The Northern Road Upgrade – Mersey Road, Bringelly to Glenmore Parkway, Glenmore Park
Submissions and Preferred Infrastructure Report
Volume 2: Appendices
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Appendix B

Technical Memorandum: Noise and vibration
Date 06 October 2017
From David Borella (Jacobs Senior Acoustic Specialist)
Subject TECHNICAL MEMO – Design refinement noise and vibration assessment

1. Project description

Roads and Maritime Services (Roads and Maritime) propose to upgrade 16 km of The Northern Road between Mersey Road, Bringelly and Glenmore Parkway, Glenmore Park (the project).

The project generally comprises the following key features:

- A six-lane divided road between Mersey Road, Bringelly and Bradley Street, Glenmore Park (two general traffic lanes and a kerbside bus lane in each direction). A wide central median would allow for an additional travel lane in each direction in the future, if required
- An eight-lane divided road between Bradley Street, Glenmore Park and just south of Glenmore Parkway, Glenmore Park (three general traffic lanes and a kerbside bus lane in each direction separated by a central median)
- About eight kilometres of new road between Mersey Road, Bringelly and just south of the existing Elizabeth Drive, Luddenham to realign the section of The Northern Road that currently runs through the Western Sydney Airport site
- About eight kilometres of upgraded and widened road between the existing Elizabeth Drive, Luddenham and just south of Glenmore Parkway, Glenmore Park
- Access to the Luddenham town centre from north of the realigned The Northern Road and the existing The Northern Road
- Twin bridges over Adams Road, Luddenham
- Four new traffic light intersections and new traffic lights at existing intersections
- Local road changes and upgrades to current access arrangements for businesses and private properties
- A new shared path for pedestrians and cyclists on the western side of The Northern Road and footpaths on the eastern side of The Northern Road where required.

A detailed description of the project, including design refinements since exhibition of the EIS is provided in Chapter 5 of the Submissions and Preferred Infrastructure Report for the project.

2. Purpose and background

The EIS for the project was publicly displayed for information and comment between 21 June and 2 August 2017. The EIS considered a range of environmental, social and planning issues and nominated a number of measures to mitigate or manage these potential impacts.

In accordance with section 115Z(6) of the Environmental Planning and Assessment Act 1979 (EP&A Act), Roads and Maritime is required to prepared a Submissions and Preferred Infrastructure
Report to respond to any issues raised by stakeholders and the community received during the EIS exhibition. The Submissions and Preferred Infrastructure Report also describes any refinements to the project's design and outlines revised environmental management measures identified in response to any changes and the submissions received. The Submissions and Preferred Infrastructure Report, including this Memorandum, will also inform the Final EIS to be prepared for the project in accordance with Part 8 of the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act), to be finalised based on the submissions received during exhibition.

The purpose of this Memorandum is to provide the results of additional noise assessment that has been carried out since exhibition of the EIS. This Memorandum should be read in conjunction with the EIS, Submissions and Preferred Infrastructure Report and any subsequent post-determination documentation.

3. Details of additional assessment

Since exhibition of the EIS for the project, road design refinements required to address drainage and driver safety needs have resulted in minor changes to the project's horizontal and vertical alignments. These changes have the potential to alter some of the operational noise predictions presented in the EIS, and in particular, alter the list of receivers identified as qualifying for noise mitigation to be provided by the Project.

A high-level screening assessment has been undertaken to identify receivers that may now qualify for consideration of noise mitigation as a result of the design refinements (in addition to the 77 mitigation-eligible receivers identified in the EIS). Further assessment and verification of noise impacts and any additional mitigation requirements would also be undertaken at the post-construction compliance stage.

In summary, this analysis identifies one additional receiver (a residence) as likely to qualify for consideration of noise mitigation. This additional receiver is indicated in Table 1 and Figure 2.

3.1 Methodology

This assessment is based on a desktop Sensitivity Analysis, a simplified approach to the Soundplan noise modelling undertaken for the EIS assessment. It uses the same CoRTN (UK Calculation of Road Traffic Noise) algorithm used in the EIS assessment but is based on simplified quantifications of the change in key road and traffic parameters indicated below:

- Analysis is restricted to receivers located nearest the road segments that have been substantially amended by the refined design. Receivers further back from the road have not been assessed as they would be less likely to now qualify for noise mitigation.
- The change of road pavement elevation has been determined from only the change in elevation of the Master Control Line (at the road median). Any additional change in pavement height contributed by “superelevation” has not been assessed. Superelevation is the tilt applied across the road cross section to suitably manage water runoff and vehicle aquaplaning risk. In the worst case scenario, the nature of the change in elevation from the road median to an outer (kerbside) travel lane is up to 0.7m where superelevation has changed from -3degrees tilt to +3degrees tilt as is proposed for the Project just north of its intersection with the existing Northern Road (near Eaton Rd).
- In general, the design refinements have only marginally altered the horizontal alignment of the EIS design by between 0-2m and so change to EIS noise predictions due to offset changes have not been assessed, although the effect of offset changes is discussed below.

