Queensland Rail – An example in effective noise mapping and noise control implementation for existing rail operations

By Dr Noel A Morris

There is an increasing trend in the world today to model noise impacts of city-wide infrastructure such as rail, road and industrial activities. This is particularly true of the European Union, which sought to produce an integrated approach across member states to predict city-wide long term average noise levels.

The outcome of such an exercise usually results in production of noise contour maps of an averaged predicted noise level indicative of all noise sources throughout an inhabited area. The difficultly in what to do next with these maps is the subject of intense investigation. An area may be deemed to be exposed to too much noise, and then the sources of the noise must be deconstructed, the culprits identified and a decision made as to which source is to be ameliorated, and which are protected. Add into this process the ad-hoc mixture of noise regulations across member States, the demarcation of responsibilities when it comes to actual supply of noise control measures, and the difficulty in using whole city mapping as a planning tool.

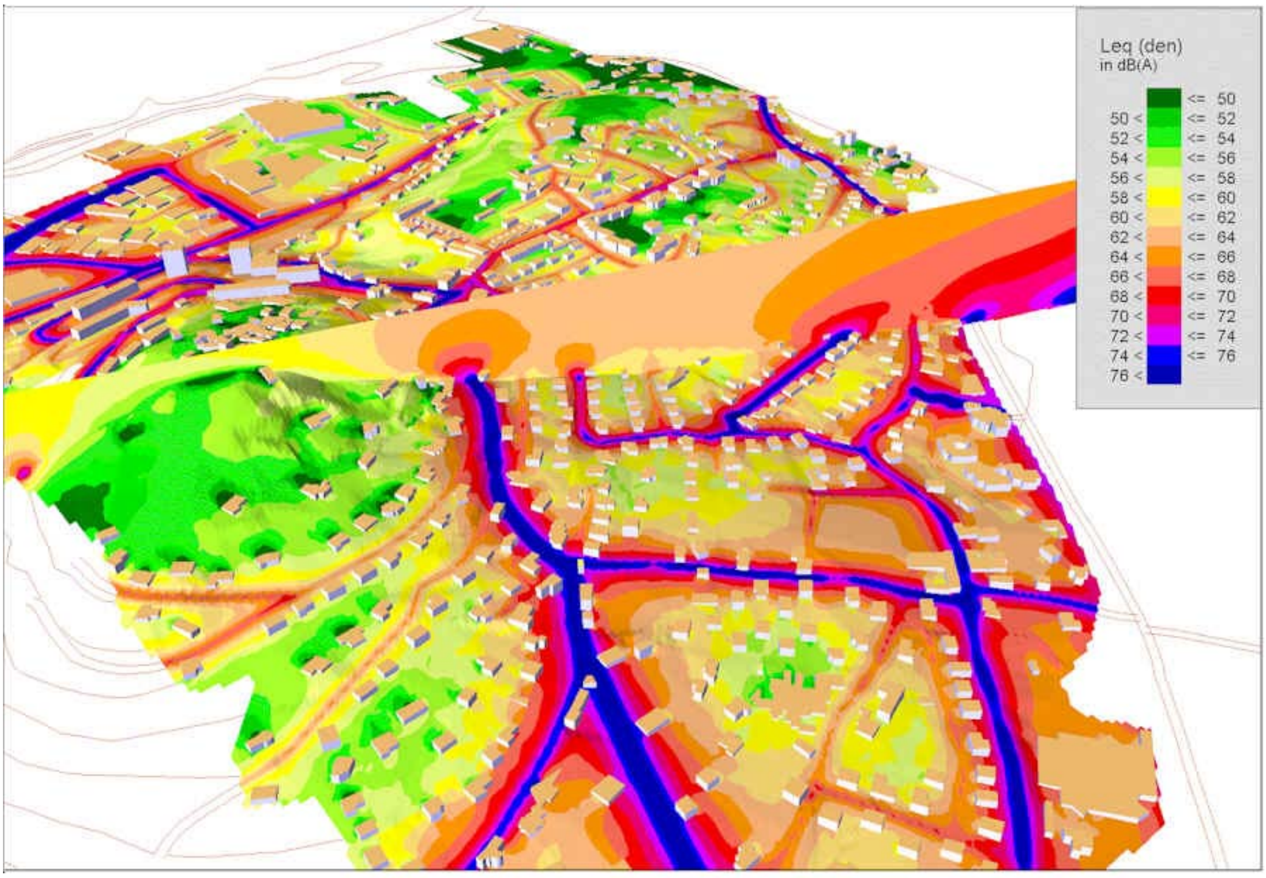

Fig 1. Whole city modelling (courtesy SoundPLAN LLC) is useful only if there is a management plan in place

With respect to rail noise in particular, experience in the United Kingdom highlights the hurdles that must be overcome. The UK railways were restructured and privatised as part of the Railways Act 1993. As reported in a 2003 EU working group on rail noise, British Rail was split into in excess of 130 divisions, most of which were privatised during 1994. Passenger services are run by 25 train operators under franchises granted by the Strategic Rail Authority. The train operators lease stock from rolling stock operating companies (ROSCOs) and stations and depots from Network Rail. Freight services are run by owner operators using their own locos and either their own or privately owned wagons. The train and freight operators obtain use of the tracks by means of access agreements with Network Rail.

