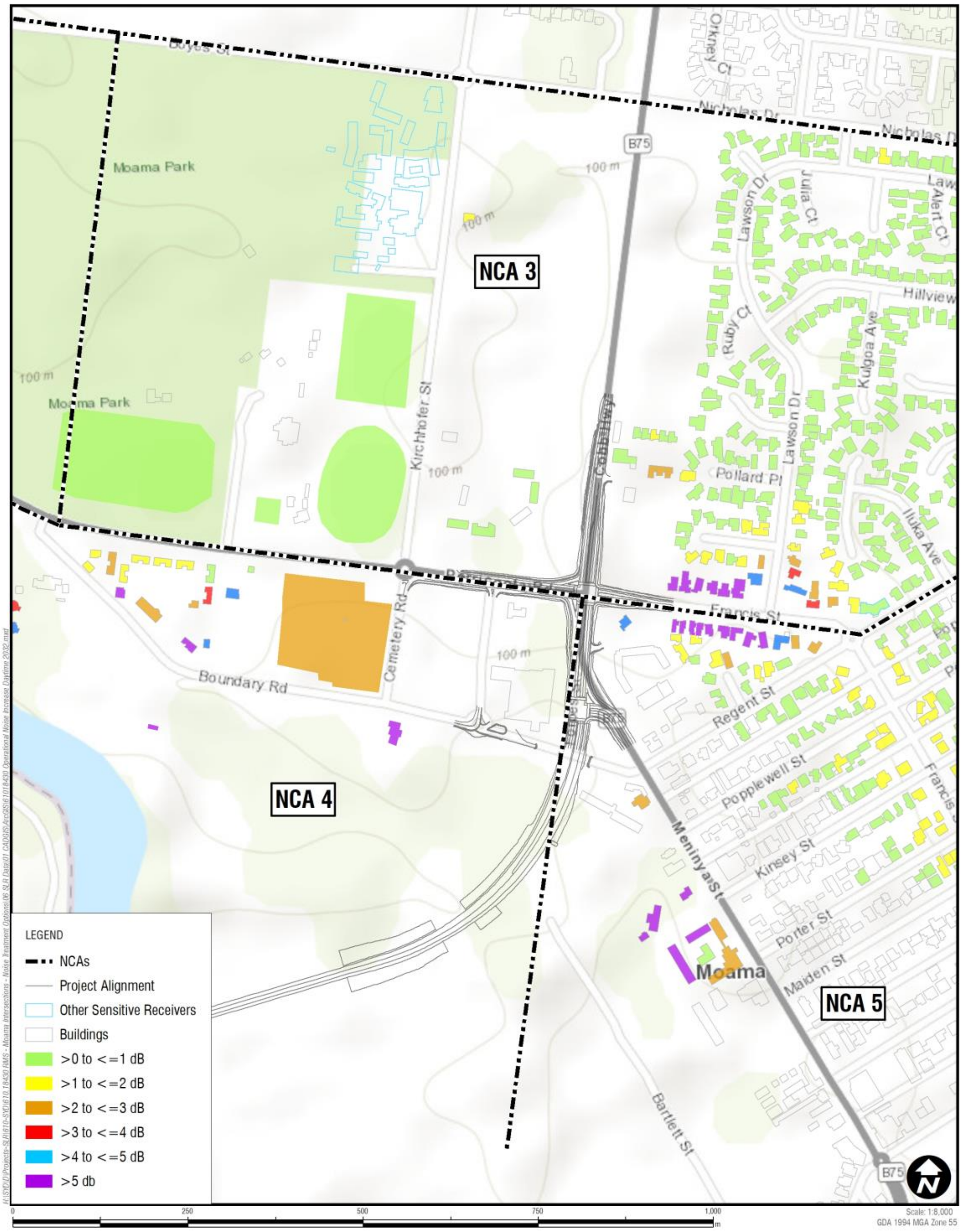


Figure 4. Worst-case predicted change in operational noise (2032 night-time, 'build' minus 'no build')



The above results show the following:

- The project would introduce new sources of road traffic noise to some areas. This includes a new elevated road that connects with the existing Cobb Highway and the opening of Francis Street as a through road to the Cobb Highway, which changes the functional class of the road. Increases in road traffic noise levels (ie greater than 2.0dB) are predicted in certain areas, including:
  - NCA03/NCA04 – along Francis Street. This area is predicted to have increases of up to 9 dB due to additional traffic. The largest increases are predicted at receivers adjacent to Francis Street.
  - NCA05 – receivers adjacent to the new elevated road. Substantial increases are predicted in this area as facades of receivers facing the new alignment in this catchment are generally not exposed to existing road traffic noise impacts.
- In other areas of the project, increases in noise due to the project are less than 2.0 dB.
- Exceedances of the NCG cumulative limit criteria (ie 5 dB or more above the NCG controlling criterion) are predicted generally at the same receivers where greater than 2.0 dB increases are predicted.
- 220 Cobb Highway and 17 Boundary Road are predicted to be subject to acute noise levels (ie daytime noise levels are 65 dBA or higher, or night-time noise levels are 60 dBA or higher).
- In summary, the project results in:
  - 26 residential receivers having increases of greater than 2.0 dB
  - 25 residential receivers being above the cumulative limit criteria
  - three floors of two residential receivers having acute noise levels
  - in total 27 residential receiver floors are predicted to have exceedances of the NCG operational road traffic noise criteria

