

### 3 SUITABILITY OF MITIGATION MEASURES/SAFEGUARDS

#### 3.1 Noise and Vibration

##### 3.1.1 Background

Section 7 of the Connell Wagner EIA dealt with an assessment of noise impacts, using the NSW Government's *Environmental Criteria for Road Traffic Noise* (ECRTN) noise guidelines and the RTA *Environmental Noise Management Manual* (ENMM). For freeways or arterial roads (the classification applicable to this upgrade of the Pacific Highway), the guideline has two assessment categories for residential noise receptors:

##### *New Freeway or Arterial Road Corridor*

This refers to a freeway, arterial or sub-arterial road that is proposed on a corridor that has not previously been a freeway, arterial or sub-arterial road, or to an existing freeway, arterial or sub-arterial road that is being substantially realigned.

The guidelines for a new road are:

- $L_{Aeq,15hr}$  (7.00 am – 10.00 pm) = 55 dBA
- $L_{Aeq,9hr}$  (10.00 pm – 7.00 am) = 50 dBA

Where existing noise levels exceeded these figures, the guidelines required that new roads be designed so existing noise levels were not increased by more than 0.5 dBA.

##### *Redevelopment of Existing Freeway or Arterial Road*

This refers to an existing freeway, arterial or sub-arterial corridor where it is proposed to increase its traffic carrying capacity, change the traffic mix, or change the road alignment through design or engineering changes. Redevelopment does not cover minor road works designed to improve safety, such as straightening curves, installing traffic control devices, or making minor road re-alignments. The criteria relating to a freeway redevelopment are:

- $L_{Aeq,15hr}$  (7.00 am – 10.00 pm) = 60 dBA
- $L_{Aeq,9hr}$  (10.00 pm – 7.00 am) = 55 dBA

Where these criteria are already exceeded, the ECRTN states '*in all cases, the redevelopment should be designed so as not to increase existing noise levels by more than 2 dB(A).*'

For non-residential developments the adopted criteria were:

Type of Development	Noise Criteria dB(A)	
	Day	Night
Places of worship	$L_{eq(1hr)} = 40$	$L_{eq(1hr)} = 40$
Active recreation (e.g. golf courses)	$L_{eq(15hr)} = 60$	
Passive recreation and school playgrounds	$L_{eq(15hr)} = 55$	

The EIS noted that the guidelines were not mandatory.

Both the EIS and EIA predicted that noise levels at a number of noise-sensitive locations, including residences, would exceed the construction guidelines outlined in the EPA's Environmental Noise Control Manual. These included those close to major cut and/or fill sections, and where blasting might be required.

Recommendations to reduce this impact included:

- the use of an alternative road surface (open graded asphaltic concrete (OGAC) or exposed aggregate concrete (EAC)), or a combination of pavement types;
- an extended height concrete barrier to the west of the highway in the vicinity of Ferry Reserve Caravan Park (Ch 44500-44800);
- a noise barrier between the highway and service road extending from the Brunswick River to the north of Rajah Road (Ch 45000-45400); and
- noise barriers on both sides of the highway near the Christian Life Centre and the northern end of Balemo Drive (between the highway and the local service road). (Ch 48250-48550 east, Ch 48600-48750 west).

As a consequence of the predictions, the RTA undertook noise ameliorative measures, prior to the commencement of construction, at those properties where operational noise measures would exceed the EPA guidelines. Provision of this treatment early was in response to feedback and lessons learnt from other road projects and was intended to provide benefits to residents from both construction and operational noise. Buildings with habitable rooms overlooking the highway and not able to benefit substantially from at-road noise mitigation, were provided with noise mitigation in the form of mechanical ventilation/air-conditioning, upgraded glazing and enclosed verandahs, and sub-floor areas where required.

Following consultation with the relevant owners, a noise wall was installed along the boundary of the Christian Life Centre and the Funeral Parlour at Billinudgel. This was in addition to at-residence noise treatments. The wall acted to create some private space at each location. This was considered by each to have greater benefits than a noise wall along the edge of the highway. The acoustic benefits for each receiver are also likely to have been greater under this arrangement.

