APPLICATION OF THE NSW EPA ROAD TRAFFIC NOISE CRITERIA TO HEAVY VEHICLE TRAFFIC ASSOCIATED WITH RURAL INDUSTRY IN TASMANIA

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Abstract

As a trial, the Tasmanian Department of Infrastructure, Energy and Resources (DIER) chose to apply the New South Wales Environment Protection Agency (NSW EPA) traffic noise criteria to a proposed road upgrade associated with heavy vehicle traffic servicing a proposed timber processing plant in southern Tasmania. The NSW EPA policy is unique in that it (somewhat tentatively) provides criteria specifically for controlling noise impacts due to increased truck traffic associated with rural industry. The proposed works consisted mainly of an upgrade, together with a short new deviation in Ranelagh, one of the affected townships. The NSW criteria were found to be complex to apply. There are separate daytime and night-time criteria, and in each case, it must be established whether the absolute criteria (60 dB(A) $L_{Aeq,1hr}$ daytime or 55 dB(A) $L_{Aeq,1hr}$ night-time) or the "existing + 2" criteria are applicable. The absolute criteria applied to the busiest time of day and the "existing + 2" criteria applied during the quietest time of day, so traffic volume estimates were required for particular times of day. Nevertheless, use of the NSW criteria resulted in recommendations for noise mitigation measures that would provide useful noise reductions, namely the use of low-noise trucks and an extension of the 80km/hr speed zones near Judbury. In addition, the need for consideration of other potentially "reasonable and feasible" noise mitigation measures was indicated.

Introduction

When assessing impacts associated with rural industry, it is important to consider changes in traffic conditions on local roads. In particular, rural industry can often generate heavy vehicle traffic on previously quiet country roads.

This paper provides a case study of the application of the NSW EPA road traffic noise criteria for heavy vehicle traffic associated with a proposed timber processing mill in southern Tasmania, together with a comparison of the NSW criteria with other criteria with regard to the extent of noise reductions achieved and success in achieving compliance with the criteria.

It should be noted that the term "noise reduction" as used above is a relative term and refers to the difference in noise level due to the noise mitigation measures after the increase in noise level associated with the additional traffic occurs. Although the noise mitigation measures implemented on many projects these days achieve quite high levels of noise reduction, it is rare for there to be a nett decrease in noise levels when comparing the situation before and after construction of a new road or an increase in traffic volume.

Background

Beginning in early 2001, Forestry Tasmania acted as the proponent for a proposal to construct a wood processing facility, known as the Southwood Resources - Huon Wood Centre, near Judbury in southern Tasmania.

One of the recommendations of the Board of Environmental Management and Pollution Control was that the developer must address the environmental impact of the proposed truck route and Marshall Day Acoustics was commissioned to undertake a noise impact assessment. The roadworks associated with the truck route consisted mostly of an upgrade of existing roads, together with a short section of new road.

Noise Criteria

While there is a Tasmanian *Code of Practice for Minimisation of Road Traffic Noise in Design and Construction,* it was decided to base the assessment on the current NSW Environment Protection Authority criteria given in *Environmental Criteria for Road Traffic Noise* (ECRTN) [1].

Concerning the impact of truck traffic associated with new rural industries, the ECTRN states that "Where local authorities identify a 'principal haulage route', the noise criteria for the route should match those for collector roads, recognising the intent that they carry a different level and mix of traffic to local roads."

For the roads traversed by the truck route the base criteria are:

- $L_{Aeq,1hr}$ 60 dB(A) Daytime (7:00am–10:00pm)
- $L_{Aeq,1hr}$ 55 dB(A) Night-time (10:00pm–7:00am)

The ECTRN also states that *"in all cases, the* [project] *should be designed so as not to increase existing noise levels by more than 2 dB(A)"* and that *"if the existing noise level is below the criteria but within 2 dB of the criteria, then the 2 dB allowance may be applied to the existing noise level."* Thus, for example, if the noise limit is 60 dB(A), then any dwelling with a current noise level greater than 58 dB(A) would have the noise level increase limited to 2 dB(A) or less.

Traffic Conditions

Table 1 shows the existing traffic volumes near Judbury (a township relatively near the Southwood wood processing facility) and near Ranelagh (a township near the highway).

Table 1. Existing traffic volumes

	Near Judbury	*Near Ranelagh*
Cars	240-270	630-1000
Trucks	15-25	30-50

Table 2 shows the expected additional daily traffic volume due to Southwood.

