GUIDANCE FOR POSSIBLE MEASURES TO MANAGE NOISE FROM ROAD AND RAIL

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Contents

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1. Introduction

1.1. Purpose of the Document

The Environmental Noise (Scotland) Regulations 2006 implement the obligations of the Scottish Government with respect to the European Parliament and Council Directive for Assessment and Management of Environmental Noise. One of the requirements of this legislation was to establish Noise Action Plans (NAPs) to reduce noise levels where necessary and to preserve environmental noise quality where it is good. During 2009, working in partnership with delivery partners, NAPs were developed and are now published in final form on the Scottish Government Website.

It is worth noting that the four main objectives of the European Noise Directive (END) can be summarised as follows:

- Monitoring the environmental problem; by requiring competent authorities in Member States to draw up "strategic noise maps" for major roads, railways, airports and agglomerations, using harmonised noise indicators L_{den} (day-evening-night equivalent level) and L_{night} (night equivalent level).
- Informing and consulting the public about noise exposure, its effects, and the measures considered to address noise, in line with the principles of the Aarhus Convention.
- Addressing local noise issues by requiring competent authorities to draw up action plans to reduce noise where necessary and maintain environmental noise quality where it is good. The directive does not set any limit values, nor does it prescribe the measures to be used in the action plans, which remain at the discretion of the competent authorities.
- Developing a long-term EU strategy, which includes objectives to reduce the number of people affected by noise in the longer term, and provides a framework for developing existing Community policy on noise reduction from source.

The Scottish Government is therefore working through the action plans, drawn up, as required by the END and is looking to manage road and rail noise by facilitating informed policy decisions.

In conjunction with the more long term policy implications it may, in some instance, be possible to consider short term intervention measures. However, there are many other non acoustic factors to be taken into account before embarking on such a programme of intervention. The following text sets out in very simple terms possibilities for consideration in respect of intervention measures.

This Guidance is predominantly for those organisations involved in implementing the Noise Action Plans (NAPs) required under the Environmental Noise (Scotland) Regulations 2006.

1.2. Context

This document provides overall context and offers possibilities for consideration in respect of intervention measures in managing noise from road and rail. However, any specific intervention to manage environmental noise impact should be considered within the wider planning, regulatory, franchising, and contractual framework of the organisations involved.

It is also important, in taking forward any appropriate measures suggested herein, to ensure that noise is managed in the context of government policy on sustainable development and that practitioners are familiar with this process.

This text is not intended to be exhaustive but includes the main themes in traffic noise control and provides simple guidance for effective assessment of any possible new measures. Readers should also recognise that any proposed targeted measure to manage noise should consider the possible wider implications of such a proposal, in particular the possible effects on sustainability, operational effectiveness, and other environmental factors such as local air quality.

The advice given in PAN 56 is also likely to be relevant to any proposed measures.

Further useful documents are listed in Appendix A.

1.3. Parties Involved

In delivering any actions from the NAPs, such as addressing Noise Management Areas (NMAs) or taking forward cross cutting measures, it is important to be aware of the roles and responsibilities of the various organisations responsible for managing transport delivery in Scotland. These include Transport Scotland, the individual Local Authorities and the Regional Transport Partnerships.

These organisations, professions, and the related delivery partners have a part to play in managing environmental noise. Details of some of these are listed in Appendix B

However, notwithstanding the above, it will be important, in delivering the NAPs, to ensure coordination and close working and communication between the various organisations and professionals who have responsibility for transportation delivery.

1.4. General Principles of Controlling Environmental Noise

In developing environmental noise reduction measures it is helpful to understand the basic general principles governing the management of noise from road and rail traffic.

Generally, the most effective measure in controlling environmental noise is either to remove the source or eliminate or reduce the generation of noise from the source. In simple terms, in either road or rail, this means reducing the traffic flow, or working with others to encourage the development of quieter vehicles, including tyres. These methods should not be considered in isolation and, as with all measures described in this document, should be considered with sustainability in mind. The main measures which relate to this method of control are discussed in Sections 2 and 3 for road and rail respectively.

Once the noise from the source propagates and disperses into the atmosphere the next level of control is concerned with the propagation path between the source and the area to be protected. These noise reduction measures operate either by screening the propagation path or by attenuation through sound absorption, and are discussed in Section 4 for both road and rail.

