The assessment and control of road traffic noise: A comparison between Irish and Australian policy

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ABSTRACT

To address the problem of environmental noise, the European Commission issued Directive 2002/49/EC which requires relevant authorities to prepare strategic noise maps and action plans. While the Directive has had a significant impact on EU Member States, outside of Europe it has had no discernable impact. This paper presents a review of the approach adapted in Ireland to the management of road traffic noise and compares it to current practices in Australia; with particular emphasis on New South Wales, i.e. we compare the approaches on an EU Member State (Ireland) with a non-EU State (Australia). In Ireland, the National Roads Authority (NRA) has been defined as a noise mapping body charged with the responsibility of preparing strategic noise maps for the national road network in accordance with the Directive. Subsequent to the transposition of the Directive, the NRA issued guidelines on the treatment of noise for national road schemes in 2004. In Australia, the NSW Office of Environment and Heritage (OEH) recently released its updated Road Noise Policy document outlining a policy for acceptable road traffic noise limits. This paper summarizes the strategies adopted by both jurisdictions and lessons learnt from each approach are explored, leading to suggestions for potential improvements to the current noise assessment and control strategies of both States.

INTRODUCTION

In 2002 the EU issued Directive 2002/49/EC requesting Member States to develop strategic noise maps and noise action plans. The first phase of noise mapping is now complete and the results have highlighted the extent to which Europeans are exposed to environmental noise, with road traffic noise identified as the most dominant source of environmental noise throughout Europe today. One primary aim of the Directive was to establish a common approach to the management and assessment of environmental noise across Europe. This saw the development of the universal noise indicators L_{den} and L_{night}. L_{den} is the day, evening, night noise indicator and includes weighting the evening and night periods to represent a value for overall annoyance, while L_{night} (with no weighting) represents an indicator for sleep disturbance. These indicators were chosen with the aim of reducing large volumes of information to a simple indicator assembly that is easy to handle, but still meaningful (Cvetkovic & Prascevic 2000). The Directive did not however stipulate any guideline limit values for environmental noise as it was felt that this would not be possible given the large differences in scale and comprehensiveness of implemented noise measures throughout the different Member States.

The Directive has had a significant effect on the assessment and management of road traffic noise in Ireland and this is likely to be the case in many other Member States, particularly those States who have no national noise prediction method. Currently, more than 28 % of EU Member States now use the L_{den} indicator for road traf-

fic noise (CEDR 2010). Outside the EU however, the terms of the Directive are not applicable and non-EU Member States are free to adopt alternative approaches. As such this paper compares the approach to the assessment and management of road traffic noise of one EU Member State (Ireland) to that of a non-EU Member State (Australia).

IRELAND

EU Directive 2002/49/EC was transposed into Irish legislation through Statutory Instrument No. 140 of 2006 (the Environmental Noise Regulations (EPA 2006)). These regulations identify the Irish National Roads Authority (NRA) as a noise mapping body with responsibility for the preparation of strategic noise maps for major national roads. The NRA's primary function, under the Roads Act (1993) is to secure the provision of a safe and efficient network of national roads. For this purpose it has the overall responsibility for the planning and supervision of construction and maintenance works on these roads.

As part of phase one of the NRA's environmental integration model (EIM), the NRA published guidelines for the treatment of noise and vibration on national road schemes (NRA 2004). Prior to the publication of this document there were no Irish guidelines governing the assessment of noise associated with either new or existing roads. These guidelines provide explicit guidance on how noise should be addressed during the development stages of a road scheme.

NRA noise guidelines

The NRA Noise Guidelines set out the procedure to be followed in respect of the planning and design of national road schemes. The guidelines are not mandatory but are recommended to achieve appropriate consistency with respect to the treatment of noise and vibration during the planning and construction of a road scheme. For full details the reader is referred to (NRA 2004) but some of the main points of the document may be summarized as:

- All new national roads schemes should be designed, where feasible, to meet a design goal of 60 dB L_{den} (free field residential façade criterion).
- Predictions should be made according to the UK's CRTN calculation methodology.
- An adapted version of the CRTN shortened measurement procedure is presented to determine baseline measurements.