The influential CoRTN parameters that may change substantially as a result of the design refinements, and that therefore have been incorporated within the sensitivity analysis, are:

- Angle of view (to the changed segment of road from a particular receiver)
Ground absorption

Acoustic screening effects (although there are no proposed barriers, the road shoulder provides some screening effect where the receiver sits lower than then level of the road, for example).

Of these parameters, it is generally the reduction in ground absorption that would most influence any change (increase) in the total operational noise level at a receiver.

CoRTN parameters that either would not change or change only insignificantly include:

- Traffic mix (volumes, speed, percentage of heavy vehicles)
- Road gradient (there will be some small segments of gradient change)
- Road surface (type)
- Ground cover (type)
- Offset distance of the receiver from the project (except receivers immediately adjacent to the project’s intersection with Littlefields Road and Gates Link Road. This is addressed separately under the section on changes in horizontal alignment).

Table 1 provides an indication of the likely change in predicted operational noise levels at key receivers, as well as whether they qualify for consideration of mitigation.

Changes in horizontal alignment

In general, the design refinements have only marginally altered the horizontal alignment of the mainline design (i.e. excluding side and access roads). In most places along the mainline, the horizontal shift – or offset - is not greater than 2 m. Changes to EIS noise predictions to receivers considered in this assessment due to such minor horizontal re-alignments are insignificant. By way of example, even where the design refinements bring the project 2 m closer (about half the width of car travel lane) to a dwelling located not closer than 100 m from the road, the change in the EIS-predicted noise level due to this offset change will be less than 0.1 dB.

As indicated in Figure 1, the project’s approaches to the Littlefields Road intersection, however, have been shifted to the east by up to 8 m for a short section. This offset reduces quickly as the design moves further from the intersection. The nearest receiver to this intersection (excluding receivers already identified to receive noise mitigation) is “2594-2776 The Northern Rd_1” located south-east of the intersection. This receiver is 72 m from the southbound master control line. The change in the
noise level for this receiver due to the reduced offset from the design refinements is approximately 0.5dB. As indicated in Table 1, this noise level change would not result in this receiver qualifying for consideration of noise mitigation.

3.2 Construction impacts

The potential construction noise and vibration impacts due to the proposed design refinements have been considered with the following findings:

- Predicted construction noise impacts would be consistent with those presented in the environmental impact statement
- Construction traffic noise impacts would be consistent with those presented in the environmental impact statement
- Potential construction vibration impacts would be consistent with those presented in the environmental impact statement.

Overall potential construction related noise impacts associated with the refined design for the project are considered consistent with those presented in the EIS. This is due to the fact that, in general, the design refinements have only marginally altered the horizontal alignment of the mainline design. Additionally, construction plant and haulage routes would be the same as outlined in the EIS.

3.3 Operational impacts

Table 1 provides an indication of the likely change in predicted operational noise levels at key receivers, as well as whether they qualify for consideration of mitigation. The receivers included in Table 1 did not qualify for operational noise mitigation in the EIS assessment. Conversely, receivers that the EIS identified as eligible for mitigation have not been included in Table 1.

The results indicate that one additional receiver would trigger for consideration of noise mitigation as a result of the design refinements (compared to that assessed within the EIS).
### Table 1 Indicative change in noise level predictions of the Proposal due to detailed design refinements

