Reducing railway noise levels - the impact of forthcoming European legislation

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ABSTRACT

Noise from railways has typically been dealt with by using the 'we were here first' argument. In the UK that continues to be largely effective, except where major refurbishment is undertaken or new lines are envisaged. Forthcoming EU legislation will require a change of approach. This paper looks at the background and sets out what will now be required: the immediate impact will be an obligation to undertake noise mapping to gain a better understanding of railway noise levels; then action plans will have to be produced to control and mitigate excessive noise (although as yet there is no indication of what will be regarded as 'excessive').

1. THE GROWING IMPORTANCE OF RAIL NOISE AS AN ISSUE

Until recently it would have been difficult to regard railway noise as a high priority issue within the UK. Railway noise has not been seen by government or the population as a particular concern: road and aircraft noise have consistently been seen as bigger issues, the former because of the substantial portions of the population affected and the latter due to the high level of noise, although largely restricted to the immediate environs of airports. In addition, rail vehicle manufacturers have made good progress in reducing diesel engine noise, which has helped to mitigate the effect of increasing traffic volumes. Except for new railways and very major enhancements (e.g. the refurbishment of the existing routes to the Channel Tunnel), railways have not had to incur expenditure to mitigate the effects of noise.

This picture is about to change. Both governments and populations of other European Union countries (and also Switzerland and Norway) have a much less tolerant view of transport noise than the UK. This has led to more stringent legislation in a number of countries, wide-

scale noise mapping, much more research activity and remedial action already having been taken at particular problem locations.

The British government has indicated its support (but no funding) for a raising of the profile of noise as an issue, for instance promoting the recent round of workshops describing the Birmingham noise mapping exercise (a recently completed 'pilot' exercise to map a major conurbation discussed below) under the banner of 'action against noise' (1).

2. CURRENT LEGISLATION

The UK has relatively little recent legislation, and what there is is considerably less onerous than that in force in Europe and North America. Typically legislation abroad requires noise mapping and action plans to control and reduce noise levels. Maximum noise levels may be set, or alternatively the requirement to put in place action plans could be couched in terms of 'continuous improvement'. Some legislation (e.g. in Germany) has been criticised by environmentalists as 'lacking teeth' (2), but in all cases more action is being taken than in the UK.

Switzerland and the Netherlands have the most restrictive noise policies. In Switzerland, SBB have spent considerable sums of money on noise mapping and on noise mitigation in response to legislation (3). In the Netherlands there have been recent examples of Nedrail being taken to court, and a marshalling yard has had a night-time prohibition put on all shunting operations (4).

The European Union action should be seen in the context of the above. The UK is at one end of the spectrum with regard to noise legislation and noise action and hence it is to be expected that the UK will have to move some distance to come 'in line'.

3. THE FORTHCOMING EUROPEAN UNION DIRECTIVE

The European Parliament is very interested in reducing the negative effects of noise and in 1997 required that 'specific measures and initiatives should be laid down in a framework directive on the reduction of environmental noise' (5).

European legislation is currently being drafted that is partly about standardising procedures for the mapping of noise levels but also about developing and implementing noise reduction action plans. For the UK the directive will introduce new responsibilities over the next few years to undertake noise mapping in all conurbations and on all major transport routes and subsequently to put in place action plans to mitigate unacceptable noise levels.

Rail will not be exempt from these actions. Noise mapping is certain to be required on busy rail routes (currently the draft directive defines 'busy' as 20,000 trains per year - equivalent to a half hourly weekday service), as a basis for subsequent action. It is likely that the current growth in traffic will prove a problem - there will be pressures to include within the action plans commitments not to increase noise emissions above current levels and this will be difficult to achieve on a location specific basis. In addition, although evidence supports the view that rail noise is less annoying than road (6), there is a body of opinion that says that rail

has done less to reduce noise levels than road or air, and that this should be remedied. Continental railways, perhaps because their finances are different, appear to support noise reduction measures and are already active in developing projects to achieve this - removing the possible defence that railways are already as quiet as they reasonably could be.

4. NOISE MEASUREMENT AND MAPPING

Noise measurement techniques are well established (7). Equipment is available for hire or purchase that gives accurate readings and the level of skill required to use this equipment is not especially high. Consultants and universities are readily available to undertake this work. Noise measurement is however quite expensive, as it requires equipment calibration and site visits. It therefore tends to be used on a limited basis, either to provide accurate data for particular 'hot spots' or to validate computer models used to produce noise maps.

There are many different models that can be used to generate noise maps, some particularly targeted at a particular mode such as the Dutch rail model, preferred and recommended by the EU (see 8. for an overview of railway noise mapping in the Netherlands) and others more aimed at the development of area maps rather than linear maps (e.g. the LIMA software used in the Birmingham project). There are as yet no definitive standards for this software (although this is being developed under EU guidance) and therefore there is an inevitable degree of variability in the outputs. Far more serious as a limitation however is the need for very good, and not readily available, data to feed the model. To get reliable outputs for railways this includes:

- Full details on noise emission, including number and nature of the trains (down to individual vehicle types), whether brakes will be in use and whether locomotives will be under power, together with appropriate unit values for different noise sources;
- Full topographical details to assess noise propagation, including cuttings/viaducts, fences, walls, building heights;
- Furthermore, and of course common to all noise mapping, to assess annoyance, details are needed on where people live, work and play, the hours they are there (e.g. day time noise is not an issue if housing is not occupied during the day, night time noise is not an issue in schools) and even their individual propensity to be annoyed by noise.

Normally limitations on cost dictate that assumptions, often heroic, are made. It should therefore be no surprise that most computer model-based noise maps can be treated as indicative only.

