Environmental Noise Seminar
25 June 2007

Noise and Vibration Management for the Southern Suburbs Railway Project

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Public Transport Authority

NewMetroRail
Making the Connection

Overview of Presentation

- **SSR Project Overview**
- **Noise Assessment & Criteria**
- **Planning**
- **Mitigation**
- **Community Consultation**
- **Case Studies**
- **Community Issues**
- **Government initiatives to assist potential land owners**

SSR Project Overview

- Starting at Perth Railway Station the railway is in tunnel under a major street of central Perth
- Travelling south the railway is located in the median of the Kwinana Freeway, passing over the Narrows and Mt. Henry Bridges and between well-developed residential areas
- The railway then leaves the Kwinana Freeway and passes through residential areas and regional parks to the regional centre of Rockingham
- Moving south the railway passes through largely rural land to the residential areas of Mandurah
- There will be 11 stations initially: two Perth City stations, eight between Perth and Mandurah and one at Mandurah

Project Map


Clarkson
Currambine
Greenwood
Midland
Canning Bridge
Thornlie
Cockburn Central
(Thomsons Lake)
Armadale
Kwinana (Thomas Road)
Mandurah
CITY SECTION

Project Overview

- **The SSR Project:**
  - **passes through "greenfields" locations where there has been no railway development previously**
  - **passes through seven Local Government areas**
  - **will link Perth with the regional centre of Mandurah, a coastal town about 72 kilometres south**
- **33 new electric 3-car set trains have been constructed for the new railway. They have a.c. traction and are designed for a speed of 130 kph**

Environmental Assessment

- **On referral to the EPA, the level of assessment was set at "Public Environmental Review" (PER)**

- **The guidelines for the PER included a requirement to manage the pollution factors of operational noise & vibration and consult fully with members of the public**

- **Operational noise & vibration criteria established in consultation with DEC/EPA**

Noise Criteria

- **To simplify noise assessment, the project was divided into two components – Perth City with a major tunnel, and south of the Narrows Bridge to Mandurah with a variety of land zonings**
- **Key agreed noise criteria were:**
- **Criterion 1: not to exceed**

LAEq(daytime 6am – 10pm)	**60 dB(A)**
LAEq(night time)	**55 dB(A)**
LAmax	**80 dB(A)**

- **Noise mitigation to be considered to bring levels to:**

Criterion 2:

LAEq(daytime)	**55 dB(A)**
LAEq(night time)	**50 dB(A)**
LAmax	**75 dB(A)**

- **Criterion 3: Noise levels to be managed to be as low as reasonably practicable**
- **Where road changes where implemented Main Road WA Noise Level Objectives were adopted.** (63 dB(A) $_{L10\ 18\ hr}$, 55 dB(A) $L_{eq,8hr}$ + 3dB(A) for high ambient areas)

Vibration Criteria

- Vibration criteria:
  - **Criterion 1: vibration isolation measures will be provided where the predicted or actual vibration is Curve 2 (109 dB) or greater, as defined in AS 2670.2**
  - **Criterion 2: the proposal will be designed to meet Curve 1.4 (106 dB), as defined in AS 2670.2**
  - **Isolation measures will be considered at the design stage where vibration is predicted to be between Criterion 1 and Criterion 2**
  - **Vibration will be managed to as low as reasonably practicable**

Additional criteria for regenerated noise from ground-borne vibration

Not to exceed:

▪ Auditorium/Performing arts	30 dB(A)
▪ Residential-private dwellings	35 dB(A)
▪ Residential-hotels	40 dB(A)
▪ Place of worship	35 dB(A)
▪ Cinema	35 dB(A)
▪ Office	40 dB(A)
▪ Library/Educational	40 dB(A)
▪ Specialty Retail	45 dB(A)

Planning

- A Master Plan for the proposed SSR was developed, incorporating a detailed 3D design for the railway alignment
- Acoustic consultants were engaged to develop separate Noise and Vibration Management Plans, based on this detailed design, for the Perth City area and the Narrows Bridge to Mandurah area
- The Plan for the Perth City was initially concept and required the constructing contractor to complete the final design and noise management, based on geotechnical and hydrology information from the tunnel drilling
- The Plan for the Narrows Bridge to Mandurah was provided to the constructing contractor with complete noise predictions and associated noise attenuation requirements, subject only to as-constructed design variations