### **3.1.2 Construction Noise**

Measures to mitigate noise impacts included:

- early at-residence treatments
- DECC notification of all after-hours work, and reporting of monthly noise monitoring
- noise monitoring of plant and equipment
- a free 1800 phone number (24hrs per day, 7 days per week) for complaints
- community relations staff
- complaint response procedures (immediate response)
- liaison with the CLG
- maintaining distance from buildings and complying with the British and Aust Standards
- inductions included discussions of noise
- Work Method Statement development with reference to noise controls
- early construction of noise barriers

- offer of temporary accommodation
- written notification to potentially affected residents/businesses of activities and timing of relevant activities
- restricting the amount of noisy equipment near sensitive receivers at any one time
- lighting plant used for night works was of a low noise design
- the existing noise barrier at the Ferry Road Caravan Park was left standing until the road was opened.

As noted earlier, the MCoA requirement for the installation of a permanent noise wall near the Rajah Road area prior to the commencement of construction was not possible, however a temporary noise shield was installed early in the construction process following consultation with DECC. Further mitigation measures included residents being offered temporary accommodation. (Refer to Photo 3.1).

A significant noise impact was associated with piling for the bridges across Marshalls Creek and Marshalls Creek Overflow adjacent to Billinudgel. Whilst this activity was confined to daylight hours, the noise impact associated with driven piles was considerable, and whilst methods to attenuate such sound, are limited, several were trialed. All feasible and reasonable mitigation measures were identified and implemented such as arranging respite times. Community notification of piling works was also provided and the 1800, 24hr 7 day per week hotline was operated continuously by the Community Manager.

Construction was also required after-hours, and actions to minimise the impacts to the community were undertaken, including restricting the hours of activities with significant associated noise impacts, and providing prior notification through direct (telephone and letter) and indirect notification (community liaison group meetings).

No blasting was required on the project.

A separate noise assessment was undertaken for the concrete batch plant, as this was not considered as part of the original EIS or EIA. The plant was located in the rest area at Yelgun, a location remote from sensitive localities along the route. This was reflected in the lack of complaints arising from the operation of this facility.

A number of noise-related complaints occurred early in the construction process, due to residents not being notified in advance of after-hours work by Abigroup, or others (such as service relocators). This appears to have mostly occurred due to not having a particular resident's phone details, or the catchment for prior notification not being large enough. This was promptly addressed and there was a notable decrease in the number of complaints generally, and of noise-related complaints specifically, over the construction period. This is considered to be due to the pro-active nature of Abigroup's community liaison officers in addressing such issues.



**Photo 3.1 Permanent noise wall near Rajah Road being constructed early in the construction phase.**

In the first six months of the construction programme there were a number of complaints resulting from construction activities occurring outside the approved hours. This was mostly related to sub-contractors, and was addressed through tool-box meetings, with few consequent repeat complaints.

The construction of the Brunswick River Bridge required after-hours work, and the associated approval was that there be no audible noise after 10pm. One complaint resulted from audible hammering after 10pm. The lack of subsequent complaints is attributed to effective controls such as tool-box meetings to reiterate the conditions, and good communication with the local community.

### **3.1.3 Construction Vibration**

There was no blasting undertaken on this project. Consequently, construction impacts from vibration mostly result from vibratory rollers. Predicting the real extent can be difficult due to the variability of the underlying soil conditions. Vibratory rollers were utilised, at times in close proximity to buildings, notably near Rajah Road and Billinudgel. Vibratory rollers of more than seven tonnes were only used within 25m of buildings once a building condition assessment, and monitoring and consultation were undertaken.

Complaints were received and some monitoring was performed but the conditions leading to the complaint were generally not repeated, or the results were below the project criteria. At Billinudgel, due to the close proximity of buildings, compaction was achieved through a combination of a smaller vibratory roller and a static roller.

Sanctum, a manufacturer of skin-care products repeatedly complained about vibration impacts in the mezzanine section of their factory and the size of the rollers used in proximity to the building. This building is immediately adjacent to the works. Measurements were undertaken, but in all cases they were below the acceptable criteria.