5.2 'Other sensitive' receivers

'Other sensitive' receivers predicted to have exceedances of the trigger levels are shown in **Table 11** for the controlling 2032 scenario. The location of the triggered 'other sensitive' receivers are shown in **Figure 5.**

Table 11. ‘Other sensitive’ receiver triggers

NCA	Receiver	Type	NMG Triggers[1]		
			Trigger 1 >2.0 dB	Trigger 2 Cumulative	Trigger 3 Acute
NCA03	Moama & District Preschool	Childcare	-	Y	-

In summary, the above assessment shows one ‘other sensitive’ receiver building is predicted to have an exceedance of the NCG operational road traffic noise criteria.

It is noted that a number of hotels are in the project area. Hotels can have staff who reside permanently on site and the NCG residential criteria have been applied to these receivers at the identified locations of any permanent residence.

5.3 Receivers eligible for consideration of ‘additional noise mitigation’

The receivers identified as eligible for consideration of ‘additional noise mitigation’ (ie triggered receivers) are summarised in **Table 12,** and shown in **Figure 5** and **Table 13**.

Table 12. Receivers eligible for consideration of ‘additional noise mitigation’

NCA	Number of triggered buildings (floors)		Comments
	Residential	Other sensitive	
NCA01	- (-)	- (-)	No triggered receivers identified
NCA02	- (-)	- (-)	No triggered receivers identified
NCA03	12 (12)	1 (1)	Residential receivers are triggered in this catchment along Francis Street due to the project opening access to this road from the Cobb Highway. One residential receiver is also triggered adjacent to Cobb Highway. The triggered ‘other sensitive’ receiver is Moama & District Preschool on Francis Street
NCA04	1 (2)	- (-)	One residential receiver is triggered in this catchment on Boundary Road
NCA05	13 (13)	- (-)	Residential receivers are triggered in this catchment along Francis Street due to the project opening access to this road from the Cobb Highway. The permanent residence at the River Country Inn hotel is also triggered.
Sub total	**26 (27)**	**1 (1)**	-
TOTAL	**27 (28)**		

Note 1: The count of ‘floors’ represents separate floors within each building. For some receivers there would likely be multiple units within the same floor, such as in residential apartment blocks.

In summary, the above assessment shows that a total of 27 sensitive receiver buildings (28 individual floors) are predicted to have exceedances of the NCG operational road traffic noise criteria and are therefore eligible for consideration of 'additional noise mitigation'.