Table 2. Additional traffic due to Southwood

Vehicle type	*Movements*
Cars	40
Light trucks	10
Heavy trucks	76

Note that there was a restriction placed on Southwood that trucks would not use the route during 2130-0630hrs.

Traffic speeds were 60km/hr within Judbury and Ranelagh and 100km/hr elsewhere with 80km/hr zones either side of the two townships. Within the 60km/hr zones it was assumed that the vehicles would be under full acceleration to ensure a conservative noise assessment.

Existing Noise Environment

The existing noise environment was found to consist of very quiet background levels (L_{A90}) which were sometimes less than 30 dB(A), interrupted every few minutes by noise from vehicles on local roads. As shown in Figure 1, night-time noise levels showed extreme variability depending on whether one or more vehicles happened to pass by during a particular 15minute sample period. One night-time measurement gave a L_{A01} of less than 30 dB(A).

It is common in Tasmania for rural dwellings to be located very close to the road. Noise monitoring, using unattended noise loggers, was undertaken at three houses. The $L_{Aeq,15hr}$ noise level was 54-56 dB(A) at 19m from the road centre line, 52-53 dB(A) at 15m and 59-62 dB(A) at 6m.

Methodology

As discussed above, the ECTRN specifies that, if possible, the base criterion be applied even if existing noise levels are high and that the allowance criterion ("existing + 2") be applied only when the base criterion cannot be achieved. However, for this project, it was known from the outset that the preferred noise mitigation measure was the use of low-noise trucks (rather than measures that could reduce noise from existing traffic as well the additional traffic) and it was clear that the "existing + 2" clause would be evoked wherever existing noise levels were high.

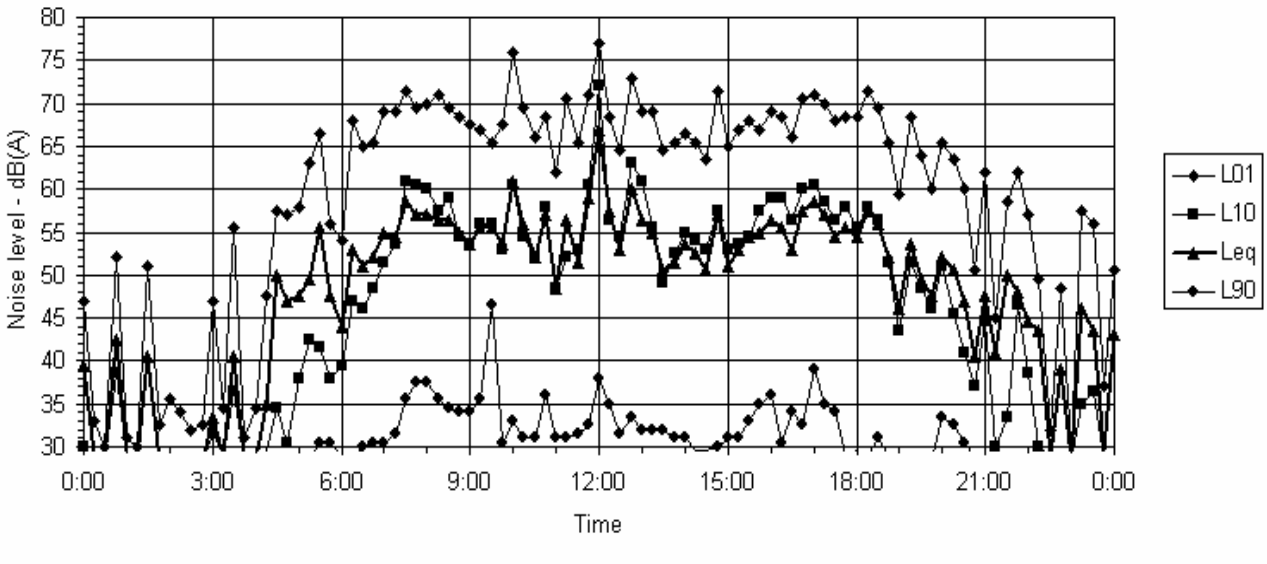

Figure 1. Sample noise level time history

Thus, the approach used to determine the need for noise control was:

- Select low noise trucks for Southwood so that, wherever possible, the noise increase is no greater than 2 dB(A).
- If the noise level increase in some areas is still expected to be greater than 2 dB(A), determine where the 60/55 dB(A) noise limit will be exceeded.
- Review noise control options for those locations where 60/55 dB(A) may be exceeded.