<table>
<thead>
<tr>
<th>Receiver</th>
<th>Approximate Chainage</th>
<th>RNP Criteria</th>
<th>Angle of View to amended road segment</th>
<th>Loss due to Ground Absorption OR Acoustic Screening*</th>
<th>Revised Noise Prediction (Higher Build Year)</th>
<th>Revised Build/NoBuild Noise Increase</th>
<th>Comments including identification of receivers now eligible for consideration of noise mitigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>2778-2828 The Northern Rd, Luddenham</td>
<td>8560</td>
<td>60 55 70</td>
<td>1.8</td>
<td>60.5 53.3</td>
<td>3.4 2.4</td>
<td>Master Control Line elevation increases by up to 1.5m. RECEIVER NOW TRIGGERS 61dB(A) exceeds RNP Criterion and Build/No Build increase &gt;2.0dB</td>
<td></td>
</tr>
<tr>
<td>2825-2841 The Northern Rd_4, Luddenham</td>
<td>8340</td>
<td>60 55 24</td>
<td>2.1</td>
<td>59.6 52.5</td>
<td>3.1 2.1</td>
<td>Master Control Line elevation increases by up to 1.5m. Receiver remains in compliance with RNP criteria (by 0.8dB, Day Criterion).</td>
<td></td>
</tr>
<tr>
<td>2859 The Northern Rd_2, Luddenham</td>
<td>7740</td>
<td>58 53 60</td>
<td>3.8</td>
<td>57.3 50.2</td>
<td>3.5 2.6</td>
<td>Master Control Line elevation increases by up to 1.8m. Receiver remains in compliance with RNP criteria (by 1.1dB, Day Criterion)</td>
<td></td>
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<tr>
<td>2292 The Northern Rd_1, Luddenham</td>
<td>6740</td>
<td>55 50 31</td>
<td>0.2</td>
<td>54.2 47.6</td>
<td>9.2 8.7</td>
<td>Master Control Line elevation increases by up to 0.7m. Receiver remains in compliance with RNP criteria (by 1.2dB, Day Criterion)</td>
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<tr>
<td>50-80 Adams Rd_1, Luddenham</td>
<td>6200</td>
<td>55 50 54</td>
<td>0.9</td>
<td>52.6 45.8</td>
<td>4.9 4.6</td>
<td>Master Control Line elevation increases by up to 0.7m. Receiver remains in compliance with RNP criteria (by 2.8dB, Day Criterion)</td>
<td></td>
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<tr>
<td>151 Adams Rd_1, Luddenham</td>
<td>6260</td>
<td>55 50 43</td>
<td>1.9</td>
<td>57.5 50.9</td>
<td>0.7 0.7</td>
<td>Master Control Line elevation increases by up to 0.7m. Receiver remains in compliance with RNP criteria (as Build/NoBuild difference (Day) is not &gt;2.0dB)</td>
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<tr>
<td>Address</td>
<td>Elevation Increase</td>
<td>Build/NoBuild Difference</td>
<td>Compliance Note</td>
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<tr>
<td>2594-2776 Northern Rd_1</td>
<td>520 m</td>
<td>1.2 dB</td>
<td>Master Control Line elevation increases by up to 1.0m. ADD 0.5dB for Distance Correction due to horizontal realignment of road bringing road 8m closer to the residence (72m away in the EIS case). Thus, Build/NoBuild difference (Day) = 1.0dB, but not &gt;2.0dB, thus, doesn't trigger</td>
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<tr>
<td>86-94 Vineyard Rd_1</td>
<td>1660 m</td>
<td>2.8 dB</td>
<td>Master Control Line elevation increases by up to 1.6m. Receiver remains in compliance with RNP criteria (by 5.4dB, Day Criterion)</td>
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<tr>
<td>2539-2547 Northern Rd_1</td>
<td>1680 m</td>
<td>2.3 dB</td>
<td>Master Control Line elevation increases by up to 0.7m. Receiver remains in compliance with RNP criteria (as Build/NoBuild difference (Day) is not &gt;2.0dB)</td>
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<tr>
<td>2465-2475 Northern Rd</td>
<td>2400 m</td>
<td>1.6 dB</td>
<td>Master Control Line elevation increases by up to 1.3m. Receiver remains in compliance with RNP criteria (by 1.9dB, Day Criterion).</td>
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<tr>
<td>8 Grover Cr_1</td>
<td>2940 m</td>
<td>1.0 dB</td>
<td>Master Control Line elevation increases by up to 1.1m. Receiver remains in compliance with RNP criteria (Day BNB &lt; 2.1dB (by 0.5dB))</td>
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<tr>
<td>2 Grover Cr_1</td>
<td>3010 m</td>
<td>1.3 dB</td>
<td>Master Control Line elevation increases by up to 1.6m. Receiver remains in compliance with RNP criteria (by 0.4dB, Day Criterion).</td>
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<tr>
<td>1 Grover Cr_1</td>
<td>3060 m</td>
<td>2.6 dB</td>
<td>Master Control Line elevation increases by up to 1.7m. Receiver remains in compliance with RNP criteria (by 0.2dB, Day Criterion).</td>
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<tr>
<td>2381 The Northern Rd_1</td>
<td>3170 m</td>
<td>3.3 dB</td>
<td>Master Control Line elevation increases by up to 1.7m. Receiver remains in compliance with RNP criteria (as Build/NoBuild difference (Day) is not &gt;2.0dB)</td>
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<tr>
<td>Address</td>
<td>Master Control Line Elevation Increase</td>
<td>Receiver Compliance</td>
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<tr>
<td>2367-2371 The Northern Road_1</td>
<td>Master Control Line elevation increases by up to 1.7m. Receiver remains in compliance with RNP criteria (by 2.5dB, Day Criterion)</td>
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<tr>
<td>2337-2339 The Northern Rd_1</td>
<td>Master Control Line elevation increases by up to 0.6m. Receiver remains in compliance with RNP criteria (as Build/NoBuild difference (Day) is not &gt;2.0dB)</td>
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<tr>
<td>2329-2335 The Northern Rd_1</td>
<td>Master Control Line elevation increases by up to 0.7m. Receiver remains in compliance with RNP criteria (as Build/NoBuild difference (Day) is not &gt;2.0dB)</td>
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<tr>
<td>2319-2327 The Northern Rd_1</td>
<td>Master Control Line elevation increases by up to 0.8m. Receiver remains in compliance with RNP criteria (as Build/NoBuild difference (Day) is not &gt;2.0dB)</td>
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<tr>
<td>343 Bradley St, Glenmore Park</td>
<td>Master Control Line elevation increases by up to 0.7m. Receiver remains in compliance with RNP criteria (as Build/NoBuild difference (Day) is not &gt;2.0dB)</td>
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<tr>
<td>14 Harold Bentleys Way, Glenmore Park (2nd Flr)</td>
<td>Master Control Line elevation increases by approx 0.5m. Receiver remains in compliance with RNP criteria (by 5.1dB, Day Criterion)</td>
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<tr>
<td>70 Eaton Rd_1</td>
<td>Master Control Line elevation increases by up to 0.6m. Receiver remains in compliance with RNP criteria (as Build/NoBuild difference (Day) is not &gt;2.0dB)</td>
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</tbody>
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* The value for the total increase in noise is determined as the higher value of the loss of ground absorption OR the loss of acoustic screening in accordance with CoRTN Clause 22.3 and Annex 7.
The Northern Road (Existing)  
The Northern Road Upgrade  
detailed design  
Western Sydney Airport site  
(Commonwealth Land)  
Defence Establishment Orchard Hills (Commonwealth Land)  
Commonwealth lands