Noise Plan – Narrows to Mandurah

- **The Plan was divided into six sections, corresponding with key locations along the railway route**
- **Noise-sensitive receivers were identified in each section, with a total of 441 receivers included in the acoustic model**
- **Noise measurements from the existing electric suburban passenger railway were used as baseline data to develop the model**
- **The model included the 3D railway earthworks design, cadastral and topographical data and Metropolitan and Peel Region Scheme boundaries**
- **Operational noise from the railway was then predicted for each section**

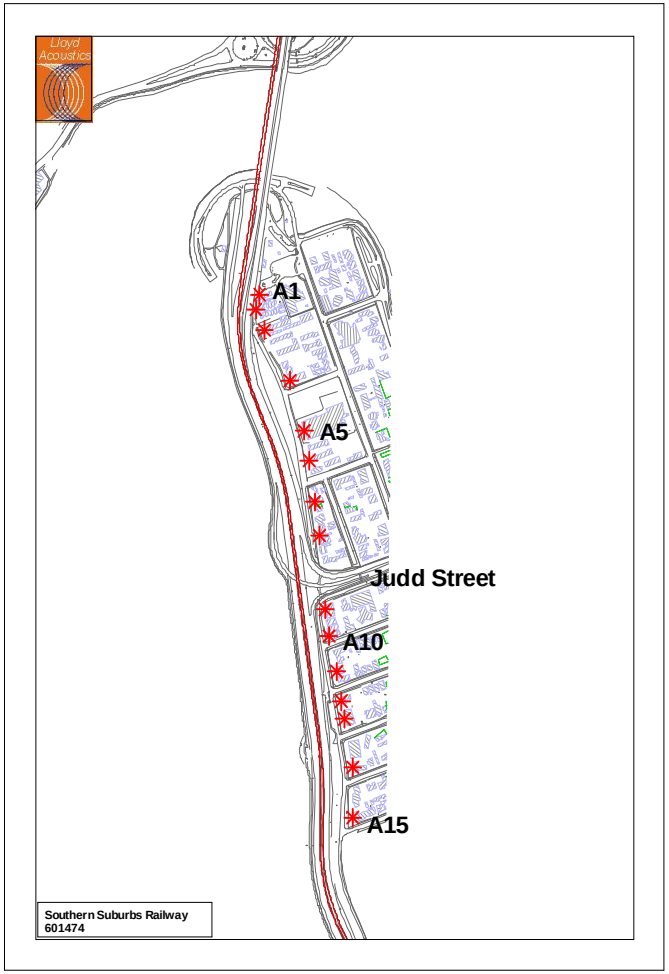
Noise Modelling Inputs

- **Distance from the track to the receiver;**
- **Speed of the train;**
- **Height of the noise source in respect to the receiver;**
- **Walls built as part of the Southern Suburbs railway project; Existing road barriers, land topography and property fences.**
- **Baseline noise output from train (measured at 15 metres at 130 km/hr)**
- **Train length**
- **Average number of pass bys per hour**
- **Height of noise source above rail head**