No substantiated rectification was required to any building as a consequence of the works.

Claims are assessed through building dilapidation surveys that assess damage before and after the works, and what might have attributed to that damage. Whilst there is no doubt that some community members would have experienced some discomfort associated with vibration, no substantiated rectification was required to any building as a consequence of the works Abigroup undertook repairs for alleged damage resulting from construction-related vibration at a number of properties. Additionally a number of other properties owners were referred to the project's insurers.

Consequently, it is concluded that the measures used by Abigroup were extensive and mostly successful. This is judged on the relatively few complaints given the size of the project and proximity to so many residents.

### **3.1.4 Operation Noise**

As a consequence of the EIA's noise predictions, prior to construction of the Upgrade, the RTA undertook architectural or at-dwelling noise control treatments at those properties where operational noise measures were expected to exceed the ECRTN guidelines. Buildings with habitable rooms overlooking the highway, and consequently not able to benefit substantially from at-road noise mitigation, were provided with noise mitigation in the form of mechanical ventilation/air-conditioning, upgraded glazing, and enclosed verandahs and subfloors where required. The status of residences requiring architectural treatment, and extent thereof, as undertaken by the RTA are presented in a schedule in the Operational Noise Management Report (ONMR).

Road design features were also used including:

- increased distance between the road and receivers (eg optimising road alignment, inclusion of landscaped areas and parklands to act as buffers between road and receivers, etc);
- use of cuttings in road to provide noise shielding;
- shielding from road structures (eg retaining walls, bridge structures etc);
- selection of quiet expansion joints for bridges;
- low-noise pavement;
- roadside noise mounds, barriers and walls; and
- fences along residential property boundaries.

Renzo Tonin (May 2008) consequently prepared a noise report following the opening of the road to assess the adequacy of the noise mitigation measures in accordance with the MCoA No. 34. The report measured noise levels over both the short and long-term at a number of noise sensitive receivers. It concluded that the modelling was generally accurate to  $\pm 3\text{dB(A)}$  of the true noise levels in practice. The 'worst-case scenario measured 2.6dB(A) above the predicted figure.

Mostly the model over-estimated the operational noise levels. However, modelled noise levels at four long-term locations (periods greater than one week), and five short-term locations (a minimum of two consecutive 15-minute sample periods) were determined to vary by more than 3dB(A) from the measured levels. Although the differences were larger, the noise model was predicting higher noise levels than the monitored noise levels, which indicates that the noise model is 'over predicting', thus resulting in conservatively higher noise levels than that which were measured.

Renzo Tonin's (May 2008) report notes that:

*A detailed environmental noise assessment for the project is documented in Appendix E and Section 5.5 'Noise Mitigation Measures' of the EIA (2002). From the EIA, Section 5.5.2 deals with Project Specific Noise Mitigation Options and Section 5.6 provides details of Design of Feasible and Reasonable Mitigation Measures. Furthermore, during the detail design phase, an analysis into the design of feasible and reasonable mitigation measures was undertaken in accordance with Practice Note IV of the ENMM. A summary of the feasibility analysis and assessment outputs is presented in Annexure I of the ONMR. Therefore, the process followed for the design of noise mitigation measures for this project, complies with the ENMM as documented in both the EIA and the ONMR.*

With regard to re-assessing the data for a 2017 opening date, the report notes:

*The variance (V) between the 2017 post-construction noise levels and the 2016 design noise levels fall within the acceptable 'less than or equal to 2dB(A)' objective at all residential properties as per the requirements of the ENMM, with the only exceptions being the following residences which have variances slightly greater than 2dB(A) [i.e. 2.1 – 2.2dB(A)]:*

- *Lot 1 Pacific Highway - the post-construction 2017 noise level is lower than the EIA predicted 2016 noise level and this residence has been architecturally treated by the RTA*
- *170 Billinudgel Road - this residence has been architecturally treated by the RTA.*

The report concludes that:

