Operational Noise Management Presentation

Pacific Highway, Bonville upgrade

14th March 2007

Please note the information provided is in text form only as the presentation in powerpoint form (including images) is too large for viewing over the website.

Objectives

Bassett Acoustics were commissioned to model the operational noise from the Pacific Highway upgrade, Bonville and to determine the most effective noise control solutions. To understand this process we will introduce and discuss the following topics:

- The applicable Noise Criteria for the upgraded highway and the relevant project approvals

- Traffic noise.
  - How is traffic noise generated (the Source)
  - Factors affecting how traffic noise is transmitted to the receiver

- Options for noise mitigation to reduce traffic noise.
  - Noise barriers.
  - Stone Mastic Asphalt (SMA) road surface.
  - At house treatments.

- Noise mitigation treatments adopted on the Bonville Upgrade.

Note: this presentation applies to operational noise of the highway upgrade, not construction noise.

The Operational Noise Criteria

The Department of Environment and Conservation (DEC) has a specific criteria called the "Environmental Criteria for Road Traffic Noise" (ECRTN) which has been used to define the Noise Criteria for the highway.

- The Noise Criteria from the ERCTN has been the basis for all the assessments and conditions associated with the highway upgrade.

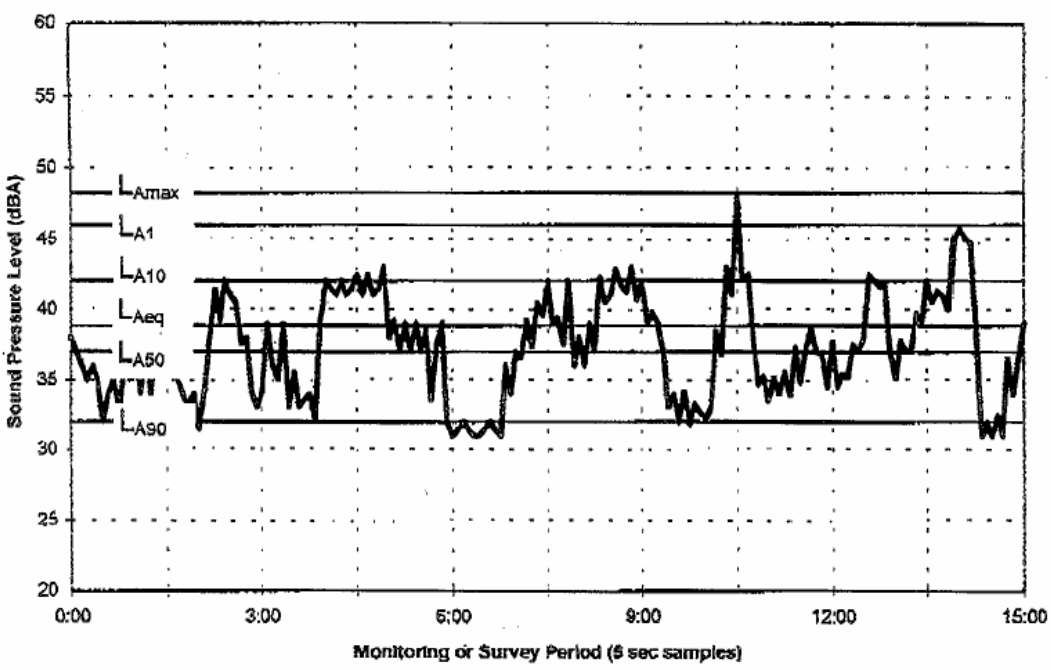
- The assessments and conditions affected by this criteria are:
  - Environmental Impact Statement (EIS)
  - Supplementary Design Reports
  - Minister of Planning Consent Conditions
  - Scope of Works and Technical Criteria (SWTC), by the Road Traffic Authority (RTA)
  - Operational Design models and reports

What is Sound?

- Sound is a pressure wave in air traveling at 340m/s
- Noise is the term for unwanted sound
- Frequency range of audible sound is 20 Hz to 20,000 Hz.
- Hearing range of 0.00002 Pa to 60 Pa
- Use decibels for convenience (due to the large scale)

How do we quantify and measure sound?

Lmax	**The maximum sound pressure level measured over a given period.**
Lmin	**The minimum sound pressure level measured over a given period.**
L1	**The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.**
L10	**The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.**
L90	**The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L90 noise level expressed in units of dB.**
Leq	**The "equivalent noise level" is the summation of noise events and integrated over a selected period of time.**



The Noise Criteria
So what are the ECRTN criteria?