Recent work led by John Hinton of Birmingham City Council has been important in raising the profile of noise mapping as a first step towards development of noise reduction action plans. The whole Birmingham conurbation has been mapped, at a cost of c.£200k (£140k consultancy, £60k in house data collection/preparation) and a booklet describing the exercise and 'lessons learned' has been published (9).

Inevitably a number of assumptions were made regarding rail noise, primarily through the lack of availability of better data:

- all railway lines were treated as being at ground level - leading to substantial over-estimation where there are cuttings and some under-estimation where there are viaducts

- only buildings and specific noise barriers have been included in the model, so reductions (e.g. from walls) are not included
- no differentiation for braking noise has been included
- all track was treated as CWR.

Considerable refinement is required before the maps produced can be used as an input to decision making. Also it should be noted that the Birmingham study made no attempt to assess annoyance (i.e. whether the level of noise really matters or not).

Comparability of noise levels is further hindered by a lack of standardisation of units of measurement. Whilst the difference between maximum noise level and an average dosage is straightforward, calculation of the average dosage is typically achieved by weighting noise at different times (i.e. night time noise is given more significance than day time noise) and there is as yet no agreement as to what hours should be regarded as 'night' (perhaps not surprisingly, as different nations have different sleeping hours - Scandinavians typically being early risers and southern Europeans typically going to bed later).

The EU's solution to these issues is pragmatic but problematic: get the member states to undertake noise mapping in the short term (currently defined for railways as during the 3 years after the directive comes into force) using the best available current techniques whilst in parallel developing a more robust and standardised methodology - then potentially get the member states to undertake the mapping exercise again.

5. NOISE REDUCTION AND MITIGATION

British Rail and UK researchers were active in investigating noise emission reduction methods in the '70s and '80s; in the '90s, the change to, and improvements in, high speed dmu technology have in practice reduced emissions on a 'per train' basis. There is however little available research that assesses whether overall noise emissions have increased or reduced or where current noise levels stand with regard to possible targets.

Research indicates that, after **diesel engine noise**, there is no one solution to achieving noise reduction, rather a range of actions across a number of fields. Recent and current research by UIC, through the European Railway Research Institute(10,11), or by individual railways (Dutch Railways in particular but also German, French and Swiss) has shown that **freight vehicle noise** is a priority, but due to different technical standards, it is uncertain if they are a similar priority in the UK. The **wheel-rail** interface is particularly important under certain conditions: tight curves (squeal), point work ('clatter') and surface irregularities (corrugation); track components can also impact rolling noise (e.g. appropriate use of pads can have a useful 'damping' effect).

Key recent projects involving ERRI have included:

Silent Track. This has looked at how to minimise noise emission resulting from track/component characteristics, with advice made on the use of pads between rail and sleeper and under sleeper. In parallel, other infrastructure related issues have been worked on, including in particular noise emissions from steel girder bridges and exploration of the benefits of rail grinding.

Silent Freight has looked at wheel design and *Eurosabot* has considered how to reduce noise caused by wheel corrugation through the use of cast iron brake blocks for tread brakes (this latter exercise resulting in UIC agreement to retro-fit composite brake blocks to freight vehicles - although this has not been straight forward in application).

Currently EU funded work is being undertaken to develop cost/benefit software to assess noise mitigation options, to enable the determination of the optimum mix of noise mitigation strategies at national or EU level. It will utilise data from Silent Track, Silent Freight and other recent research to construct different future strategies. Running under the acronym *STAIRRS* (strategies and tools to assess and implement noise reducing measures for railway systems), this has the involvement of ERRI and a number of state railways; Railtrack has a representative on the steering group.

Noise barriers have been seen for some time as the route to reducing noise at the recipient; a number of articles consider the effectiveness of different types of barrier. It is generally accepted that, depending on the terrain and whether braking is a regular feature, low barriers are adequate, to deflect noise from the wheel/rail interface. However research is now showing that noise barriers are not a particularly cost-effective way of minimising the effect of noise at the recipient: better in the long term to adopt actions to reduce noise at source and to remove people from the source by appropriate land use planning restrictions. Ameliorating actions such as barriers and insulation should only be a last resort, used at particular 'hot spots'.

The EU draft directive does not currently directly require noise reduction and mitigation work: it requires the development of action plans that set out what could be done to reduce noise levels, what is actually planned and whether budget provision has been made. Considerable uncertainty remains as to whether specific maximum noise levels will be set or noise reduction targets required: the draft directive gives the commission the right to produce further guidelines, which might (or might not) cover these issues.

It is also important to note that the linkages between the specific levels of a particular kind of noise and community annoyance are complex (see 12. for a discussion of annoyance from high speed train noise). To date, drafts of the directive have not attempted to deal with this. Views also vary as to the extent to which noise presents a health risk (see for instance 13.) and again, the directive as currently drafted makes no attempt to link action plans with health.

6. CONCLUSION

Overall, then, noise matters to the UK railway industry because over the next few years substantial (but still undefined) costs are going to have to be incurred to produce noise maps (the Birmingham mapping exercise cost in excess of £200,000: mapping most of the UK rail network will cost many times that) and, potentially, put in place expensive mitigating measures. In addition, in the worst case scenario, traffic growth could be restricted by noise level targets.

For these reasons, 'do nothing' is not an option for companies in the UK railway industry. Involvement in the drafting and consultation of the directive is of particular importance to ensure that UK views are taken into account and that growth of rail volumes is not

constrained. Noise mapping will be required. Action can be expected to be required (as it already has been across much of Europe) to reduce noise levels, by some combination of reduced vehicle noise, reduced noise at the vehicle-rail interface and, as a last resort, noise barriers and insulation. Funding will have to be found. One way or another, all sectors of the railway industry will be affected.

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