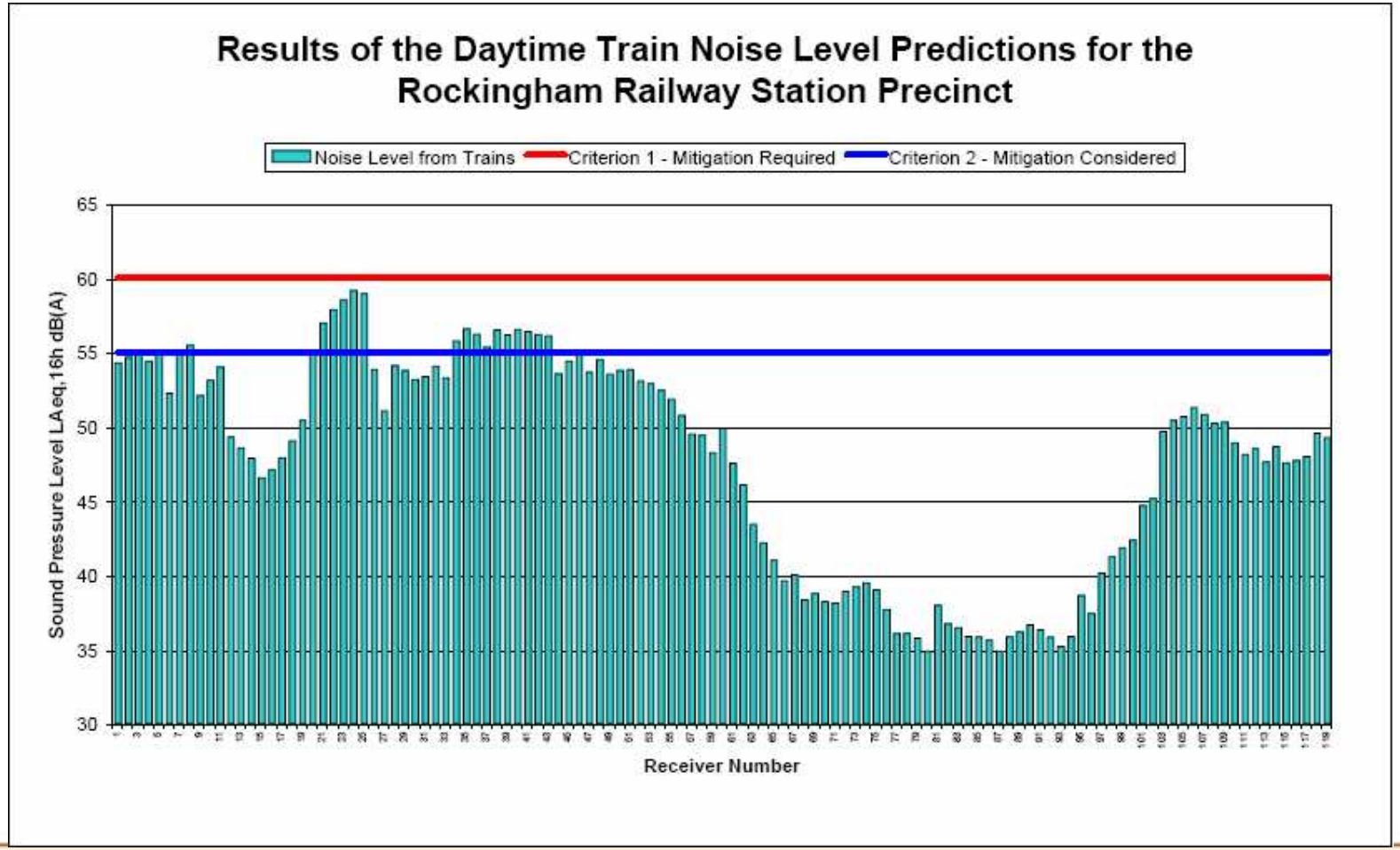
Interpretation of Results

- **The noise predictions for passing trains were prepared as bar-chart graphs, expressed as both average (LAEq) and maximum (Lmax) levels of decibel (dB) sound energy**
- **These results were then compared with the noise Criteria and the ambient noise level experienced by the respective receivers**
- **Receivers were then divided into groups that met Criteria 2; groups that were between Criteria 2 and 1, requiring consideration of noise mitigation, and those above Criteria 1 where noise mitigation is required**
- **A list of options was developed for each of the areas to be considered for noise mitigation**

Receiver Location Diagram



Examples of Bar-Chart Noise Predictions



Options for Noise Mitigation

- **Bunds or berms of earth that may be constructed as part of the earthworks for the railway formation**
- **Barriers or walls of masonry or other materials of suitable surface density**
- **In some circumstances where noise barriers are unacceptable from a visual amenity perspective, train speeds can be reduced from 130 kph to 100 kph or less**