The final level of noise control is related to noise transmission through the building façade, and an overview of this is provided in Section 5.

In practice, reducing the impact of noise from road and rail traffic will likely involve a combination of such measures and some examples are discussed in Section 5.3.

2. Road Traffic Source Noise Reduction Measures

2.1. Traffic Improvement Schemes

Traffic Improvement Schemes are introduced for a combination of reasons. These include reducing journey times and costs (thereby meeting wider objectives), improving accident statistics, and minimising environmental impacts. When such schemes are being designed, irrespective of their primary intention, appropriate care in design can result in a reduction in environmental noise at source by virtue of significant reduction in traffic flow, composition and speed.

Table 2.1 indicates the logarithmic relationship between a reduction in traffic flow and noise level.

Reducing flow is generally not a solely effective measure for noise reduction in most situations, as the flow reduction required for any significant effect is not realistically achievable. For example Table 2.1, shows a 3 dB(A) reduction in noise, requires a 50% reduction in traffic volume. Such reductions are not normally possible without significant intervention elsewhere to replace the removed transport need.

Table 2.1. Reduction in Traffic Flow and Noise at Typical Free Flow Condition Speeds

Traffic flow reduction	25%	50%	75%	90%
Noise reduction dB(A)	1.2	3	6	10

In addition, when considering flow reduction to reduce noise, other effects should be borne in mind. For example, where achieved, a reduction in flow may lead to less congestion and promote higher traffic speeds which will offset, to some extent, the reduction in noise gained. Alternatively, a reduction in congestion, if the scheme is carefully designed, may promote smoother driving which would reduce noise emissions from accelerating vehicles.

With all of the above in mind, care is therefore required in the design of traffic improvement schemes to ensure noise reduction possibilities can be maximised.

Where a traffic improvement scheme reduces the statutory speed limit significant noise reductions may be achieved but this is dependent on traffic composition.

Table 2.2 illustrates the typical reduction in noise for various reductions in the speed limit for differing traffic flow compositions (% HGV in the flow). For example, if the speed limit is reduced from 60 to 40 mph, noise reductions of between 4.5 to 3.0 dB(A) may be achieved for HGV compositions from 0 to 20%, respectively.

For smaller speed reductions at lower speed limits (i.e. from 40 to 30 mph), noise reductions of less than 1 dB (A) may be achieved, and the influence of traffic composition is less pronounced. It should also be noted that where HGV compositions exceed about 20%, reduction in speeds below 20 mph will cause noise levels to increase. However, notwithstanding the effects of reduction in speed limit, the enforcement of the existing speed limit is equally important in achieving worthwhile reductions in noise.

To maximise any related noise reductions, enforcement of speed limit with cameras measuring average speed may be more effective than individual cameras at spot locations.

Table 2.2. Typical Reduction in Noise for Different Statutory Speed Limit Reductions and Traffic Compositions

Reduction in statutory speed limits (mph)	% HGVs[1]		
	0	10	20
60 to 40	4.5	3.5	3.0
50 to 30	3.0	2.2	1.8
40 to 30	0.8	0.5	0.4

[1] Heavy Goods vehicles (HGVs) defined as vehicles with unladen weight in excess of 3.5 tonnes

The noise reduction figures in Table 2.2 above, achieved by reduction in statutory speed limits, may not be realised by other methods to encourage speed reduction. For example, traffic management schemes which include vertical deflection (such as speed cushions, humps, and tables), or horizontal deflection (such as chicanes) may, overall, lead to noise reduction, but in some circumstances there may be an increase in noise due to drivers adopting a more aggressive style of driving. Information regarding changes in noise from such measures is published in *Traffic Advisory Leaflet 6/96 – Traffic calming – traffic and vehicle noise* Department for Transport 1996.

Other methods of reducing the source noise include altering the flow composition. For example if the %HGVs in a traffic flow are reduced a significant improvement in noise reduction can be achieved e.g. reducing the %HGVs from 20% to 5% would reduce traffic noise by about 3 dB(A) for traffic speeds at about 30 mph.

2.2. Improving the Acoustic Performance of Road Surfaces

The acoustic benefit gained from laying a low-noise surface is dependent firstly, on variables associated with the composition of the material such as aggregate size and void content and secondly, but equally importantly, on the current acoustic performance of the surface being replaced.