Receivers qualifying for at-property treatment

- Assessed as eligible in EIS
- Assessed as eligible as a result of design refinements

Figure 2  
Receivers identified as likely eligible for at-property noise mitigation
Figure 2 | Receivers identified as likely eligible for at-property noise mitigation
Figure 2

Receivers identified as likely eligible for at-property noise mitigation.

- **The Northern Road (Existing)**
- **The Northern Road Upgrade**
- **detailed design**
- **Western Sydney Airport site** (Commonwealth Land)
- **Defence Establishment Orchard Hills (Commonwealth Land)**
- **Commonwealth lands**

**Receivers qualifying for at-property treatment**
- **Assessed as eligible in EIS**
- **Assessed as eligible as a result of design refinements**

0 200 400 m
Figure 2 | Receivers identified as likely eligible for at-property noise mitigation
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Receivers qualifying for at-property treatment
- Assessed as eligible in EIS
- Assessed as eligible as a result of design refinements

Legend:
- The Northern Road (Existing)
- The Northern Road Upgrade
detailed design
- Western Sydney Airport site (Commonwealth Land)
- Defence Establishment Orchard Hills (Commonwealth Land)
- Commonwealth lands
4. **Environmental management**

The EIS identified environmental management and mitigation measures that Roads and Maritime would adopt to avoid or reduce environmental impact (refer to Section 12 of the EIS) in addition to a range of noise mitigations proposed for the project.

Consistent with the EIS, a Noise Management Plan would be established which would outline monitoring and reporting requirements to confirm the effectiveness of these measures, and determine if any additional measures are required. No further environmental management measures have been identified due to design refinements of the project.