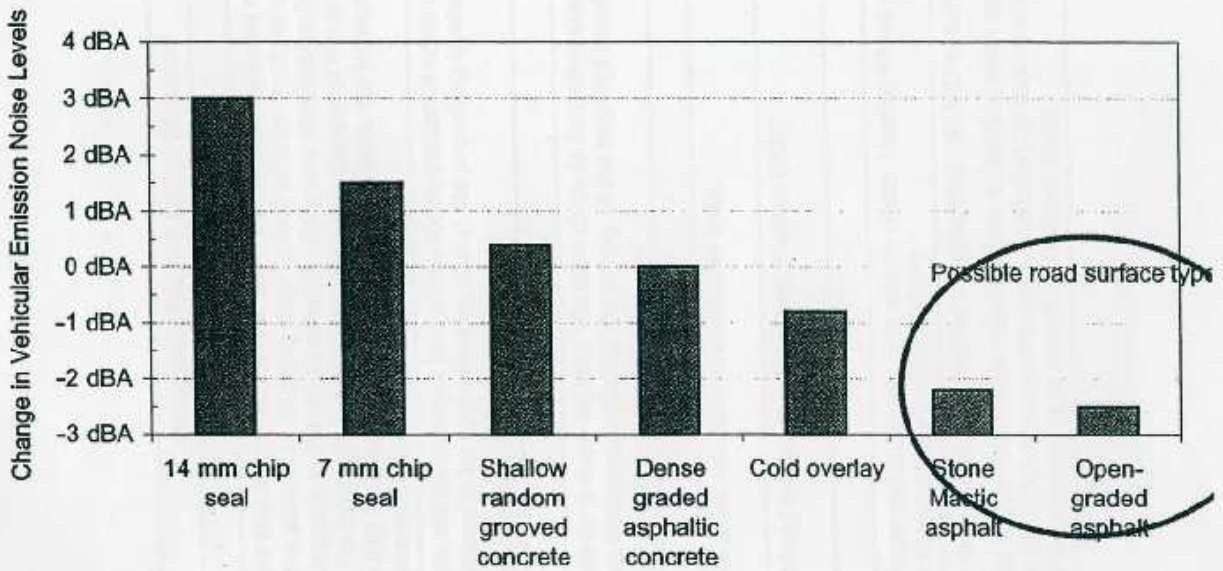
Mitigation installed on the SSR

- Approx. 6 kilometres of noise walls
- 1.4 kilometres stone mastic asphalt road surfacing
- 680 metres of double track ballast matting
- 1.3 kilometres of double track vibration isolation in City tunnels