None of the contracts between parties in the industry specifically deal with noise. The contracts between Network Rail and UK Train Operators includes an environmental clause placing responsibility for investigating and deciding action on environmental conditions. Under this clause Network Rail can decide on action to be taken by the Train Operators but have few contractual levers to force them to comply. The access charging regime does not currently have any provision for differential charging based on environmental criteria, including noise. Whole city noise maps are being produced in the UK. However, the application of noise mapping in the UK, as an effective tool in controlling rail noise, is going to be difficult to implement. As with many other EU countries, there are no limits for controlling noise levels from trains that run on existing track, nor is there a cohesive structure to implement an action plan.

An example of successful use of noise mapping, planning and execution of noise control strategy is the model being applied by Queensland Rail (QR) Australia on a State-wide basis. It should be noted that as with the experience in Europe, other Australian States have gone down the path of rail and track privatisation. This, together with the historical fact of States adopting different gauges and separate State environmental regulations on such matters as railway noise, results in the Australian experience being analogous to that in Europe. It is a macro-example of how noise management and types of rolling stock can diverge across geographical areas. It also shows how a successful model can be developed independently where there is organisational cohesion.

Firstly, QR completed a comprehensive project to determine the noise footprint from its existing operations across the Queensland rail network. The noise footprint was prepared using SoundPLAN environmental software, which predicted average energy (L_{Aeq}) and single event maximum noise levels across the network.

The modelling predictions were verified through site measurements. At all sites measured with and without noise barriers, difference between the measured and predicted levels were within ± 2 dB(A), with most sites within ± 1 dB(A). This is considered to be very good correlation for transportation noise modelling and comparable to accuracy ranges found in other transport modes such as road.

The modelling was part of an overall approach known as the Network Noise Management Plan (NNMP). The Network Noise Management Plan (NNMP) was developed as a practicable and achievable long-term planning approach to enable specific measures to be implemented. It was formulated to identify noise issues in a logical, prioritised and equitable manner within ongoing budgetary constraints (Page 8, QR Noise Code of Practice, http://www.corporate.qr.com.au/Images/ENV_RD_2700_NSE_tcm15-3103.pdf). Preparation of the NNMP involved the application of a standard investigation methodology to all QR's noise generating activities as per the overall intent of its Noise Code of Practice.

This methodology involved four (4) steps, as described in QR's Code of Practice.

Phase 1: Management Unit Identification
In order to allow a simplified and structured investigation to be performed, QR divided its network into discrete, identifiable management units. Management units were sections of corridor or facilities.

Phase 2: Initial Scoping Exercise – QR performed a State-wide noise audit based on the management unit structure. This audit involved the collection of base data on noise generating activities and the subsequent estimation of noise contours. The number of potential noise-affected receptors within a management unit was evaluated and if greater than zero (0), the management unit proceeded to phase 3 for detailed noise assessment. If no potential noise-affected receptors are identified then the unit proceeded directly to phase 4.

Phase 3: Detailed Noise Assessment – For units identified as containing the potential for adversely affected noise receptors in phase 2, QR undertook a detailed noise assessment.

This assessment:

- predicted noise levels at individual receptors
- generated noise contours for surrounding areas
- identified a number of noise amelioration techniques suitable for reducing the noise impacts on the surrounding community to agreed planning levels.

From this information QR selected the most appropriate, reasonable and practicable noise amelioration techniques and determined their suitability by modelling their anticipated effects. Cost of implementation was also estimated for the purposes of budget preparation.

Phase 4: Prioritising Management Units – At the completion of the detailed assessments, QR incorporated all management units into the NNMP. Detailed budgets and work schedules were developed based on the final prioritisation of management units and the funds available for implementation. A management unit's priority was dependent upon:

- the level and frequency of noise exceedance
- the number of receptors affected
- the impact of suggested mitigation measures on normal rail operations
- the cost of the identified mitigation technique
- the history and nature of complaints from local residents

- an assessment of how effective any reasonable and practicable noise mitigation measures were likely to succeed in reducing noise.