Calculation Method – Upgraded Section

Noise levels were calculated at a nominal distance of 10m from the road centreline for the existing traffic conditions and for the future traffic conditions with the additional traffic associated with the Southwood facility. If the traffic noise increase was found to be 2 dB(A) or less, then the NSW allowance criteria would be achieved. If the noise levels increase was greater than 2 dB(A), then the distance within which 60/55 dB(A) would be exceeded was determined.

Calculation Method – New Deviation

For the proposed section of new road, a computer noise model was used. Noise levels were predicted using the Nordic method [2]. This method was chosen because it is the only standard method for road traffic noise which can predict maximum noise levels. In addition, it is a true L_{Aeq} method and can, in theory, be used for very low traffic volumes, unlike the more commonly used *Calculation of Road Traffic Noise* (CRTN) method [3].

The maximum noise levels were estimated to assess noise impact in terms of sleep disturbance and interference with speech communication. As the focus of this paper is the effectiveness in this case of the NSW criteria, the maximum noise level assessment is not discussed here.

Noise Emission Estimates

Table 3 shows the assumed maximum noise levels and sound exposure levels for the various vehicles considered in the assessment.

Table 3. Assumed vehicle noise levels at 10m on sprayed seal road surface (dB(A))

Vehicle type	L_{Amax}	*SEL*
60km/hr, full throttle		
Car	70	75
Conventional light/medium truck	76	81
Low-noise heavy truck	78	83
100km/hr, cruising		
Car	80	81
Conventional light/medium truck	82	83
Low-noise heavy truck	86	87

The emission levels for cars and conventional trucks were based on:

- The Nordic noise calculation method, discussed further in the next section.
- The noise emission levels determined for the Traffic Noise Model (TNM) recently developed in the USA [4].
- A comparison of vehicle noise emission levels in Australia with those used in the American Traffic Noise Model. [5](NSW RTA 2001)
- Noise levels measured on various types of vehicles within the study area.
- Vehicle noise emission levels reported in earlier work on this project. [6].

Noise emission levels for low-noise heavy trucks

The road network in Tasmania is sometimes referred to as a "closed system" and the opportunities for regulation of the trucking industry are very different in Tasmania compared to the mainland.

Thus, it was considered that one of the most practical noise control options for this project was the use of low-noise trucks. However, the determination of achievable noise emission levels for low-noise trucks (as shown in Table 3) was somewhat problematic. It was not possible to simply rely on noise emission limits from overseas, as the road surface was to be a 10mm sprayed seal. Pass-by noise emission testing of road vehicles in Australia and overseas is generally undertaken with the vehicles travelling on a dense-graded asphalt surface. Thus, it was necessary to estimate the tyre noise component of the overall pass-by noise level in order to adjust the overall noise emission level for low-noise trucks travelling on a sprayed seal surface.

In the end, the noise emission estimates for the low-noise heavy trucks were based on the noise limits for heavy trucks used in Europe as specified in UN ECE Regulation 51 and EEC Council Directive 92/97. These regulations specify noise limits for heavy trucks that are 7 dB less than the noise limits specified in Australian Design Rule ADR28/01. The noise emission estimates were adjusted upward to allow for the sprayed seal surface.

However, it should be noted that even with heavy trucks, tyre noise may well be the predominant noise source at speeds above 50-70km/hr [7]. This is especially true at 100km/hr, and it not entirely certain that the noise levels shown in Table 3 could feasibly and reasonably be achieved on a sprayed seal surface. It was recommended that a range of tyres may need to be investigated on a sprayed seal surface.

Additionally, there was some concern that the use of B-doubles in hilly terrain may require vehicles that were higher powered than typical European trucks and that the UN ECE regulation may be difficult to comply with. However, a report by the National Roads and Transport Commission [8] states that "there are many European vehicles with rated power above 270kW which must

comply with the still lower ECE limits". Scania, for instance, are currently selling trucks in Australia with net engine powers of around 400kW that comply with the UN ECE regulation. [9].

Compliance with noise criteria

Existing roads – Allowance Criteria

It was expected that the greatest change in noise level would occur either during the middle of the day (when the greatest number of additional trucks were expected) or during the early evening (when the existing traffic volumes were low).

The estimated changes in noise level were

- 4-6 dB(A) near Judbury, where the existing traffic volumes were relatively low
- 1-2 dB(A) near Ranelagh, and between Ranelagh and the Highway
- 3 dB(A) between Ranelagh and Judbury.

Thus, whatever the existing noise level, the NSW allowance criteria would not be exceeded near Ranelagh, and between Ranelagh and the Highway.