Figure 5. Receivers eligible for consideration of additional mitigation

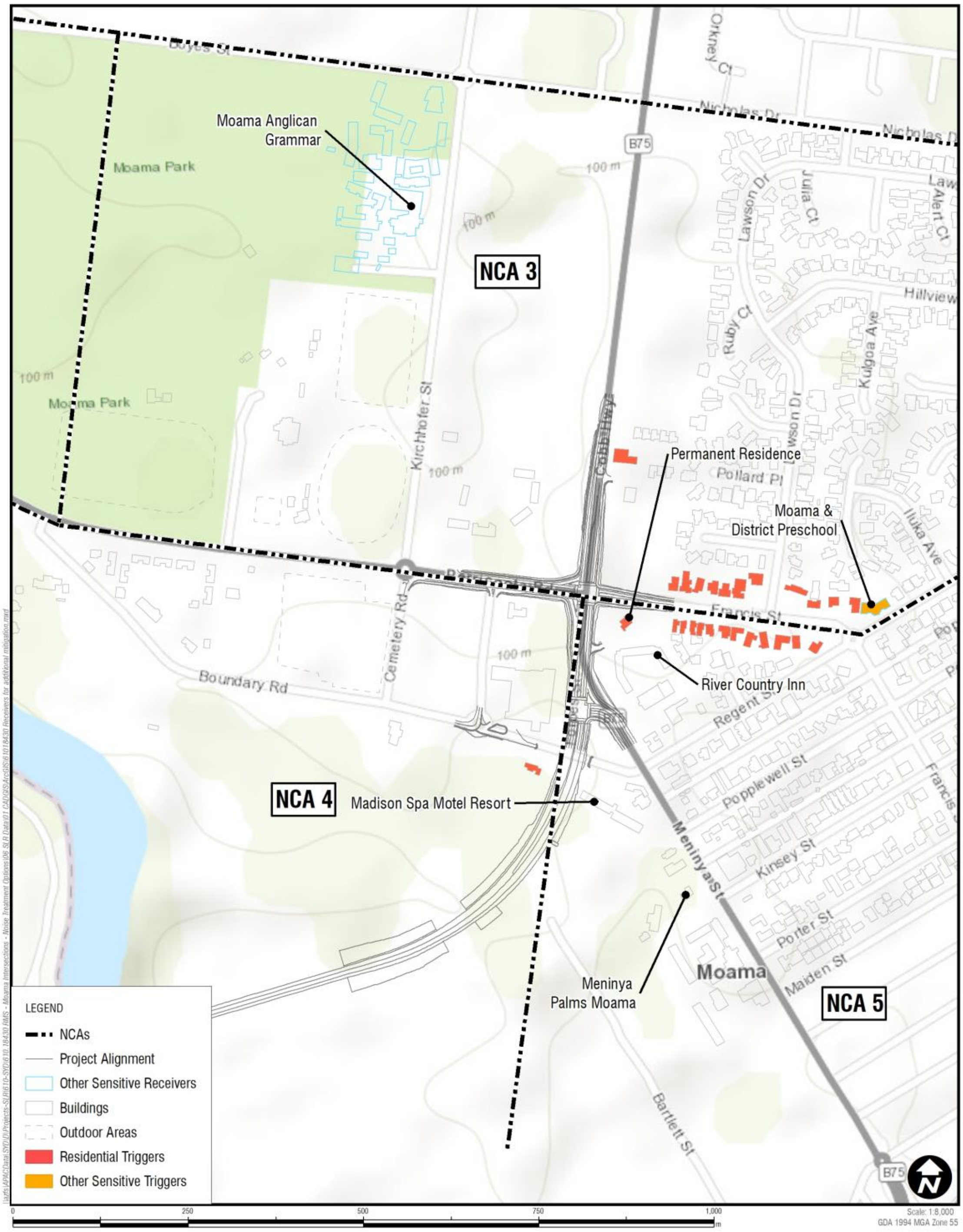


Table 13. Receiver floors eligible for consideration of at-property treatment

Count	NCA	Address	Floor	Receiver	Identified in REF NIA
1	NCA03	Receiver 1	1	Residential	-
2	NCA03	Receiver 2	1	Residential	-
3	NCA03	Receiver 3	1	Residential	-
4	NCA03	Receiver 4	1	Residential	-
5	NCA03	Receiver 5	1	Residential	-
6	NCA03	Receiver 6	1	Residential	-
7	NCA03	Receiver 7	1	Residential	-
8	NCA03	Receiver 8	1	Residential	-
9	NCA03	Receiver 9	1	Residential	-
10	NCA03	Receiver 10	1	Residential	-
11	NCA03	Receiver 11	1	Residential	-
12	NCA03	Receiver 12	1	Residential	-
13	NCA03	Receiver 13	1	Other (Childcare)	-
14	NCA04	Receiver 14	1	Residential	Yes (2 Boundary Road)
15	NCA04	Receiver 15	2	Residential	Yes (2 Boundary Road)
16	NCA05	Receiver 16	1	Residential	-
17	NCA05	Receiver 17	1	Residential	-
18	NCA05	Receiver 18	1	Residential	-
19	NCA05	Receiver 19	1	Residential	-
20	NCA05	Receiver 20	1	Residential	-
21	NCA05	Receiver 21	1	Residential	-
22	NCA05	Receiver 22	1	Residential	-
23	NCA05	Receiver 23	1	Residential	-
24	NCA05	Receiver 24	1	Residential	-
25	NCA05	Receiver 25	1	Residential	-
26	NCA05	Receiver 26	1	Residential	-
27	NCA05	Receiver 27	1	Residential	-
28	NCA05	Receiver 28	1	Residential	-

The assessment shows 25 receiver floors along Francis Street (24 residential and one childcare) have been additionally identified as eligible for additional mitigation in comparison to the REF NIA. As these newly identified properties require access from Francis Street, the most appropriate form of mitigation is considered to be at-property treatment. At-property treatment is also the most appropriate measure for the additional residential receiver identified on Cobb Highway.

The reason for the discrepancy between the REF NIA and the current assessment is due to the change in Francis Street from a no-through local road to a collector road with through traffic and associated traffic volume increase. The change in road usage was not included in the REF NIA.

As noted in **Section 4.4**, at-property treatment was previously committed to in the Submissions Report at:

- 17 Boundary Road, Moama (incorrectly identified as 2 Boundary Road in the REF NIA and Submissions Report)
- River Country Inn (Meninya Street facing rooms)

5.4 At-property mitigation – architectural treatment

Where residual impacts remain, the final approach used to minimise road traffic noise impacts is at-property mitigation. This typically involves using architectural treatments such as thicker glazing and doors, or upgraded facade constructions to achieve appropriate internal noise levels.

