Chapter 14

Noise and vibration
14.0 Noise and vibration

14.1 Introduction and approach

A detailed noise and vibration assessment was undertaken as part of the study in order to determine the existing acoustic values of the study area as well as the potential for impacts on these values. The results of these investigations are reported in Technical Paper 8, in Volume 2 of the revised assessment report.

This section provides a summary of the noise and vibration issues related to the construction and operation of the SFRC. A description of the existing acoustic environment is provided, based on background monitoring undertaken as part of the SFRC study. Noise and vibration models were used to predict the impact of the SFRC upon the local environment, and the most appropriate operational noise criteria were applied to the project. Based on the above, the potential impacts of the SFRC with respect to noise and vibration were described, and mitigation measures to address these likely impacts were identified.

14.2 Existing acoustic environment

The existing acoustic environment in the study area was quantified by undertaking a background noise monitoring program at various locations within the study area. The locations selected for monitoring were scattered along the full length of the SFRC study area recognising the different acoustic environments along the proposed corridor. Monitoring locations were chosen in locations away from known noise sources in an attempt to gain a true snapshot of the existing acoustic environment.

Existing background noise levels within the corridor of interest are generally low with few existing major noise emitters within the corridor of interest or nearby. The average daytime background noise level ($L_{A90}$) ranged between 30 dB(A) and 39 dB(A). These noise levels are generally described as “low” and are typical of rural sites without surrounding industry or transportation. A site with a night-time background level of 30 dB(A) is described as “Areas with negligible transportation” by AS1055.2 – 1997 “Acoustics – Description and measurement of environmental noise – Application to specific situations”. Night-time Rated Background Levels fell below 26 dB(A) at all but two of the noise monitoring sites.

14.3 Operational noise criteria

The operational noise criteria for this project are based on rail planning levels outlined under Queensland Rail’s Code of Practice - Railway Noise Management, December 2007, “the Code”. The Environmental Protection (Noise) Policy 2008 as in force on 1 January 2009 excludes noise from the ordinary use of rail transport infrastructure from environmental nuisance. Accordingly the Code’s planning levels are considered to be the only current applicable requirements for noise from railway operations in Queensland.

The Code sets noise criteria in terms of a 24-hour average equivalent continuous A-weighted sound pressure level ($L_{Aeq (24 hour)}$) and a single event maximum sound pressure level. The Code planning levels are as follows:

- 65 dB(A) $L_{Aeq (24 hour)}$
- 87 dB(A) single event maximum level

The noise level is to be assessed one metre in front of the most exposed façade of an affected noise sensitive place. Other relevant criteria were investigated, most notably TMR’s Queensland Transports’ Interest in Planning Schemes (QTIPS) as this criterion gives guidance for planning future development adjacent to the preferred alignment.

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9 In accordance with Section 12 of the Code, single event maximum level is defined as ‘the arithmetic average of maximum levels from the highest 15 single events over a given 24 hour period.’
The construction of the preferred alignment is not proposed for at least 10 and 15 years and as such determining the appropriate criteria is not possible at this time as criteria may continue to evolve over this time. In determining impacts and potential mitigation measures, both the QR criteria and the TMR criteria have been assessed. By providing assessment to both criteria future planning (based on the QTIPS criterion) can also be considered at the appropriate time.

14.4 Potential impacts and mitigation – operational noise

A computer noise model was developed using various acoustic prediction methods to enable the comparison of forecast noise levels against relevant criteria. The model has been validated at locations in Queensland where rolling-stock operates at similar speeds and track conditions to that proposed for the preferred alignment.

Table 30 and Table 31 outline the number of dwellings forecast to experience noise levels in excess of relevant criteria. This is graphically represented in Map 8.2 and Map 8.3.

<table>
<thead>
<tr>
<th>Contour Zone</th>
<th>Estimated Number of Dwellings Exceeding Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>QR External Criteria</td>
<td>15</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Contour Zone</th>
<th>Estimated Number of Dwellings* Exceeding this Level of Criterion</th>
</tr>
</thead>
<tbody>
<tr>
<td>L_{A_{max}} 55 - 59 dB(A)</td>
<td>160</td>
</tr>
<tr>
<td>60 - 69 dB(A)</td>
<td>215</td>
</tr>
<tr>
<td>70 - 84 dB(A)</td>
<td>80</td>
</tr>
<tr>
<td>85 dB(A) +</td>
<td>15</td>
</tr>
</tbody>
</table>

Where residences are found to be located within the QR external criteria limit line, noise mitigation measures will be investigated. It is recommended that residences within this line be assessed on a case-by-case basis. Various methods of building construction techniques and building orientation can be considered in ensuring the dwellings falling within the nominated contour zone would meet the TMR internal criterion. These are identified in Technical Paper 8 (Volume 2).

14.5 Potential impacts and mitigation – operational vibration

Forecast operational ground vibration levels were assessed against current Australian ‘best practice’ criteria. These criteria are the accepted vibration criteria for many governing bodies within Australia. The vibration forecasts were based on vibration levels measured for a number of train pass-by’s at a location on the existing Brisbane network. These measurements were taken in order to establish the Vibration Dose Value versus distance relationship for typical rail freight movements.