- *the post-construction operational noise assessment of traffic noise levels confirm that the intended acoustical outcomes as described in the environmental documents were achieved,*

- *there is a clear trend in the post construction noise levels being lower than the predictions made,*
- *the post-construction operational noise assessment found there to be no clear trend of shortfalls in the design outcomes, therefore no additional noise mitigation measures are necessary,*
- *the implemented traffic noise mitigation measures were evaluated and as a result of a clear trend of noise compliance being demonstrated, this confirms the adequacy of the traffic noise measures implemented on this Project, and*
- *community noise complaints have been addressed by re-assessing traffic noise levels at complainant properties or properties in the vicinity of where complaints have arisen, and noise levels were found to comply with the applicable environmental noise objectives.*



**Photo 3.2 View from Rajah Road across the northern approach to the Brunswick River showing the benefit of the clear noise barriers in maintaining the local visual amenity.**

#### **3.1.4.1 Operational Noise Complaints**

In the three months following the highway Upgrade being opened to traffic, the Roads and Traffic Authority (RTA) and its contractor Abigroup Contractors Pty Limited (Abigroup) received operational noise complaints from residents living in the vicinity of the upgraded highway. These complaints have typically been regarding the noise generated from three potential sources: profile line marking, engine / exhaust braking, and noise associated with vehicle / pavement wearing surface (tyre and different operational noise).

Profile line markings' are white lines with bumps usually installed along the outer edges of a road carriageway. They are designed to warn drivers who may be suffering from fatigue or inattention that they are moving outside their lane. Renzo Tonin & Associates (May 2008 Appendix D) were engaged to undertake a study on the noise impacts associated with vehicles going over the profile line markings installed on the pavement wearing surface of the upgraded section of Pacific Highway, located between the Brunswick Heads North Interchange and Yelgun. The study's scope was to:

- Investigate and differentiate noise emissions from the profile line marking from that caused by the rest of the Upgrade;
- Measure / quantify noise generated by the profile line marking installed on the pavement wearing surface;
- Analyse and assess the noise generated by the profile line-marking and compare this against overall noise levels from sections of the Upgrade without the profile line marking to better understand community noise complaints.

The report noted that:

- *although noise pertaining to profile line marking events has a distinct character that is clearly audible and identifiable over general traffic noise, its effects on overall project noise levels are likely to cause increases of up to 2.2dB(A) and typically less than 1dB(A) in the LAeq scale,*
- *recorded profile line marking events did not typically cause an overall increase in the LAmax scale, however this is potentially due to profile line marking events occurring at locations which were not immediately adjacent to the measurements sites, in comparison to where the LAmax from vehicle pass-bys occur,*
- *noise from profile line marking events can cause an increase in the frequency of occurrence of maximum noise events, and*
- *based on the results of this study, it is likely that profile line marking noise may not cause an increase in sleep disturbance in terms of noise amplitude alone, however there is a likelihood that profile line marking events would cause an increase in the number of LAmax noise events.*

Since the completion of the study, and in spite of compliance with the noise goals, the RTA removed the profile line-marking from the Upgrade. It has also erected 'Reduce Engine Braking Noise' signs.

### **3.1.5 Operation Vibration**

No impacts are expected from vibration during the operation of the Upgrade.

### **3.1.6 Learnings**

The undertaking of noise ameliorative measures by the RTA, prior to the commencement of construction, is considered to have been a significant measure in minimising impacts upon the community. Addressing each resident on a case-by-case basis also provided better outcomes and a lower cost than a blanket approach to noise amelioration.

It is suggested that the measures utilised by both the RTA and Abigroup were sufficient to prevent predicted impacts, but not necessarily to prevent complaints. On other occasions, the community, by being well-informed regarding the reasons for, and duration of noise exceedances, proved to be highly tolerant of such requests, and also of extended working hours.

The removal of the profile line-marking now appears to be associated with an increase in single-vehicle, fatigue-related accidents on the Upgrade.

The noise models being used and special efforts specified in the contract documents for this project that were applied to calculate traffic noise have reached a level of sophistication such that predicted levels are generally within 2dB(A) of the calculated levels.