These treatments are generally limited to architectural upgrades to building elements and the installation of acoustic screen walls close to the receiver where they also protect outdoor living spaces.

Architectural treatments are more effective when they are applied to masonry buildings compared to lightly clad timber framed structures. Caution should be taken before providing treatments to buildings in a poor state as they may not be effective.

The architectural treatments provided are typically limited to:

- fresh air ventilation systems to meet the National Construction Code of Australia requirements with the windows and doors shut
- upgraded windows and glazing, and solid core doors on the exposed facades of the substantial structures only (eg masonry or insulated weatherboard cladding with sealed underfloor). These techniques would be unlikely to produce any noticeable benefit for light frame structures with no acoustic insulation in the walls
- upgrading window or door seals and appropriately treating sub-floor ventilation
- sealing wall vents
- sealing the underfloor below the bearers
- sealing eaves.

The requirement for at-property treatment would be investigated further as the project progresses through detail design.

6 Conclusion

Transport for NSW in partnership with Major Road Projects Victoria (MRPV), is building a second Murray River bridge crossing at Echuca-Moama. SLR Consulting Australia Pty Ltd (SLR) has been engaged by TfNSW to provide a review of the detailed design for the project, with respect to the REF NIA and complete a revised assessment of the operational road traffic noise impacts in NSW.

Operational road traffic noise levels have been predicted for the detailed design and the assessment has identified an additional 25 receivers along Francis Street (24 residential and one child-care centre) and one residential receiver on the Cobb Highway as eligible for consideration of at-property treatment.

The additional receivers on Francis Street were not previously identified as the REF NIA had not considered the impacts from joining the western end of Francis Street to the Cobb Highway and the associated function class change and increase in traffic volume.

Appendix A: Acoustic terminology

1. Sound Level or Noise Level

The terms 'sound' and 'noise' are almost interchangeable, except that 'noise' often refers to unwanted sound.

Sound (or noise) consists of minute fluctuations in atmospheric pressure. The human ear responds to changes in sound pressure over a very wide range with the loudest sound pressure to which the human ear can respond being ten million times greater than the softest. The decibel (abbreviated as dB) scale reduces this ratio to a more manageable size by the use of logarithms.

The symbols SPL, L or LP are commonly used to represent Sound Pressure Level. The symbol LA represents A-weighted Sound Pressure Level. The standard reference unit for Sound Pressure Levels expressed in decibels is 2 x 10^{-5} Pa.

2. 'A' Weighted Sound Pressure Level

The overall level of a sound is usually expressed in terms of dBA, which is measured using a sound level meter with an 'A-weighting' filter. This is an electronic filter having a frequency response corresponding approximately to that of human hearing.

People's hearing is most sensitive to sounds at mid frequencies (500 Hz to 4,000 Hz), and less sensitive at lower and higher frequencies. Different sources having the same dBA level generally sound about equally loud.

A change of 1 dB or 2 dB in the level of a sound is difficult for most people to detect, whilst a 3 dB to 5 dB change corresponds to a small but noticeable change in loudness. A 10 dB change corresponds to an approximate doubling or halving in loudness. The table below lists examples of typical noise levels.

Sound Pressure Level (dBA)	Typical Source	Subjective Evaluation
130	Threshold of pain	Intolerable
120	Heavy rock concert	Extremely noisy
110	Grinding on steel	
100	Loud car horn at 3 m	Very noisy
90	Construction site with pneumatic hammering	
80	Kerbside of busy street	Loud
70	Loud radio or television	
60	Department store	Moderate to quiet
50	General Office	
40	Inside private office	Quiet to very quiet
30	Inside bedroom	
20	Recording studio	Almost silent

Other weightings (eg B, C and D) are less commonly used than A-weighting. Sound Levels measured without any weighting are referred to as 'linear', and the units are expressed as dB(lin) or dB.

3. Sound Power Level

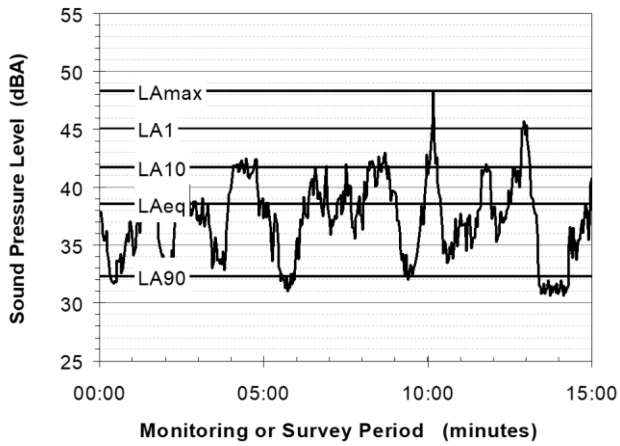
The Sound Power of a source is the rate at which it emits acoustic energy. As with Sound Pressure Levels, Sound Power Levels are expressed in decibel units (dB or dBA), but may be identified by the symbols SWL or LW, or by the reference unit 10^{-12} W.