An indication of the reduction in noise achieved by replacing traditional 20mm Hot Rolled Asphalt (HRA) surface with a low-noise surface, for example, a thin Stone Mastic Asphalt (SMA), is shown in Table 2.3 below.

Table 2.3. Typical Reduction in Noise After Replacing HRA with A Low-Noise Surface[1].

Traffic speed (mph)	Reduction in noise (dB(A)) and %HGVs[2]		
	0	10	20
30	4.2	3.3	2.7
50	4.6	3.9	3.4
60	4.7	4.1	3.6

[1] Reductions based on surface conditions when relatively new.
[2] HGVs defined as vehicles with unladen weight in excess of 3.5 tonnes

The table shows, as traffic speeds increase and the percentage of HGVs in the traffic stream decrease, the acoustic benefits in noise reduction improve.

The values for the typical noise reductions at the time of replacement, as shown in Table 2.3, are likely to be conservative since no allowance has been made for age-related noise deterioration of the existing surface (the above reductions are based on the average acoustic performance of these surface types when relatively new). The initial attenuation may, therefore, be higher than that shown in Table 2.3[1].

The acoustic performance of low noise surfaces are known to deteriorate with age[1], and the design specification of such surfaces as SMA to maintain durability is challenging.

2.3. Junction Design

Junction design considers factors such as traffic flow, traffic speeds, pedestrian movement, road layout and geometry.

Improving a junction layout can actively promote smoother driving, and can reduce acceleration noise. Although the outcome of noise action plans relating to the acoustic benefits from promoting smoother driving would not be recognised by the current noise prediction method used in the UK, this may become a viable option in the future[2].

Typical examples of where junction design improvements have been implemented include replacing signalised junctions with roundabouts, or non-signalised junctions with mini-roundabouts. In assessing the noise impacts from such scheme changes, the impact of changes in both noise emissions from individual vehicles (based on the maximum pass-by noise levels) and the change in overall traffic noise levels (based on longer term averaging of all vehicles emissions in the traffic stream e.g. $L_{Aeq,1h}$ dB) need to be considered.

[1] Abbott P G, P A Morgan, B McKell (2010). *A review of current research on road surface noise reduction techniques.* TRL Published Project Report PPR443. Transport Research Laboratory, Wokingham. UK

[2] The EU funded research programme HARMONOISE/IMAGINE which is intended to provide Member States with environmental noise prediction models for the purposes of strategic noise mapping allows for noise emissions from accelerating road vehicles to be taken into account.

Compared with steady speed vehicle pass-bys, noise emissions from individual vehicles decelerating, when approaching, or accelerating away from, a junction can vary by as much as ± 4 to 5 dB(A) (HARMONOISE/IMAGINE MODEL). Sites where there are large variations in vehicle noise emissions between vehicles accelerating and decelerating through a junction may benefit from improvements to the junction design. Although typically overall traffic noise levels have been found to decrease by about 2 dB(A) where roundabouts have replaced signalled junctions, the reduction in the variability of noise from individual vehicles may bring additional benefits in reducing annoyance on top of that expected from just a reduction in overall traffic noise levels.

2.4. Street Maintenance

Surface irregularities, poorly re-instated trenches, bridge joints and other such discontinuities in the surface profile can increase noise levels significantly. Typically, such surface irregularities, cause impulsive body rattle noise, particularly in the case of heavy goods vehicles which can generate increases in pass-by noise levels of about 10 dB(A) when travelling over such surface profiles causing significant disturbance to residents in the vicinity. Although the outcome of noise action plans relating to the acoustic benefits from removing surface irregularities would not be recognised by the current UK noise prediction method used for strategic noise mapping, nevertheless, such problems may contribute to complaints received by local authorities from noise disturbance caused by road traffic in urban areas.

2.5. Driver Behaviour

Influencing the way vehicles are driven can have significant benefits in reducing noise impacts from road traffic. Estimates of the potential reduction in noise by adopting a less aggressive driving style range from 1 dB(A) to 5 dB(A) for cars and heavy commercial vehicles, to as much as 7 dB(A) for motorcycles[3].

However, influencing driver behaviour in order to reduce noise alone is not straightforward. The most effective mechanism is through campaigns to educate the public in understanding the associated benefits in adopting a more passive style of driving. These include the economic benefits in reduced fuel consumption, the health benefits in reducing exhaust fumes and the overall improvements in traffic safety.