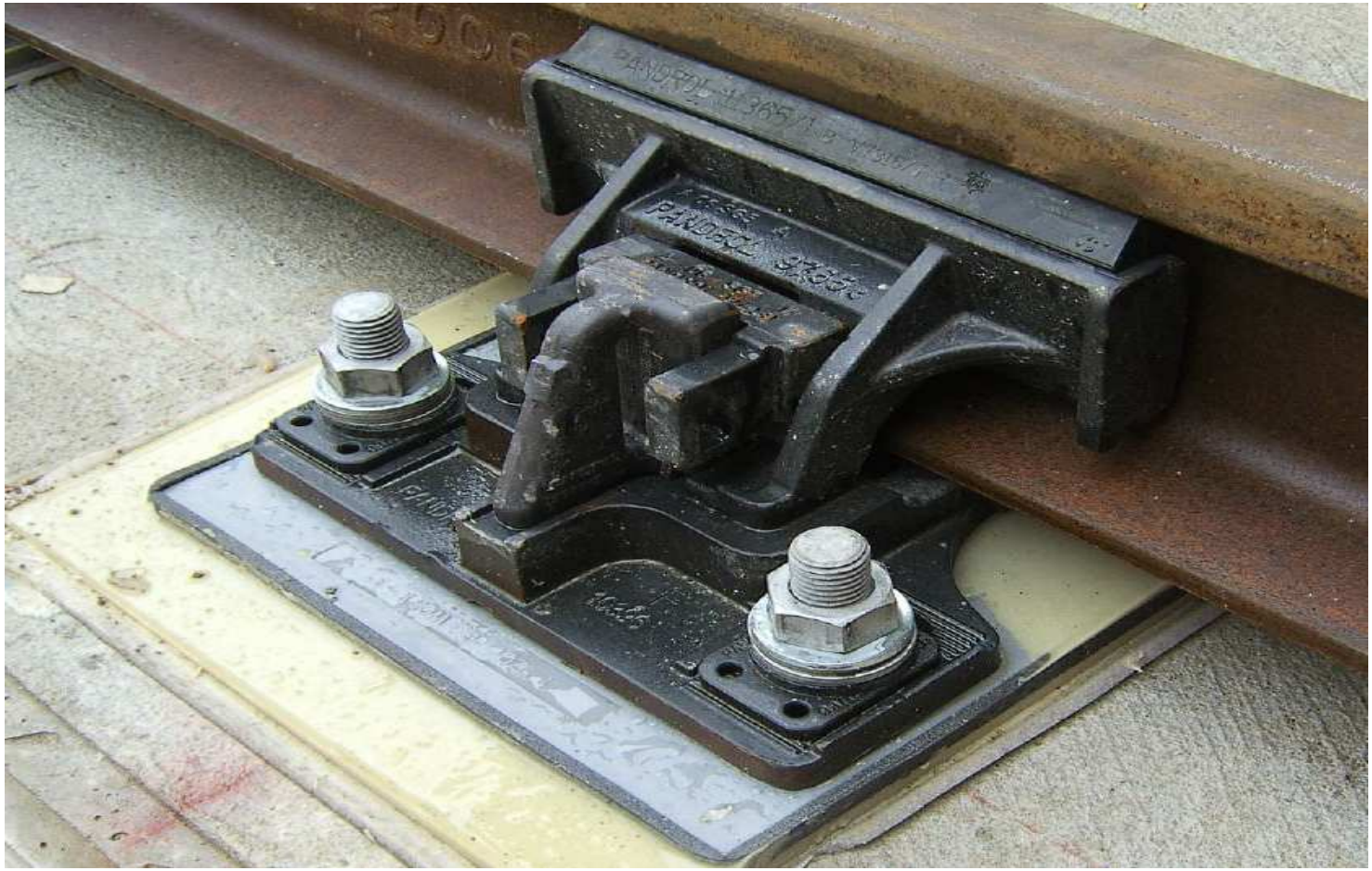
Road Surface Treatments

Maunsell SINCLAIR KNIGHT MERZ
JOINT VENTURE

Subject: Overview of Mitigation Process
Date: 11 January, 2003
Project No: DE02300.190



Vibration Isolation City Tunnels



City Tunnel Esplanade to William Street

Vibration Modelling Drop Hammer Tests

Contract Management

- Variations in the contracted scope of work such as the installation of addition noise and vibration measures when the project is under construction are potentially very costly.
- Good planning is essential.
- Decisions to install additional measures must be justifiable.

Community Consultation

- Public meetings were arranged for each area of Local Government where community concerns had been raised
- Generally, the issue of train (and station) noise was one of the key concerns of residents adjacent to the railway
- Subsequent meetings were arranged with smaller groups of residents to address specific issues in their locations
- These meetings also involved officers from the respective Local Governments

Explaining Noise and Noise Criteria

- Criteria for train operations vs Criteria for road noise vs Environmental Protection (Noise) Regulations (construction and station environments)
- Counter intuitive nature of combined noise from different sources (50 dB train noise + 50 dB road noise does not equal 100 dB of total noise)
- Separation of noise modelling of noise from different sources
- Averaging of noise energy over given time periods
- These can be difficult issues for people with no acoustic background to understand and accept.

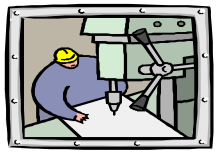
Examples of consultation tools used

- Indicative pictorial noise chart
- Video with audio of train pass bys on a busy road to demonstrate the masking effect of the dominant noise source

Noise Barometer
Sound Pressure Levels dB(A)