The relationship between Sound Power and Sound Pressure is similar to the effect of an electric radiator, which is characterised by a power rating but has an effect on the surrounding environment that can be measured in terms of a different parameter, temperature.

4. Statistical Noise Levels

Sounds that vary in level over time, such as road traffic noise and most community noise, are commonly described in terms of the statistical exceedance levels LAN, where LAN is the A-weighted sound pressure level exceeded for N% of a given measurement period. For example, the LA1 is the noise level exceeded for 1% of the time, LA10 the noise exceeded for 10% of the time, and so on.

The following figure presents a hypothetical 15 minute noise survey, illustrating various common statistical indices of interest.



Of particular relevance, are:

LA1 The noise level exceeded for 1% of the 15 minute interval.

LA10 The noise level exceeded for 10% of the 15 minute interval. This is commonly referred to as the average maximum noise level.

LA90 The noise level exceeded for 90% of the sample period. This noise level is described as the average minimum background sound level (in the absence of the source under consideration), or simply the background level.

LAeq The A-weighted equivalent noise level (basically, the average noise level). It is defined as the steady sound level that contains the same amount of acoustical energy as the corresponding time-varying sound.

5. Frequency Analysis

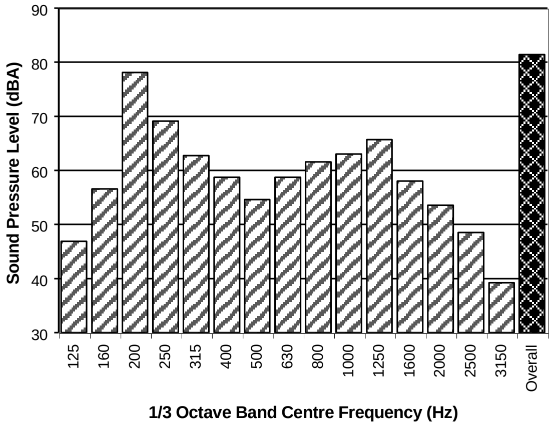
Frequency analysis is the process used to examine the tones (or frequency components) which make up the overall noise or vibration signal.

The units for frequency are Hertz (Hz), which represent the number of cycles per second.

Frequency analysis can be in:

- Octave bands (where the centre frequency and width of each band is double the previous band)
- 1/3 octave bands (three bands in each octave band)
- Narrow band (where the spectrum is divided into 400 or more bands of equal width)

The following figure shows a 1/3 octave band frequency analysis where the noise is dominated by the 200 Hz band. Note that the indicated level of each individual band is less than the overall level, which is the logarithmic sum of the bands.



6. Annoying Noise (Special Audible Characteristics)

A louder noise will generally be more annoying to nearby receivers than a quieter one. However, noise is often also found to be more annoying and result in larger impacts where the following characteristics are apparent:

- **Tonality** - tonal noise contains one or more prominent tones (ie differences in distinct frequency components between adjoining octave or 1/3 octave bands), and is normally regarded as more annoying than 'broad band' noise.
- **Impulsiveness** - an impulsive noise is characterised by one or more short sharp peaks in the time domain, such as occurs during hammering.
- **Intermittency** - intermittent noise varies in level with the change in level being clearly audible. An example would include mechanical plant cycling on and off.
- **Low Frequency Noise** - low frequency noise contains significant energy in the lower frequency bands, which are typically taken to be in the 10 to 160 Hz region.

7. Vibration

Vibration may be defined as cyclic or transient motion. This motion can be measured in terms of its displacement, velocity or acceleration. Most assessments of human response to vibration or the risk of damage to buildings use measurements of vibration velocity. These may be expressed in terms of 'peak' velocity or 'rms' velocity.

The former is the maximum instantaneous velocity, without any averaging, and is sometimes referred to as 'peak particle velocity', or PPV. The latter incorporates 'root mean squared' averaging over some defined time period.

Vibration measurements may be carried out in a single axis or alternatively as triaxial measurements (ie vertical, longitudinal and transverse).

The common units for velocity are millimetres per second (mm/s). As with noise, decibel units can also be used, in which case the reference level should always be stated. A vibration level V, expressed in mm/s can be converted to decibels by the formula 20 log (V/Vo), where Vo is the reference level (10^{-9} m/s). Care is required in this regard, as other reference levels may be used.

