Proceedings of the Institute of Acoustics

A REVIEW OF STANDARDS FOR RAILWAY NOISE IN DIFFERENT COUNTRIES

J G Walker

Institute of Sound and Vibration Research, University of Southampton, Southampton SO9 5NH

INTRODUCTION

In an earlier paper [1], the author discussed the noise implications of a European high-speed railway network which the Community of European Railways plans to establish within the next 20 years or so, and which will form the core of the future European transportation infrastructure. The development of the network means that high speed trains will cross national boundaries as conventional trains do at present.

A major development of this nature, together with other international developments in transport will bring pressure to develop common environmental standards. The European Community has already moved towards this objective in a number of areas such as water and air pollution and the EC Noise at Work Regulations and the road vehicle noise emission limits provide examples of international regulations in acoustics. Although it may be more difficult to achieve, it is likely that common European environmental noise standards will eventually be defined in one form or another.

The report of the Mitchell Committee [2], in recommending a national noise insulation standard for new railway lines in the UK, reviewed existing noise standards for railways in other countries, although the brief of the Committee was to recommend a standard that would equate to the existing UK regulations for new highways.

This paper will refer to that report, will examine the standards or recommendations for railway noise in other countries, discuss, where possible, the basis for the standards and consider the practicality of developing a common European standard.

COMPARING STANDARDS AND RECOMMENDATIONS

Environmental noise standards or recommendations have traditionally been developed from studies of the relationship between community response and exposure to noise from a specific source. The problems in comparing standards for different countries are considerable; some of the factors influencing the levels at which the standards or recommendations are set are discussed below.

1. The noise and social survey design will influence the dose-response relationships. For example, the dose-response relationship derived from a study confined to a specific

locality may be different to that from a national study because local factors will influence the results. Questionnaire design is also important.

2. Most studies of railway noise show that, in general, annoyance increases steadily with increasing noise level and no particular "critical" level of noise exposure can easily be defined from the dose-response relationship. Each authority will select its own level for inclusion in a standard or recommendation.

3. Some standards or recommendations will be based on "acceptability" whilst others may be based on levels that should never be exceeded.

4. Road traffic noise studies have been more numerous than railway noise studies. In a number of countries road traffic noise standards have been the base from which railway standards have been derived. A 5dB "bonus" is often allowed to recognize the lower annoyance caused by railway noise at the same level.

5. Different legal frameworks have lead to different standards.

6. Some countries favour use of the 'facade' level (1-2 m from a building facade) in standards; others use "free-field" levels. The difference between the two is around 3dB.

7. There is widespread agreement that standards and recommendations should be expressed in terms of L_{Aeq}, which has been shown in the majority of studies to correlate better than most other descriptors in common use. However, the period over which L_{Aeq} is described varies; a number of standards and recommendations divide the 24 hours into two or more periods (e.g., day, evening, night). The night-time L_{Aeq} may be reinforced by a maximum noise level in some cases.

All the above factors influence noise levels defined in national standards and recommendations, and a number of standards and recommendations currently used in selected European countries will be considered in the next section.

EXISTING STANDARDS AND RECOMMENDATIONS FOR RAILWAYS IN OTHER EUROPEAN COUNTRIES

The Mitchell Report [2] included a brief summary of standards or recommendations in a number of European countries. This section, including the Table, is based upon that and other material. It includes only noise standards or recommendations which refer to residential property and differentiates between those which are merely guidelines and those which identify the levels at which insulation of the property concerned is required. It also includes road traffic noise standards where possible.

A REVIEW OF STANDARDS FOR RAILWAY NOISE IN DIFFERENT COUNTRIES

Guidelines for new railways are defined in Denmark but there are no specific provisions for acoustic insulation if they are exceeded. However, the Government helps to fund insulation of properties affected by noise from existing railways and a similar policy is likely to be adopted for new railways. In Norway, the establishment of standards for new railways is under discussion, but the Government already provides funds for insulation to reduce the noise impact of existing railways. In view of the cost of the required insulation the limit is set at 73dB (L_{Aeq}). In Sweden, standards for both outdoor and indoor noise levels are set; insulation is provided both for new railways and for alterations to existing lines.