However, even with the low-noise trucks, the change in traffic noise level was expected to exceed 2 dB(A) near Judbury and to slightly exceed 2 dB(A) west of Ranelagh. Thus, if there were any houses adjacent to these sections of the route where the future $L_{Aeq,1hr}$ noise level was expected to exceed the base criteria of 60/55 dB(A), then noise control measures would need to be considered.

Existing roads – Base Criteria

Daytime

In order to estimate the highest $L_{Aeq,1hr}$, it was necessary to determine which one-hour period during the day and during the night had the highest traffic volume when existing traffic was combined with the additional future traffic. The assessment began by looking at the highest daytime $L_{Aeq,1hr}$.

Between Ranelagh and Judbury, especially on the outskirts of Ranelagh, there were a number of houses at risk of exceeding 60 dB(A).

In Judbury, it was assumed that the new trucks would be traveling at 60km/h under full acceleration (due to the hilly terrain). As shown in Table 3, noise emission in this condition is 4 dB(A) less than cruising at 100km/h and there were no houses at risk of exceeding 60 dB(A).

Either side of Judbury, however, where the speed limit was expected to be 100km/hr, there were 4 houses at risk of exceeding 60 dB(A).

Night-time

Due to the prohibition of Southwood trucks during 2130-0630hrs, there was only one half-hour period (0630-0700hrs) during the night that needed to be considered.

It was found that compliance with the 55 dB(A) criterion would be achieved wherever compliance was achieved with the daytime criterion provided there are no more than 3 truck movements during 0630-0700hrs.

New Road – base criteria

Contour maps of noise levels near the new section of road were generated using the Nordic calculation method as implemented on SoundPLAN computer software.

It was found that the 60/55 dB(A) criteria would not be exceeded at any residences adjacent to the proposed deviation.

Review of Noise Control Options

Table 4 provides a summary of the noise control options reviewed, together with an evaluation of the suitability of the technique to this project.

Table 4. Review of noise control options

Noise control option	*Suitability to this project*
Reduction of vehicle noise emission	Suitable. This approach had already been shown to be effective.
Align road to increase buffer distances	Suitable. Clear compliance with noise level criteria has already been demonstrated near the proposed deviation by locating the new road as far as possible from existing residences.
Build road below grade	Not cost effective.
Build road underground	Not cost effective.
Use low-noise road surface	May be suitable for some sections of this project.
Lower speed limit	Feasible for this project, provided that speed limits are consistent with driver expectations. For example, if a road is designed for a speed of 100km/hr, but assigned a speed limit of 70km/h,it is likely that many vehicles will exceed 70km/h.
Truck restrictions (eg at night)	Suitable. Night-time impacts were considerably reduced by closing the gates at Southwood at night.
Noise barriers	Feasible for this project, but visual impacts may be an issue.
Town planning	Not reasonable or feasible. Land uses adjacent to the route were considered to be appropriate.
Acoustic treatment of affected buildings	Could be feasible for this project, but may not be cost-effective for large numbers of dwellings.

Suitable noise control techniques

Of the noise control techniques reviewed in Table 4, the following were identified as potentially feasible:

- Reduction of vehicle noise emission
- Alignment of road to provide adequate buffer distances
- Truck restrictions at night
- Low noise road surfaces
- Speed limits, if consistent with driver expectations
- Noise barriers
- Insulation of affected noise-sensitive buildings.

According to the NSW policy, it is also necessary to demonstrate that noise control techniques are reasonable. This means that noise control measures must be shown to provide a useful noise reduction (given the number of people affected) and be cost-effective, as well as other considerations.

The "reasonable and feasible" test would also need to be applied to the selection of low-noise trucks. As discussed above, it was not entirely certain that the noise emission levels shown in Table 3 could definitely be achieved on a sprayed sealed surface.

The discussion below is based on the recommendations made concerning noise control. Consistent with the NSW approach, it was also recommended that the selection and design of noise control measures be finalised during the detailed design phase, taking account of community and local council preferences, visual impacts, feasibility and reasonableness issues and cost-effectiveness.

Between Ranelagh and Judbury

For the residences on the outskirts of Ranelagh, it could be argued that it would be unreasonable to provide additional noise control, given that the "existing + 2" allowance criterion was only exceeded by 1 dB(A). However, the following techniques were suggested for this section:

- Use of a 7mm sprayed seal rather than a 10mm seal.
- Reduction in speed to 70km/hr. This would only apply to the Southwood trucks - other traffic would only be limited to the 100km/hr speed limit.