- LAeq,15hr = 55 dB (Day) which means: the average noise level measured from 7am until 10pm each day should not be greater than 55 dB outside at the receiver due to the new road.

- LAeq,9hr = 50 dB (Night) which means: the average noise level measured from 10pm until 7am each night should not be greater than 50 dB outside at the receiver due to the new road.

- If the existing road noise already exceeds the two levels given above, the redeveloped section of road should not cause an increase of more than 2 dB.

- If the predicted noise levels exceed the criteria all reasonable and feasible measures must be implemented, including at house treatments, noise walls, barriers and road pavement type.

Traffic Noise
What is the source of traffic noise?

- Below 50 km/h the engine and exhaust generate the majority of the noise.

- Above 50 km/h the tyres generate the majority of the noise.

    - Tread block impacts the road surface generating vibration and noise.

    - Air is compressed between the treads generating noise.

- The **worst case** noise for any highway will be when the vehicles are moving at speeds greater than 100 km/h.

What factors affect the level of traffic noise at the receiver?

- Traffic level (traffic mix, number of vehicles etc).
- The material used for the road surface.
- Gradient of the road surface.
- Receivers angle of view.
- Distance from road to receiver.
- Barriers or noise walls in between the road and receiver.
- Topography (the hills and troughs in the land between the receiver and the road, this includes the fills and cuts used to make the road)
- Air absorption (absorption of sound as it moves the air and loses energy to heat).
- Ground absorption (absorption of sound by the surface material i.e. tarmac or grass have very different ground absorption).
- Temperature differences (can change the path followed by sound).
- Wind speed differences (can change the path followed by sound).

Options for Controlling Traffic Noise
At the source (or road)

- Noise barriers, either walls or mounds.
- Use quiet road surfaces.
- Minimise steep sections in the road to reduce the need for accelerating and decelerating.

At the receiver

- At house mitigations including glazing enhancements on windows and air ventilation / conditioning.

Where reasonable and feasible, the preference is control / minimise the noise at the source rather than at the receivers as this is more effective. This is not possible in all cases.

Options for Controlling Traffic Noise

Noise walls or barriers

- Sound is transmitted from the source to the receiver and can be thought to travel along many straight lines or rays, sometimes also called **paths.**
- Noise walls partially block these paths and reduce the amount of noise transmitted to the receiver.
- Noise walls work better when close to the source of the noise.
- Effective noise walls can produce noise reductions of **10-15** dB.
- Reducing the noise by 10dB will seem half as loud to the receiver.

Stone Mastic Asphalt (SMA)

- SMA has a 'Negative' surface texture.
- SMA has surface air paths. These air paths help absorb noise at the road surface.
- This reduces the noise transmitted to the receivers by approximately 3 dB.
- Stone mastic asphalt will be laid for all new road surfaces north of Reedy Creek (i.e. the new highway and associated ramps).

At House Treatments

- Sound moves through air very easily, so one of the best ways to reduce the amount of noise entering the home is to block all natural air paths.
- Air conditioning or mechanical ventilation allows the air paths into the home to be controlled and for windows to remain closed, thereby reducing the noise entering the home.
- Depending on the type of windows it may be necessary to improve the glass in the windows. This is often done with double glazed windows.

- Bedrooms are the most sensitive rooms to noise in your home, so these rooms will always receive the largest amount of treatment, if it is required.

- Depending on the orientation of the home, local topography etc not all living spaces in a home will require treatment

Treatments adopted for the Bonville upgrade

- **Archville Station Road interchange north bound on ramp**. Construction of 550 metres of noise barrier 3.5 to 4.5 metres high along western side of the carriageway between station 40 and 590 west.

- **Archville Station Road interchange south bound off ramp**. Construction of 620 metres of noise barrier 0 to 4.0 metres high along the eastern side of the carriageway between station 50 and 670 east.
- Residents to the South of Archville Station road do not require a noise wall as the road passes through a cutting in this section, effectively shielding the residents in this area.

Treatments adopted for the Bonville upgrade

Noise Walls

- **Grandis Road fill area**. Construction of 640 metres of noise mound 0 to 5.0 metres high between station 98070 and 98710 west. Construction of 570 metres of noise mound 0 to 4.0 metres high between station 98030 and 98640 east.