8. Human Perception of Vibration

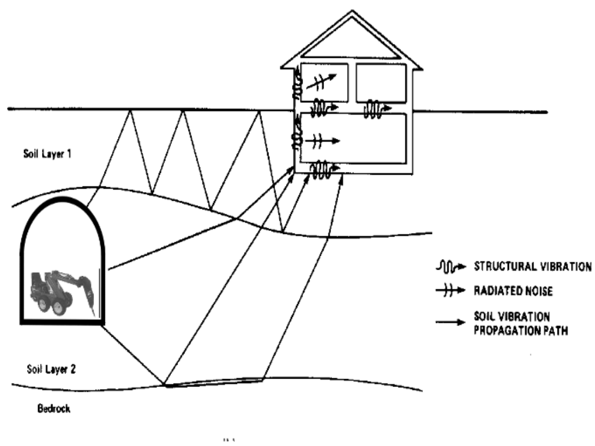
People are able to 'feel' vibration at levels lower than those required to cause even superficial damage to the most susceptible classes of building (even though they may not be disturbed by the motion). An individual's perception of motion or response to vibration depends very strongly on previous experience and expectations, and on other connotations associated with the perceived source of the vibration. For example, the vibration that a person responds to as 'normal' in a car, bus or train is considerably higher than what is perceived as 'normal' in a shop, office or dwelling.

9. Ground-borne Noise, Structure-borne Noise and Regenerated Noise

Noise that propagates through a structure as vibration and is radiated by vibrating wall and floor surfaces is termed 'structure-borne noise', 'ground-borne noise' or 'regenerated noise'. This noise originates as vibration and propagates between the source and receiver through the ground and/or building structural elements, rather than through the air.

Typical sources of ground-borne or structure-borne noise include tunnelling works, underground railways, excavation plant (eg rockbreakers), and building services plant (eg fans, compressors and generators).

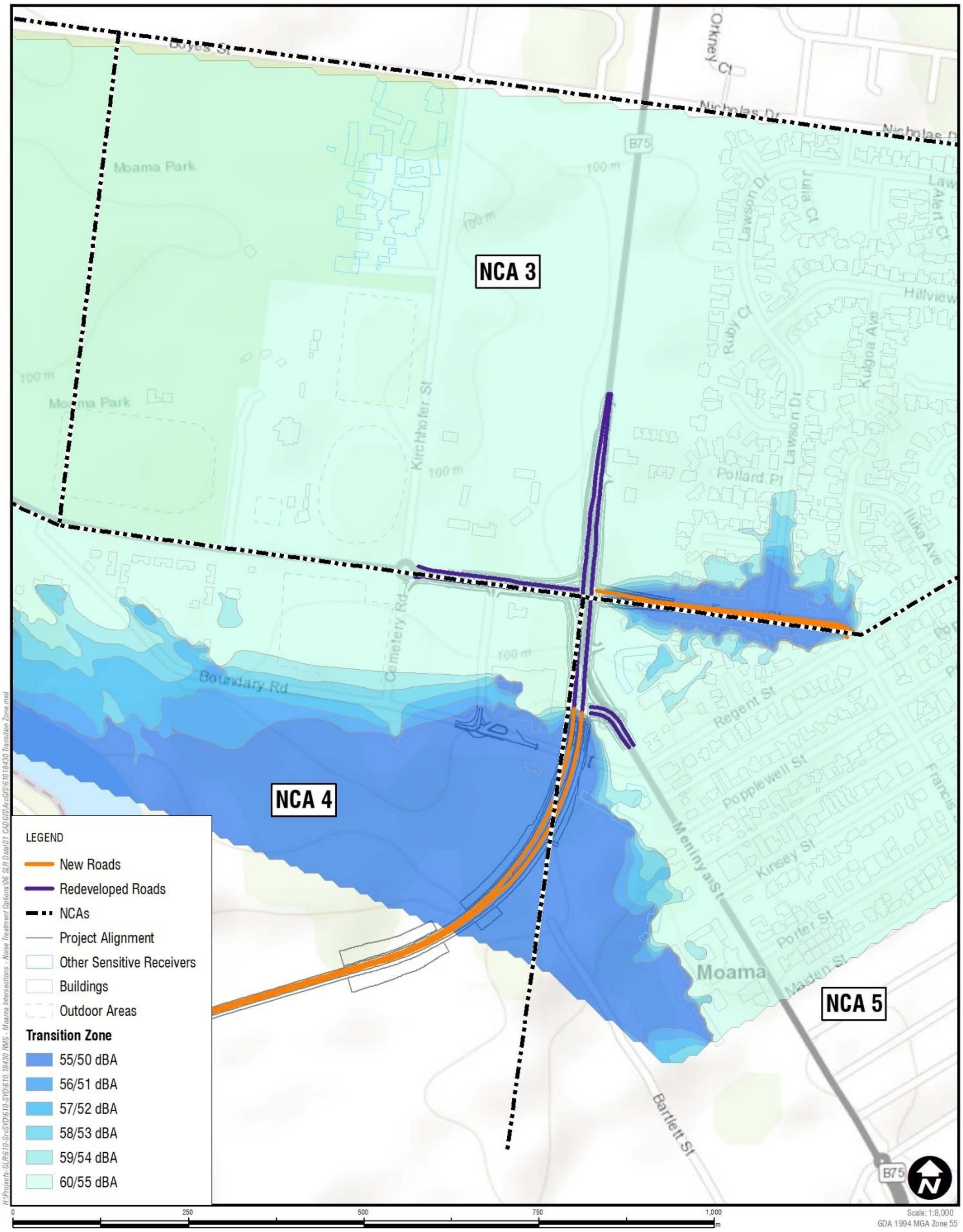
The following figure presents an example of the various paths by which vibration and ground-borne noise may be transmitted between a source and receiver for construction activities occurring within a tunnel.