Near Judbury

Use of speed restrictions was considered to be reasonable near Judbury as it would be consistent with the expectations of drivers that speeds be restricted near a built-up area. Of the 4 residences at risk of exceeding 60 dB(A), the nearest was at a distance of 15m from the road centreline. The noise level at this distance could be reduced to 60 dB(A) by reducing the speed limit to 80km/hr for all traffic (not just the Southwood trucks).

Selection of Southwood trucks

The reasonable and feasible test would also need to be applied to the selection of low-noise trucks. As discussed above, it was not entirely certain that the noise emission levels shown in Table 3 could definitely be achieved on a sprayed sealed surface.

Comparison with Other Criteria

The efficacy of other policy approaches used in Tasmania was compared to the NSW criteria. A summary of this comparison follows:

NSW EPA

Compliance with this policy can always be achieved because the criteria are not mandatory, as noise control methods must be feasible and reasonable. However, use of the policy did lead to useful recommendations for control of road traffic noise.

Tasmanian Policy

The then current Tasmanian road traffic noise policy set a noise limit of 68 dB(A) $L_{A10(18hr)}$. Since that time, a draft policy has been publicly announced which sets a noise limit of 63 dB(A) $L_{A10(18hr)}$.

It was found that, the $L_{A10,1hr}$ noise level due to the Southwood trucks would not exceed 60 dB(A) unless there were more than 24 truck movements during a one-hour period. Thus, compliance with either policy could be easily achieved. However, this would mean that there would be no need to implement noise control measures.

The Tasmanian Environmental Protection (Noise) Regulations 1977 state that large trucks built after 1/7/1979 must comply with a 92 dB(A) noise emission limit. Assuming that this limit applies to truck noise measured in accordance with ADR 28/01, the noise limit shown is 5 dB(A) greater than the current ADR noise limit of 87 dB(A). It is currently not possible to buy trucks in Australia that are as noisy as 92 dB(A). Again, compliance with this policy would be easily achieved, but there would be no pressure to provide noise control.

Also examined was a common Tasmanian industrial noise precedent that required the increase in noise level to be no more than 5 dB(A). Compliance would not be achieved as noise level increases of up to 6 dB(A) were expected near Judbury, even with low-noise trucks. If compliance with this precedent was mandatory, it would be very effective in controlling noise, as the project could not proceed. However, it is not appropriate to use industrial noise criteria to manage road traffic noise impacts.

Summary

In general, it was found that the Tasmanian criteria were either higher than the predicted noise levels, in which case there was no requirement to consider noise mitigation measures, or were lower than the predicted noise levels, but were inapplicable to road traffic noise.

By contrast, use of the NSW criteria led to practical noise control recommendations.

Conclusions

The NSW criteria were found to be complex to apply. Even a brief perusal of the NSW RTA manual [5] will show that this can often be true. There are separate daytime and night-time criteria, and, because the criteria were in terms of $L_{Aeq,1hr}$, the base criteria had to be assessed for a different time of day than the allowance criteria.

Furthermore, in this case, the client's preference for noise control at the source effectively led to a reversal of the order of precedence of the criteria, causing the author to look first at the allowance criteria before assessing whether the base criteria would be exceeded.

Nevertheless, use of the NSW criteria resulted in recommendations for noise mitigation measures that would provide useful noise reductions, namely the use of low-noise trucks and an extension of the 80km/hr speed zones near Judbury. In addition, the need for consideration of other potentially "reasonable and feasible" noise mitigation measures was indicated.

Discussion

One simple measure of the success of environmental noise policy can be found by looking at whether the policy actually results in noise control measures being implemented whenever there are noise impacts. This can be ensured by using suitably restrictive criteria.

However, the extent of noise control must be balanced against the negative effects of the noise mitigation measures, such as degradation of visual amenity, over-shadowing by noise barriers and cost to the taxpayers.

On this project, use of the NSW approach resulted in an outcome that appeared to provide a good balance between limiting community noise exposure and limiting public expenditure.

However, it is not clear that the NSW approach would identify projects that should not proceed. Where mandatory criteria are used, it is a simple matter to design the necessary noise control measures and let the proponent decide whether the cost is worth it. If so, the project proceeds, with sufficient noise control measures to ensure compliance with noise criteria. If not, the project is shelved.

With the flexible criteria used in NSW, could there be a situation where all available noise control measures were unreasonable and unacceptable impacts were not mitigated?

References

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