This Appendix presents a summary of the various noise sources/levels and how these are implemented in the SoundPLAN computer noise modelling.

1 Summary of Noise Sources

Electric Multiple Unit Passenger Trains

The source noise levels for Electric Multiple Unit Passenger trains are shown in **Table 1** and are based on the full sample of trains in the Rail Noise Database. Although there were no millennium trains operating when the Rail Noise Database or PRP studies were undertaken (1996/2000), recent noise measurements undertaken by Heggies Australia have indicated that the noise emissions from Millennium and Tangara trains are similar.

Table 1 Electric Multiple Unit Passenger Train Noise Levels

Train Type	Noise Level at 80 km/h and 15 m (dBA)			Speed Dependence (dBA)	Source Height
	LAmax (average)	LAmax (5% exceedance)	LAE (Log average)		
Tangara	85	90	89	See Note 1	0.5 m
Double Deck Suburban	87	92	92	See Note 1	0.5 m

Note 1: For wheel-rail noise, the LAmax speed relationship in dBA is 30 log (V/Vo), the LAE speed relationship is 20 log (V/Vo). Where V is the operating speed and Vo = 80 km/h.

For the Main North Line noise calculations, the LAmax noise levels in **Table 1** have been reduced by 3 dBA on the basis of recent attended noise measurements results.

Rail Surface Discontinuities

Where possible, the locations of discontinuities are incorporated into the computer modelling, using the adjustments listed in **Table 2** over a track length of 10 m. These values are based on adjustments recommended for rail joints and turnouts in Nordic (1996), and are consistent with measurements carried out by Heggies Australia on several previous projects.

During the computer modelling, these corrections are applied to the LAmax and LAE wheel-rail noise, for 10 m of track centred on the discontinuity (where such discontinuities can be identified). This results in an overall increase in noise level of only 2.5 dB at 15 m from a turnout, indicating that the change in the character of the noise rather than the change in level may be more significant to the common perception of turnouts being much noisier than smooth track.

Table 2 Wheel-Rail Noise Adjustments at Rail Discontinuities

Track Feature	LAE and LAmax Noise Level Increase (dBA)
Turnout	+6
Mechanical Joint	+3
Diamond Crossing	+10
Glued Joint (uneven)	+3

Bridges and Viaducts

On bridges and viaducts, vibration from the trains is transmitted into the supporting structure, resulting in noise radiation from the bride or viaduct. The level of increased noise is dependent on a variety of factors. To simplify the modeling process, **Table 3** provides L_{Amax} and L_{AE} corrections over the length of the bridge or viaduct. These increases apply to the wheel-rail component.

For the Main North Line noise modelling, no adjustments have been made for proposed road under-bridges and viaducts, as it has been assumed that these structures will be ballasted concrete spans with no side screens.

Table 3 Increase in Noise Level at Bridges and Viaducts

Description of Bridge	L_{Amax} and L_{AE} Noise Level Increase (dBA)
Open transom, fabricated steel web, no side screens	+10
Open transom, fabricated web forming side screens	+8
Ballasted, steel box girder, no side screens	+4
Ballasted, fabricated web forming side screens	+4
Ballasted, concrete span, no side screens	0
Concrete trackbed, concrete box girder, concrete side screens	-2
Ballasted, concrete span, concrete side screens	-5

2 SoundPLAN Computer Modelling

SoundPLAN Version 6.3 has been used to calculate railway noise emission levels for this study. Of the train noise prediction models available within SoundPLAN, the Nordic Rail Traffic Noise Prediction Method (Kilde 1984) has been used, since it is capable of efficiently calculating both the L_{Amax} and L_{Aeq} noise levels.

The calculation procedure involves a 360° scan from each receiver point (using fixed angular steps), with the contributions from each angular increment summed to determine the total received noise level. The calculation procedure takes into account the direct noise, the noise diffracting over obstacles or barriers and the noise reflected off buildings.

A separate model run was also carried out using a fixed calculation grid with a spacing of 20 m to produce noise contours. The resultant contours were interpolated between the grid points.

The relevant train operations data was obtained from RailCorp and TIDC. The locations of track features, such as turnouts were taken from the relevant line drawings and information provided by TIDC.

For passenger trains, the maximum train speeds were based on the posted speed boards and speeds measured during the attended measurements. Where considered necessary, some additional ramping of speeds was provided to avoid large step changes in speed.