The term 'regenerated noise' is also used in other instances where energy is converted to noise away from the primary source. One example would be a fan blowing air through a discharge grill. The fan is the energy source and primary noise source. Additional noise may be created by the aerodynamic effect of the discharge grill in the airstream. This secondary noise is referred to as regenerated noise.

Appendix B: Operational information

Transition Zones



Traffic Data – Project Opening (2022)

Route	Without Project				With Project			
	Daytime (15 hour)		Night time (9 hour)		Daytime (15 hour)		Night time (9 hour)	
	Light	Heavy	Light	Heavy	Light	Heavy	Light	Heavy
New Bridge	NA	NA	NA	NA	7210	1272	483	85
Cobb Highway (North of Perricoota Road)	4716	524	316	35	5437	604	364	40
Meninya Street	11886	1321	796	88	7610	846	510	57
Perricoota Rd	4514	502	302	34	5098	566	342	38
Francis Street (West of Lawson Drive)	131	15	9	1	1653	184	111	12
Francis Streat (Between Lawson Drive & Regent St)	913	101	61	7	1653	184	111	12
Francis Street (East of Regent Drive)	1112	124	74	8	1653	184	111	12
Regent Street (North of Francis Street)	1155	128	77	9	1155	128	77	9
Regent Street (South of Francis Street)	1295	144	87	10	1295	144	87	10
Martin Street	1302	145	87	10	1302	145	87	10

Traffic Data – Future Design (2032)

Route	Without Project				With Project			
	Daytime (15 hour)		Night time (9 hour)		Daytime (15 hour)		Night time (9 hour)	
	Light	Heavy	Light	Heavy	Light	Heavy	Light	Heavy
New Bridge	NA	NA	NA	NA	8079	1426	541	96
Cobb Highway (North of Perricoota Road)	5535	615	371	41	6297	700	422	47
Meninya Street	13610	1512	912	101	8065	896	540	60
Perricoota Rd	5019	558	336	37	5250	583	352	39
Francis Street (West of Lawson Drive)	140	16	9	1	1705	189	114	13
Francis Streat (Between Lawson Drive & Regent St)	977	109	65	7	1705	189	114	13
Francis Street (East of Regent Drive)	1188	132	80	9	1705	189	114	13
Regent Street (North of Francis Street)	1234	137	83	9	1234	137	83	9
Regent Street (South of Francis Street)	1383	154	93	10	1383	154	93	10
Martin Street	1364	152	91	10	1364	152	91	10