Rock

100
90
80
70
60
50
40
30
20
10
0



Factory Floor

Busy Road

Normal Conversation

Open-Plan

Library

Forest Background

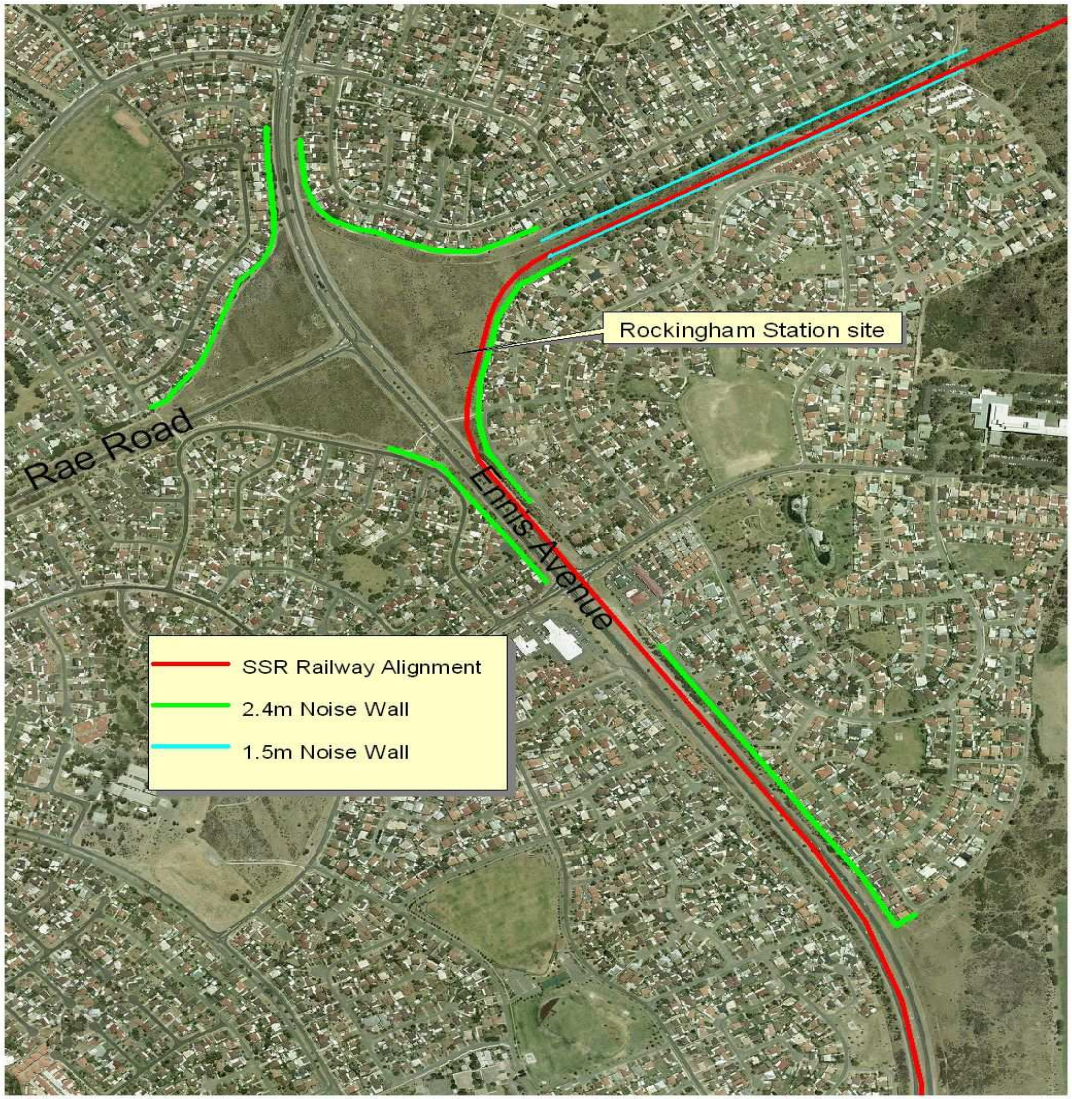
Threshold of

Case Study - Rockingham

- **Some residential areas adjacent to the railway alignment in the regional centre of Rockingham predicted to exceed Criteria 1**
- **In the southern residential areas, a combination of speed reduction and construction of 2.4 metre high brick walls against the rear of property boundaries proposed to effectively reduce noise to Criteria 2**
- **In the northern residential areas, several residences were predicted to receive rail noise between Criteria 2 and 1; placement of low walls immediately adjacent to the railway in this corridor should significantly reduce noise levels to all adjacent residences. A train speed reduction will also be implemented and monitored.**
- **Additionally, a significant number of 2.4 metre high brick noise walls have been constructed to manage traffic noise from road changes associated with Rockingham Station access. These walls will also effectively reduce rail noise in these areas.**

Case Study - Rockingham

- **At a meeting of residents from Hillman and Woodbridge, on opposite sides of the railway alignment to the east of Rockingham Station, it was announced that the Hillman residences would receive a noise wall, but a wall was unnecessary for the Woodbridge residences, based on current noise predictions.**
- **This created a great degree of animosity amongst the residents. Subsequently it was decided not to construct any noise walls adjacent to residences but to install smaller, more effective noise walls immediately adjacent to the railway tracks.**