It has been noted that, due to the lack of detailed planning guidance relating to other sources of noise, the approach and limits set out by the NRA have been applied to other scenarios (EPA 2009). For example, planning conditions relating to new residential developments alongside existing roads may call for the façade level to be limited to the 60 dB design goal described in the NRA Guidelines. This approach is inappropriate and uses the Guidelines in a context for which they were not designed. It would seem that, in the absence of relevant guidance and legislation, the NRA Guidelines are becoming a *de facto* standard in Ireland. The NRA's construction noise and vibration limits have also been reproduced extensively in quite unrelated contexts (EPA 2009).

It is also important to note where the NRA Guidelines sit in respect to the overall planning process. It is the competent authority (which may be An Bord Pleanála[1] or the local authority in the case of national road project development) who decides whether an EIS produced for a national road development adequately discusses the likely changes in noise climate and consequent effect on occupiers of noise sensitive locations. The competent authority does this after taking account of the views of the public and other specialist bodies required to be consulted and after having regard to relevant publications, including those of the National Roads Authority.

Mitigation measures

In order to meet the design goal of 60 dB L_{den}, the NRA recognized that noise mitigation measures, where feasible, would be necessary to achieve this goal at noise sensitive locations. However, it should be noted that mitigation measures were only deemed necessary when the following three conditions were satisfied at designated sensitive receivers:

a) the combined expected maximum traffic noise level, i.e. the relevant noise level, from the proposed road scheme together with other traffic in the vicinity is greater than the design goal;

b) the relevant noise level is at least 1 dB more than the expected traffic noise level without the proposed road scheme in place;

c) the contribution to the increase in the relevant noise level from the proposed road scheme is at least 1 dB.

These three conditions were primarily adopted to ensure that mitigation measures arising out of the assessment process were based upon the impact of the scheme under consideration (NRA 2004). However, there are a number of situations that may arise where the application of the three conditions may not be appropriate. These conditions have the potential to allow development to proceed in locations where noise is already deemed high without requiring noise mitigation. This is particularly relevant to road scheme upgrades where the existing noise levels can already be quite elevated.

Strategic noise mapping and action planning

The first phase of noise mapping, in accordance with Directive 2002/49/EC was successfully completed in Ireland in 2007. In total this included one agglomeration (Dublin), one airport and approximately 600 km of major roads outside Dublin and involved five noise mapping bodies. These noise maps describe the level of noise exposure of approximately 1.25 million people. Road traffic noise was identified as the most dominant source of environmental noise in Ireland, both within and outside the agglomeration.

Following the development of strategic noise maps, Member States must ensure that noise action plans are then developed. The Directive describes action plans as plans 'designed to manage noise issues and effects, including noise reduction if necessary'. In Ireland, noise mapping bodies are not automatically identified as action planning authorities. Instead noise mapping bodies create noise maps on the behalf

[1] The Irish national planning appeals board, set up to operate an open and impartial planning appeals system.

of the relevant action planning authority, usually the local County Council. For the first phase a total of 22 local authorities developed noise action plans for major roads within their jurisdictions (Shilton & Stafford 2009) based on maps developed by the NRA.

The Regulations define the Irish Environmental protection Agency (EPA) as the national lead authority to supervise and guide the various noise mapping bodies and action planning authorities. Further, action planning authorities should primarily design their action plans with the twin aims of: (1) avoiding significant adverse health impacts from noise; and (2) preserving environmental noise quality where it is good. Guidance notes are offered on the preservation of quiet areas, quiet areas in open country, planning, sound insulation etc. Two types of noise levels are also proposed; onset levels for the assessment of noise mitigation and onset levels for the assessment of noise preservation where they are good.