(Pages 8 & 9, QR Noise Code of Practice, http://www.corporate.qr.com.au/Images/ENV_RD_2700_NSE_tcm15-3103.pdf)

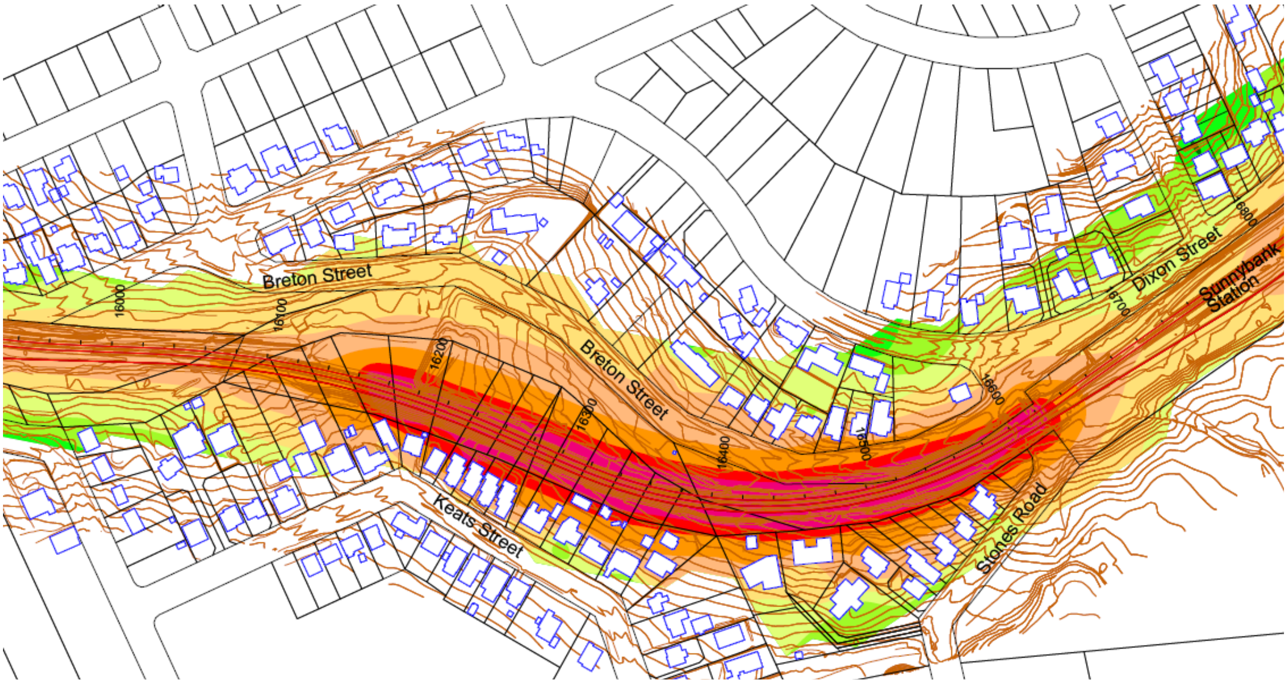

Fig 2. Typical noise contours used to identify affected residences as part of the NNMP

The NNMP adopted by QR is instructive for a number of reasons. Its success highlighted the need for noise mapping and subsequent processing of results to be taken on a network-wide basis, including all aspects of rail operation such as track, shunting and rolling stock choice and maintenance. It ensured valuable resources and funding was dedicated to delivering noise reduction measures rather than carrying out noise measurements at every affected site.

QR was able to do so because of its structure as a Government Owned Corporation (GOC) and ability to integrate all pertinent aspects of its business into the development of the noise management plan. For fragmented and privatised railway systems, success of a noise management plan is critically dependent upon an agreed management structure which involves all business units from the start. The challenge for such a structure is in reaching agreement on allocation of resources and demarcation of responsibility.

The comprehensive noise mapping of the rail network by QR is a good example of how computer modelling of predicted noise levels led not only to colour maps identifying problem areas, but also provides a physical outcome of noise reduction at appropriate places. As such, the experience of QR is a positive one for not only rail, but any sources of noise including road and industry. As long as there is sufficient corporate support behind such an initiative within an organisation, noise management plans can be formulated that convert exercises in whole city mapping into action that improves the noise amenity of affected residents.

QR has completed all phases of the NNMP. QR is now in the process of delivering its noise reduction measures (e.g. noise barriers) in accordance with the priorities determined through this process. This implementation process started from the year 2000 through funding from its State Government. QR has already constructed close to $19 million of noise barriers over the intervening 6 year period and remains committed to this implementation process.

For further details on QR's experiences and current initiatives, please contact Mr Mark Batstone (Senior Environmental Adviser of Network Access, QR). He can be contacted on +61 (07) 3235 1567 (Phone), +61 (07) 3235 5191 or mark.batstone@qr.com.au.

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