Treatments adopted for the Bonville upgrade

Noise Walls

- **North of Bonville Station Road**. Construction of a 260 metre long noise barrier 0 to 3.5 metres high along western side of the carriageway between station 99320 and 99580.

Noise Walls

- **South of Herdegen Close**. Construction of a 450 metre long noise barrier 2.5 to 4.0 metres high along western side of the carriageway between station 100850 and 101300.

Process for house treatments

- The Environmental Impact Statement (EIS), Ministers Consent Conditions and the Scope of Works and Technical Criteria (SWTC) identified the houses most likely to be affected by the highway upgrade and recommended at house treatments for those dwellings. The dwellings were placed into 3 groups with different requirements:

    - Group 1 – comprised 9 dwellings to receive house treatment before construction begins

- Groups 2 and 3 – comprised 21 dwellings that would potentially require treatment before operation of the road

- Bassett were able to model the road in greater detail and identified exactly which dwellings should receive treatment.
- Most of the houses requiring treatment were inspected to determine their construction, current glazing, orientation and room sizes.
- The treatment was determined by calculating how much sound was transmitted through walls, windows, roofs and doors and comparing this with the design criteria for internal noise levels as given in the ECRTN. These levels were:

    - LAeq,15hr = 45 dB (Day) which means: the average noise level measured from 7am until 10pm each day should not be greater than 45 dB inside a living room at the receiver due to the **new** road.
    - LAeq,9hr = 35 dB (Night) which means: the average noise level measured from 10pm until 7am each night should not be greater than 35 dB inside a bedroom at the receiver due to the **new** road.

Process for house treatments

- 11 dwellings have received air conditioning (to allow windows to remain closed).
- 9 dwellings will receive glazing upgrades to the bedroom window/s.
- 2 of the 9 dwellings have received glazing upgrades to the living room windows.

Operational monitoring for the Bonville upgrade
What is operational monitoring?

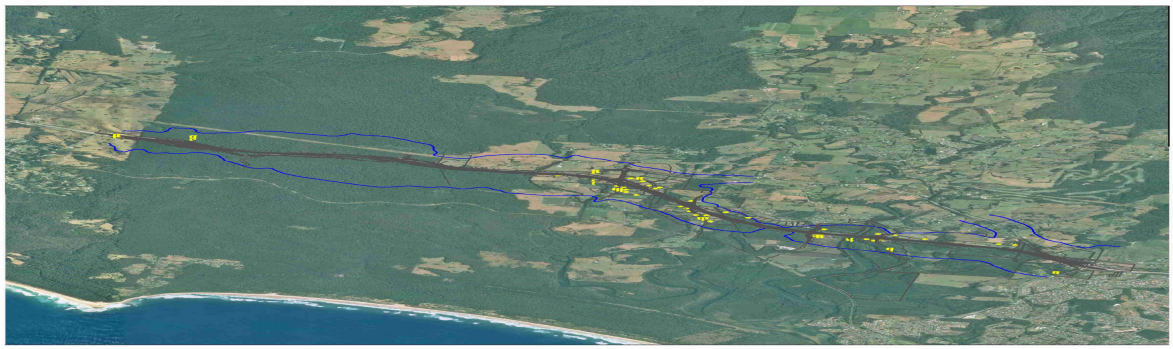
- The road will be monitored at numerous locations for periods of 1 week to obtain an average LAeq during the day and night.
- With this data the noise model predictions can be analysed for accuracy.
- The noise mitigation measures can then be assessed for effectiveness by comparing the noise data against the design criteria.
- If there are discrepancies further mitigation measures will be designed and implemented.

Noise Contours
Night-time Contours

- The next images show how the improvement in treatments and modelling have reduced the noise levels at the receivers.

- The **BLUE** line shows the LAeq,9hr = 50 dB (Night) noise contours that were accepted by the planning and consent authorities.

- The **RED** line shows the LAeq,9hr = 50 dB (Night) noise contours that Abigroup are working towards.



Outcomes

- The road has been extensively modeled using the most advanced software available.

- Noise walls will be constructed at key locations to reduce noise.

- A noise reducing road surface (SMA) will be laid near most of the residential dwellings.

- At house treatments will be provided to residents who will be significantly affected by the upgrade.

- Abigroup have improved upon the designs used to acquire planning approval for the new road and have ensured that all reasonable and feasible measures will be implemented to reduce noise.

- Noise will be monitored once the road is operational, to ensure the design goals have been met.

Questions?