In general action plans prepared for the first phase did not report forecasted improvements in noise levels or exposure statistics associated with the adoption of proposed mitigation measures. A general discussion of possible mitigation measures was presented instead. Commonly proposed mitigation measures include the construction of new road schemes to bypass towns, promoting public transport, traffic calming measures, resurfacing roads and petitioning the EU to set more stringent vehicles and tyre noise regulations.

AUSTRALIA

In Australia, road traffic noise is regulated by the various state and territory governments. This is in contrast to the regulation of international aviation noise which is regulated by the Commonwealth Government. As a consequence of there being multiple regulatory authorities, there are a mix of noise indices (L_{10} or L_{eq}) as well as varying times for delineating day and night (6 or 7am/10pm). Whilst there may be some fundamental differences in setting criteria between the various jurisdictions, the actual outcomes and management procedures are generally fairly similar. For the purposes of this paper a comparison has been done to New South Wales, the most populous state in Australia with almost 7 million residents and is home to 4.7 million registered vehicles out of an Australian total of 16.1 million (ABS 2008, 2010).

New South Wales

In NSW noise criteria for a range of activities is set by the Office of Environment and Heritage (OEH). The Road Noise Policy (RNP) is the relevant document for assessing major roads and sets the criteria listed in Table 1.

Table 1: NSW noise level criteria

Activity	Assessment Period	
	$L_{eq\ (15\ hour)}$ **Day**	$L_{eq\ (9\ hour)}$ **Night**
New Roads	55 dBA	50 dBA
Redeveloped Roads	60 dBA	55 dBA
Objective for Existing Roads (where no redevelopment is planned)	60 dBA	55 dBA

In addition the RNP sets criteria for sensitive receivers such as churches and school classrooms. To protect the amenity of low noise environments the RNP also seeks to restrict the relative change in noise levels to either the criteria or no more than 12 dBA, whichever is lower.

Road noise criteria in NSW is non-mandatory, however strong justification in terms of reasonableness and feasibleness must be demonstrated if these levels are not met by new road projects. Whilst noise goals are set for existing roads, in practice these levels are exceeded by a large number of high volume roads, particularly in Sydney.

The Roads and Traffic Authority (RTA) is the State Government agency with the responsibility for managing the network of major road in NSW including noise issues. For smaller projects this agency is a self-determining body, however, for larger projects approval lies with the NSW Department of Planning and Infrastructure (DP&I). The RTA interprets the requirements of the RNP and outlines how it will meet its obligations in the Environmental Noise Management Manual (ENMM). This document provides a number of practical scenarios to assist engineers and network planners in meeting noise objectives in a consistent manner. In addition this document establishes the framework for the Noise Abatement Program (NAP).

The Noise Abatement Program

The NAP was originally developed from a 1995 State election commitment to address impacts to residences which had a pre-existing road traffic noise problem. There was no commitment to annual expenditure, however historically the RTA spends around AU$3m pa. The NAP is a prioritized retrofit program that seeks to fund solutions to existing road noise problems. It does not provide funds to mitigate noise from new projects. The ENMM provides guidance on how a priority system should work and how to select the most appropriate treatment options. In practice, the large majority of treatments provided are 'at-receiver' mitigation such as architectural treatment of windows and doors or in some cases construction of courtyard walls. In urban areas, noise walls are not a usual option because of access issues.

Currently the RTA caps treatment at around $25,000 to those residences that are deemed fit for mitigation work. There are no internal noise goals to meet for existing residences, and the RTA makes no guarantee in regards to meeting specific internal noise levels.

The Noise Abatement Database

As a consequence of managing complaints, the RTA undertakes a great deal of noise monitoring to establish whether a property qualifies for inclusion on the NAP. Initial screening may involve examining known noise levels at nearby properties, examining traffic volumes and speed or by undertaking short term (15 minute) noise monitoring during high traffic periods. If the screening indicates the property may qualify for inclusion on the NAP database then 7 day monitoring will be undertaken.