Operational Noise Predictions

Name	NCA	Flr	Easting	Northing	RecType	Address	NCG Criteria		Period	Predicted Noise Level (dBA)												> 2 dBA Increase		Cumulative Limit		Project Acute		Eligible for Consideration of Mitigation
										At Opening (2022)						Future Design (2032)												
										No Build		Build		Final Build		No Build		Build		Final Build								
							D	N		D	N	D	N	D	N	D	N	D	N	D	N	D	N	D	N	D	N	
NCA03.RES.0453.01	NCA03	1	297933	6001925	Residential	Receiver 1	55	50	P	53	44	57	47	57	47	54	44	57	47	57	47	Y	-	-	-	-	-	Y
NCA03.RES.0443.01	NCA03	1	298017	6001903	Residential	Receiver 2	55	50	P	59	50	61	52	61	52	60	50	61	52	61	52	Y	-	Y	-	-	-	Y
NCA03.RES.0397.01	NCA03	1	297875	6001940	Residential	Receiver 3	55	50	P	51	42	56	46	56	46	52	43	56	46	56	46	Y	-	-	-	-	-	Y
NCA03.RES.0280.01	NCA03	1	297686	6002114	Residential	Receiver 4	60	55	P	66	57	66	56	66	56	67	58	66	57	66	57	-	-	Y	-	Y	-	Y
NCA03.RES.0206.01	NCA03	1	297985	6001908	Residential	Receiver 5	55	50	P	59	50	61	51	61	51	59	50	61	52	61	52	Y	-	Y	-	-	-	Y
NCA03.RES.0116.01	NCA03	1	297958	6001904	Residential	Receiver 6	55	50	P	59	50	62	53	62	53	60	50	62	53	62	53	Y	Y	Y	-	-	-	Y
NCA03.RES.0313.01	NCA03	1	297851	6001926	Residential	Receiver 7	55	50	P	55	46	61	52	61	52	55	46	62	52	62	52	Y	Y	Y	-	-	-	Y
NCA03.RES.0105.01	NCA03	1	297831	6001923	Residential	Receiver 8	55	50	P	55	46	62	52	62	52	56	47	62	52	62	52	Y	Y	Y	-	-	-	Y
NCA03.RES.0470.01	NCA03	1	297814	6001928	Residential	Receiver 9	55	50	P	55	46	61	52	61	52	55	46	61	52	61	52	Y	Y	Y	-	-	-	Y
NCA03.RES.0088.01	NCA03	1	297794	6001931	Residential	Receiver 10	55	50	P	55	46	62	52	62	52	56	47	62	52	62	52	Y	Y	Y	-	-	-	Y
NCA03.RES.0325.01	NCA03	1	297775	6001934	Residential	Receiver 11	55	50	P	56	47	62	52	62	52	57	48	62	53	62	53	Y	Y	Y	-	-	-	Y
NCA03.RES.0055.01	NCA03	1	297758	6001932	Residential	Receiver 12	55	50	P	57	48	62	52	62	52	58	49	62	53	62	53	Y	Y	Y	-	-	-	Y
NCA03.OCC.0521.01	NCA03	1	298044	6001899	Other (Childcare)	Receiver 13	45	-	H	61	54	62	55	62	55	62	54	63	55	63	55	-	-	Y	-	-	-	Y
NCA04.RES.0029.01	NCA04	1	297557	6001669	Residential	Receiver 14	55	50	P	55	46	64	55	64	55	56	46	65	55	65	56	Y	Y	Y	Y	Y	-	Y
NCA04.RES.0029.01	NCA04	2	297557	6001669	Residential	Receiver 15	55	50	P	57	47	66	56	66	56	57	48	66	57	66	57	Y	Y	Y	Y	Y	-	Y
NCA05.RES.0239.01	NCA05	1	297960	6001843	Residential	Receiver 16	55	50	P	60	51	61	52	61	52	60	51	62	52	62	52	Y	-	Y	-	-	-	Y
NCA05.RES.0194.01	NCA05	1	297932	6001850	Residential	Receiver 17	55	50	P	59	50	61	52	61	52	59	50	62	52	62	52	Y	Y	Y	-	-	-	Y
NCA05.RES.0013.01	NCA05	1	297910	6001851	Residential	Receiver 18	55	50	P	57	48	60	51	60	51	57	48	60	51	60	51	Y	Y	Y	-	-	-	Y
NCA05.RES.0111.01	NCA05	1	297886	6001852	Residential	Receiver 19	55	50	P	56	47	60	51	60	51	56	47	61	51	61	51	Y	Y	Y	-	-	-	Y
NCA05.RES.0238.01	NCA05	1	297866	6001854	Residential	Receiver 20	55	50	P	53	44	59	50	59	50	53	44	60	50	60	50	Y	-	Y	-	-	-	Y
NCA05.RES.0146.01	NCA05	1	297846	6001863	Residential	Receiver 21	55	50	P	55	46	62	52	62	52	55	46	62	53	62	53	Y	Y	Y	-	-	-	Y
NCA05.RES.0240.01	NCA05	1	297831	6001865	Residential	Receiver 22	55	50	P	54	46	62	52	62	52	55	46	62	53	62	53	Y	Y	Y	-	-	-	Y
NCA05.RES.0337.01	NCA05	1	297809	6001867	Residential	Receiver 23	55	50	P	54	46	62	52	62	52	55	46	62	53	62	53	Y	Y	Y	-	-	-	Y
NCA05.RES.0263.01	NCA05	1	297785	6001870	Residential	Receiver 24	55	50	P	55	46	62	53	62	53	55	47	62	53	62	53	Y	Y	Y	-	-	-	Y
NCA05.RES.0422.01	NCA05	1	297795	6001869	Residential	Receiver 25	55	50	P	55	46	62	52	62	52	55	46	62	53	62	53	Y	Y	Y	-	-	-	Y
NCA05.RES.0424.01	NCA05	1	297760	6001874	Residential	Receiver 26	55	50	P	56	47	62	52	62	52	57	48	62	53	62	53	Y	Y	Y	-	-	-	Y
NCA05.RES.0426.01	NCA05	1	297771	6001872	Residential	Receiver 27	55	50	P	55	46	62	52	62	52	55	47	62	53	62	53	Y	Y	Y	-	-	-	Y
NCA05.RES.0262.01	NCA05	1	297689	6001878	Residential	Receiver 28	58	53	P	62	53	63	54	63	54	63	53	64	54	64	54	Y	-	Y	-	-	-	Y