SSR Rockingham Noise Walls

Case Study – South Perth
Residences Between Criteria 1 & 2

- **The predicted rail noise along the South Perth foreshore was at or just below Criterion 1**
- **Majority of residents put a greater emphasis on the visual amenity of their view across the Swan River than the nuisance of noise from the Kwinana Freeway**
- **Effective opaque barriers were rejected and the high cost of transparent barriers could not be justified in view of the high ambient noise from the Freeway**
- **A speed reduction from 130 kph to 100 kph max. was able to reduce rail noise to just above Criterion 2 for daytime and just below for night time**

Other Areas Between Criteria 1 & 2

- **A number of isolated residences in the alignment were predicted to have noise levels between Criteria 1 and 2**
- **Mitigation treatments for these locations could not be justified and are regarded as receiving noise levels as low as reasonably practicable, however they will be subject to operational noise level measurements.**

Case Studies – Bull Creek Station

- **The northbound Freeway off-ramp was required to be relocated immediately adjacent to existing residences to provide space for the construction of the Bull Creek Station carpark.**
- **Consultation with affected residents and the City of Melville Mayor and officers led to an architectural review of the Station plans.**
- **This ultimately resulted in no change to the off-ramp alignment and increased parking space from the reconfiguration of the internal roads in the parking area.**

Bull Creek Station

Public Transport Authority

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Community Issues

Melville Times

Community

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OARSOME EFFORT
Learning students hit the water
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realestate
Home in a peaceful street

Your best guide to LOCAL PROPERTY
See inside

WIN!
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Selway Road residents John Bailey, Hilty West, Marie Powell and Shirley McGowan hope an end to their freeway nightmare is near. Picture: Martin Kennealey

Buffer buck passed

By RACHEL WATTS

A THREE-YEAR ordeal that left Brentwood residents looking out over the Kwinana Freeway from their homes could be nearing an end.

Residents of Selway Road say their homes have fallen in value by about $30,000 since the realignment of the Kwinana Freeway intersection with Leach Highway.

Before the roadworks, the traffic was hidden behind vegetation and residents had been told by Melville Council that a wall, similar to the one built by the council further along Selway Road, would be built to buffer noise from the freeway.

The wall for the rest part of the street was planned for 2006-07, but it was never built and the council later claimed it was Main Roads' responsibility.

This week, Main Roads agreed to seek a solution.

"We were told our wall was on the budget but then the roadworks started as it was put on hold," resident Hilty West said.

"We are the only quadrant on this intersection that does not have a wall."

To add to the problem, vegetation that residents planted opposite their homes as a screen was ripped up during works to realign the freeway ramp.

"We were told there would be landscaping to hide the eyesore but that hasn't happened," long-term resident John Bailey said.

"I had planted hedges and geraldton wax opposite my house to screen it and they were ripped out.

"I was told they'd be replaced, but they weren't."

Melville Council acting chief executive Robert Wilts said buffer walls on the freeway were the responsibility of Main Roads. The council agreed to build the buffer wall at another section of Selway Road after Main Roads refused. He said after the Southern Rail Link was announced, the council decided the onus should be on the State Government to build buffer walls.

Main Roads said it would ask the contractor back to plant vegetation. Main Roads met Melville Council representatives on Friday to discuss why the council built a brick wall on part of the road in the 1990s.

"We want to know why the council built the wall to its current point and why it did not complete the wall after apparently giving residents an undertaking to do so," public affairs manager Dean Roberts said.

Community Issues

- "You cleared all the trees and now the noise is much louder" – real or perceived, the effect is the same.
- "I bought a buffer zone" – The "buffer zone" is a pre existing transport reserve.
- "My property has been devalued" – Very difficult to confirm if this actual occurs once people are used to the change. Values may in fact go up with better proximity to transport infrastructure.
- "You built a wall across the road from me. When am I getting mine?" – Projects must consider the ramifications of creating unsustainable precedents. The wall must stop somewhere and there is always another house across or down the road.

Government Initiatives to assist potential land owners

- Advice or conditions on planning approvals for new property developments adjacent to proposed transport infrastructure projects. (e.g. estate boundary walls or noise sensitive house design)

- Memorials on new titles advising the land is adjacent to a proposed transport infrastructure project and may be subject to some degree of noise and vibration.