France has no formal legislation relating to noise from new or existing railways although recommendations do exist.

Germany has recently introduced more stringent standards which apply to both new and "significantly changed" railways. In the latter case alterations have to result in noise level increases of 3dB(A) or rise to an absolute level of 70dB(A) during the day and 60dB(A) at night. If these noise levels are exceeded noise insulation is installed in affected properties.

The Netherlands have defined strict noise goals for both new and existing lines. If, on new lines, the goals cannot be met by control at source or by use of trackside barriers, insulation of affected properties is required.

Switzerland also has national legislation relating to railway noise; insulation is provided when the defined levels are exceeded.

Table I summarizes noise standards or recommendations for new railways in a number of countries. Since it is based on information from different sources, and some is currently under discussion, the levels quoted, and their interpretation, may change. However, it is believed to be accurate at the present time and in any case serves to illustrate the range of levels that are currently included in national standards.

CONCLUSIONS

It is difficult to identify a common strand among the standards other than the use of L_{Aeq}. However, where a road traffic noise standard is quoted it is generally 5dB above the railway standard, although some countries are re-appraising this, particularly when the railway standard is at or below 60dB(A). This is not unreasonable because any difference increases with increasing noise levels. At around 55dB(A) or so any differential will probably disappear.

Some standards are clearly intended to be "acceptable" whilst others will lead to higher levels of adverse response but which are felt to be reasonable, and take into account other considerations. For example, the standards for existing lines in Norway are influenced by economic factors.

The 24 hour values of L_{Aeq} range from 60dB to 66dB. In terms of subjective impact this may not be large but in terms of operational implications it is equivalent to a four-fold change in the numbers of railway operations. This clearly is significant for operators.

There is at present no international standard or recommendation for the maximum level of noise emission for trains. It is difficult to define as the emitted level depends not only on the rolling stock itself but on the type and condition of the track on which it runs, which will be beyond the control of the rolling stock manufacturer. If guidance on these matters did exist it could help national authorities to set realistic standards and control measures in the light of the likely mix of international traffic on their railway tracks.

Until international standards are defined the national railway companies will have to meet different standards as their trains operate within different countries. It will be up to the national authority to ensure that the mix of trains operating within that country will meet their own standards. This could lead to confusion for both operators and legislative bodies. There is a need to formulate consistent standards so that all trains operating internationally can comply. The economic implications are clear; twice as many trains which are 3dB quieter than others can operate and still produce the same overall noise level. This has important implications both for the authorities and for the operators when standards have to be met.

REFERENCES

J G Walker A European high-speed railway network; the noise implications. Proc Inter-Noise 90, 361-365. (1990)

C G B Mitchell (Chairman) Railway noise and the insulation of dwellings. Department of Transport (1991)

TABLE I Noise standards or recommendations for new railways and new roads in a number of countries.

Country	Standard, Guideline or Recommendation	Road [level given in L_{Aeq} unless stated] [Facade: F; Freefield FF]	Railway	Time of Day	Note
Denmark	G	58(F)	63(F) 88L_{Amax}	24h 24h	
Norway	R	-	60(F)	24h	
Sweden	S	-	63(F) 30(Indoor,living) 50L_{Amax}(Indoor, bed)	24h 24h 2200-0600	
France	R	60(F)	65-70(F)	0800-2000	1
Germany	S	59(FF) 49(FF)	59-64(FF) 49-54(FF)	0600-2200 2200-0600	1
Netherlands	S	- 55(F) 50(F) 45(F)	60(F) 60(F) 55(F) 50(F)	24h 0700-1900 1900-2300 2300-0700	1,2 1,2 1 1
Switzerland	S	55 45	60(FF) 50(FF)	0600-2200 2200-0600	1 1
UK	S: Road R: Railways	68$L_{A10,18h}$	66(F) 61(F)	24h 2300-0700	1 1

Notes: 1. Insulation to property provided when these levels exceeded.
2. These limits to be reduced to 57dB(A) on 1 January 2000.