The measured vibration levels for the diesel locomotive hauled trains were adjusted to account for proposed operational conditions to enable vibration impacts to be forecast for the SFRC. It was found that operational vibration impacts are forecast to be significantly lower than operational noise impacts. The forecast buffer distance within which exceedances of vibration criteria are forecast is 20 metres from the preferred rail alignment which is significantly less than the buffer distance required to ameliorate noise impacts.
14.6 Potential impacts and mitigation – construction noise and vibration

The general noise and vibration impacts from the construction of the SFRC were also investigated. The details of the construction methodology for the SFRC are yet to be fully developed. Accordingly a more detailed construction noise and vibration assessment may be required when construction methods are finalised.

It is recommended that construction plant be selected on the basis of low noise emission. Noise emissions from construction plant can be reduced by fitting exhaust mufflers, using reversing alarms that emit a broadband noise rather than a beep, maintaining plant in good working order and following best practice construction methodologies. The Construction Environment Management Plan (CEMP) will be developed to manage possible noise and vibration impacts from construction, including implementing plant selection based on acoustic issues.

There is likely to be a requirement for blasting at various points along the corridor where cuttings are required through hard rock. It is not possible to identify these locations specifically at this stage of the project and as such further detailed assessment of the acoustic impacts of blasting will need to be undertaken prior to construction occurring. A specific management plan should be developed for all proposed blasting in order to ensure that any impacts are mitigated where possible.

The construction of the proposed tunnels in the Washpool/Woolooman area will potentially generate a range of acoustic and vibration impacts. The extent of these impacts will vary depending on the construction methodology adopted. However, the remote nature of the area is such that significant impacts are not anticipated.

Construction noise and vibration guidelines were recommended based on best-practice values and the results of the background noise monitoring program. It was found that there exists the potential for impacts to surrounding residences, especially those closest to the preferred rail alignment. However, these impacts are short-term and can be minimised by implementing best-practice construction techniques. Various key points are recommended to be incorporated into the Construction Environment Management Plan for the SFRC.

14.7 Conclusion

Potential acoustic impacts from the Southern Freight Rail Corridor were investigated. The existing acoustic environmental values were quantified by a background noise monitoring program. It was found that the existing acoustic environment in the area is low.

A detailed review of operational noise criteria was undertaken. This review was undertaken due to the uniqueness of the project site and the need to assess the acoustic amenity impacts for existing residential dwellings, including sleep disturbance effects. The operational noise criteria considered to be most appropriate for this study are those within the Noise EPP, the QR Code of Practice – Railway Noise Management, and the TMR Interest in Planning Schemes Night-time Internal Noise Criterion. These are listed below in Table 32.

Table 32 Summary of relevant noise criteria

<table>
<thead>
<tr>
<th>Description</th>
<th>Descriptor</th>
<th>Criterion</th>
</tr>
</thead>
<tbody>
<tr>
<td>QR - External Noise Level at facade</td>
<td>$L_{Aeq}$ (24 hour)</td>
<td>65 dB(A)</td>
</tr>
<tr>
<td></td>
<td>$L_{Amax}$</td>
<td>87 dB(A)</td>
</tr>
<tr>
<td>TMR- Night-time Noise intrusion level within Bedrooms</td>
<td>$L_{Amax}$</td>
<td>50 dB(A)</td>
</tr>
<tr>
<td>TMR - Equivalent external noise criterion outside bedroom windows</td>
<td>$L_{Amax}$</td>
<td>55 dB(A)</td>
</tr>
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</table>
The application of these operational noise criteria is believed to adequately address the issue of changes to acoustic amenity for a greenfield site in an area as quiet as that surrounding the proposed alignment. It is recommended that for the purposes of this planning study, the criteria listed in Table 32 are applied. However, a reappraisal of these criteria should be undertaken during detailed design, based on:

- any changes to existing criteria
- any new criteria
- any changes to the acoustic environment of the study area (particularly as a result of intensified development in key areas of the SEQRP western corridor strategy (such as Ebenezer, Purga, Swanbank, Ripley and Bromelton))

Operational noise impacts have been assessed for the SFRC. Noise contours were produced based on QR external noise criteria and TMR internal noise criteria. Recommended mitigation measures for sensitive receivers falling within the QR External Criteria buffer were detailed. It was identified that approximately 15 residential dwellings are forecast to exceed QR external criteria. A further estimated 455 residential dwellings are forecast to exceed TMR internal noise criteria, which range up to approximately 2.5 kilometres from the revised alignment. The TMR internal criteria buffer was also presented to enable the planning of future developments in the vicinity of the SFRC. Various stages of mitigation measures have been recommended based on the level of forecast exceedances. These mitigation measures include:

- Stage 1 – mechanical ventilation
- Stage 2 – air conditioning and window seals
- Stage 3 – facade/glazing upgrade and air-conditioning
- Stage 4 – high performance acoustic materials, special construction techniques and specialist advice

Operational vibration was assessed based on measurements of existing diesel locomotive hauled rail movements. It was found that a buffer distance of 20 metres from a preferred alignment is required to achieve forecast compliance with operational vibration criteria.

Construction noise and vibration goals were recommended for the construction phase of the SFRC project. Construction noise and vibration guidelines were then recommended for the SFRC. Buffer distances were predicted for various noisy plant and construction noise and vibration management procedures were recommended. These are to be outlined in the CEMP.