To qualify for inclusion on the NAP database a receiver must exceed the criteria by at least 5 dB during either the day or evening periods. There are additional qualification criteria for entry on the NAP database including a residency requirement. In recognition that home owners make strategic decisions in purchasing homes, the RTA generally excludes homes that have been owned by the residents for less than 7 years. Also excluded are residential dwellings that trigger a need for increased architectural

acoustical designs under the Infrastructure State Environment Planning Policy (ISEPP).

The NAP database is a priority based listing that places the most affected properties at the top of the list. Properties stay on this list until treated, however, in practice those that just manage to qualify for inclusion on the NAP database will never be treated because they will be queue jumped by more highly exposed residences. Depending on funding available, the level at which treatment is made available varies year by year. Residences on the top of the list are typically 10 -15 dBA above the noise objectives i.e. an $L_{eq(9h)}$ night time level of 65 - 70 dBA.

As of February 2011 the NAP database has measured noise levels for 715 properties including 555 in Sydney. In addition more than 500 km of noise barriers have been entered on the database.

The Infrastructure State Environmental Planning Policy (Infrastructure SEPP)

Traditionally, residential development in Sydney has often occurred along busy transport corridors. Whilst in many cases the residential development occurred when the corridor carried low levels of traffic, natural growth has often resulted in the residences now adjoining heavily trafficked high speed transport routes. In other cases, residential development may have occurred due to low land costs or proximity to a center with services and public transport. Regardless of the original reasons for the development occurring, the quality of life of the residents can be adversely affected unless appropriate site layout, design or other mitigation measures to minimize noise and air quality impacts have been integrated into the development.

The NSW Government has recognized that in order to provide environmentally sustainable and affordable housing for a growing population with smaller household sizes it would require renewal of existing urban areas. Moreover, while this new housing should ideally be located near a center, within walking distance of frequent public transport, this should only occur where adverse noise and air quality impacts of the road can be minimized and good quality high amenity residential developments are created.

To facilitate these objectives the Infrastructure SEPP was gazetted to allow effective delivery of infrastructure across the State. Key objectives of this planning policy were to:

- protect the safety and integrity of key transport infrastructure from adjacent development; and
- ensure that adjacent development achieves an appropriate acoustic amenity by meeting the internal noise criteria specified in the Infrastructure SEPP.

In summary, this policy effectively sought to place responsibility for managing transport noise impacts on new developments on to the residential developer and provide a mechanism to ensure that only acoustically acceptable residential developments were constructed in areas of high transport noise. A major initiative of this SEPP is that for the first time a planning instrument in Australia has established internal noise levels (35 dBA for bedrooms and 40 dBA for other habitable rooms) in new residential developments planned along identified transport corridors.

To support the Infrastructure SEPP, the NSW Department of Planning released *Development in Rail Corridors and Busy Roads – Interim Guideline* in 2008. This document was developed with significant input from acoustic experts and other government agencies, and provides guidance on building design, internal layout and architectural principles to achieve an acceptable internal acoustic environment as well as synergies in addressing air and noise impacts. The Guideline also provides general guidance on strategic planning for Councils and other government agencies, or private proponents investigating possible locations for new residential and other sensitive development that require development approval. In addition, it provides guidance on site selection to reduce or avoid the need for mitigation measures for new residential (e.g. single/dual occupancy, multi-unit, etc.) dwellings.

DISCUSSION

It would seem that policy relating to the assessment and management of road traffic noise in Ireland has largely been driven by EU legislation however a comparison with that of NSW shows that there are similarities in some critical aspects of road traffic noise management. Examples include the use of non-mandatory criteria and feasibility conditions associated with mitigation measures. However, in other management areas very different approaches have been used. Table 2 presents the commonalities of the two jurisdictions along with areas which were not found to have comparable road traffic noise management tools.

Table 2: Comparison of noise management tools used by Ireland and Australia

Noise Management Tool	Ireland	NSW
Noise Policy	✓	✓
Guidelines	✓(1 document)	✓(2 documents)
Non Mandatory Criteria	✓	✓
Level of Mitigation based on being Reasonable and Feasible	✓	✓
Additional Consideration of Low Noise Environments	✓	✓
Noise Maps	✓	×
Action Plans	✓	×
Preventative Strategy	×	✓
Noise Abatement Program	×	✓
Funding Model	×	✓
Database of Impacted Residences and Measures Implemented	×	✓

For Ireland, there are lessons to be learnt from the Australian policy, particularly in the establishment of a Noise Abatement Database which would support the development of strategic noise maps and action plans.

With regards to noise mapping, NSW has closely followed this EU initiative, particularly that of Dublin, and while there has been recognition that such an exercise would provide useful information there has been some reluctance for any particular Government agency to take responsibility to develop a full scale noise map. Noise mapping is seen as a useful modeling tool to predict impacts associated with changes to the road network and modal changes in freight transport. It is likely that in the near future that NSW will continue to monitor the success of noise mapping in Europe, particularly the development of Action Plans. Should NSW decide to implement noise mapping, the extensive NAP database would provide an excellent calibration tool.

The Infrastructure SEPP is proving to be an excellent preventative measure in NSW and ensures that developments which may have a nominally noisy façade, still manage to provide acceptable internal noise levels. Its adoption by Irish regulators would address the issue of the NRA Guidelines being used as a de facto standard and could form part of a national noise action plan.

CONCLUSIONS

Both Irish and NSW jurisdictions have committed considerable resources to develop road traffic noise management measures. This review has found that these approaches are virtually exclusive in the information and responses they result in. Because there is minimal overlap in the approaches, the authors believe that there would be no conflict or duplication in continuing the respective management directions whilst incorporating aspects of the other jurisdictions management procedures. Moreover, it is seen that this amalgamation of approaches would: enhance the level of scientific input; develop preventative strategies; improve network planning by the addition of a predictive ability; and deliver more measurable outcomes.

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Management for wind turbine generated environmental noise

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INTRODUCTION

One of current environmental problems in Latvia and in the world, that still is under evaluated and waiting to be resolved, is environmental noise. The process of management of environmental noise in Latvia was started in 2004, when Latvia joined the EU and the requirements of corresponding directives were incorporated into state's legislation. However, even now on national or municipal level the administrators of resources fail to see the noise pollution as a matter of priority.

One type of environmental noise sources that should be managed, are stationary facilities, among them wind energy facilities. The activity of wind turbine generates tonal, broadband, low frequency and impulsive sound (Rogers et al. 2002). The level of noise generated by wind energy facilities depends on the parameters of the wind turbine, the distance to the receiver, air absorption, orographic conditions, meteorological conditions as well as sound obstructions.

The noise generated by the wind energy facilities may cause social behavior disorders in the receptor; for example, discontent, aversion and annoyance, or it can advance disorders of speech, sleep or intellectual work performance (Rogers et al. 2002). In practice it is believed, that with appropriate wind park layout planning the negative influence of the noise can be reduced, although the perception of the noise and consequently the level of its impact is determined by various subjective factors. Whether the sound becomes undesirable depends on the type of sound, the sensitivity of hearing and on other factors that may affect every particular person. In sensitive people the agitation caused by the noise might cause stress induced illnesses. Still, part of the society considers the infrasound to be one of the main problems caused by the wind parks, even though so far no evidence of its negative influence has been found (Wind noise turbine conference 2011). Due to the above mentioned subjective considerations, it is impossible to clearly determine the effects of noise generated impacts and their accompanying reactions.

The development of wind parks has become one of the most disputable questions also in Latvia. Imperfections in legislation and in concepts of planning, as well as insufficient communication among involved parties about the development of wind parks and their diverse impacts, have increased the emergence of negative attitude in part of the society as well as popular protests. In year 2010 several constitutional law-suits related to the impact of wind park development on society´s health and rights to live in a congenial environment, have been adjudicated. Problematic situations of the development of wind turbines have been widely reflected in mass media and several research studies about the future development have been started.

The use of wind parks in production of renewable energy recourses in Latvia

The need to construct wind parks is determined by the necessity to develop the use of renewable energy thus enabling the sustainable management of natural resources