Encouraging companies such as freight carriers and other delivery companies to send staff on ‘ecodriving’ courses to promote driving styles which reduce fuel consumption could also highlight the benefits gained in reducing noise impacts in a meaningful way which can be easily understood. For example, driving in a higher gear to maintain road speed reduces fuel consumption due to lower engine speed. Reducing engine speed by 50% will reduce engine

[3] *Practitioner Handbook for Local Noise Action Plans – Recommendations from the Silence Project. European Commission*

noise by 15 dB(A). The engine noise from one vehicle at 4000 rpm is equivalent to the combined noise produced by 32 vehicles at 2000 rpm.

Alternative ways of influencing driver behaviour to reduce noise impact is through the use of active road signs to protect nearby noise sensitive areas.

This has been tried in Austria. The idea of the signs is to encourage drivers to keep to the speed limit by relying on their goodwill in responding to messages like “I want to Sleep! Please Shhh!” set alongside a photo of a sleeping baby.

An example of this type of sign is shown in Figure 2.1.

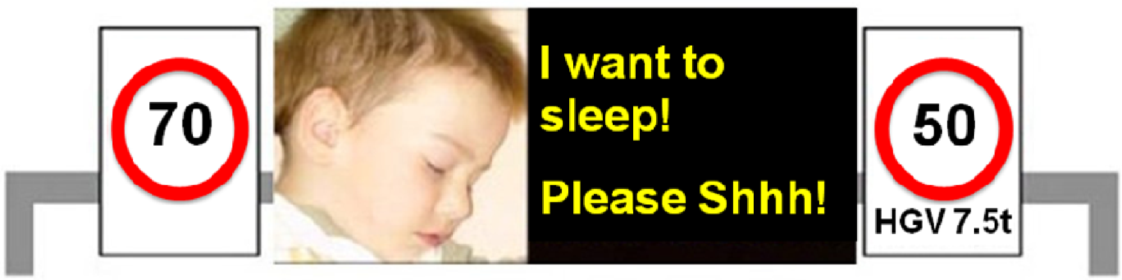
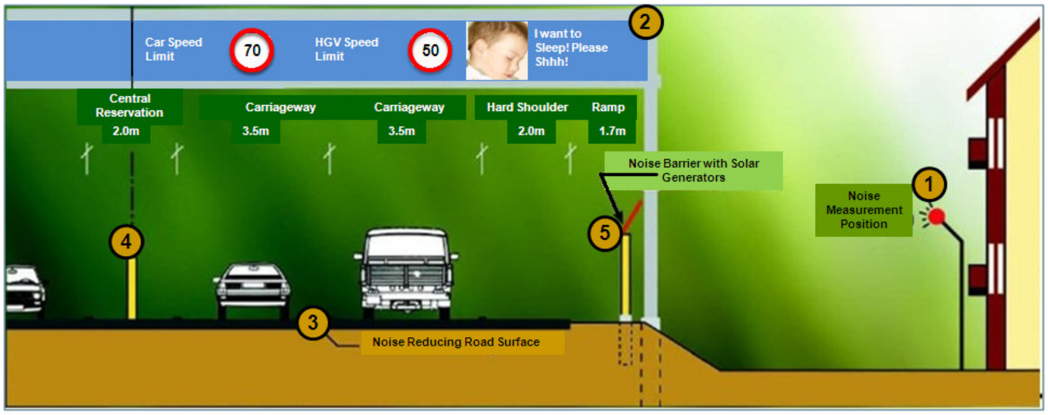


Figure 2.1. Example of sign used to influence driver behaviour

A more proactive scheme has been tried in Gleisdorf, Austria which again shows a baby asleep with a similar message but is displayed on an overhead gantry. Figure 2.2 shows an example based on the Austrian scheme. A sophisticated traffic noise monitoring facility is set up close to the road. Variable speed limits are displayed alongside the message and controlled by monitoring traffic noise levels. Noise criteria levels are set which if exceeded activate and reduce the speed limits and thereby reduce noise levels at nearby residencies. Noise benefits of up to 6 dB(A) are achievable providing vehicles adhere to the speed limits.[4]

[4] Aigner. G (2003). *Alternatives in Modern Noise Protection.*Presentation at the Symposium Lärmschutz, Asfinag, Krems, Austria.



Key
1 – Noise Measurement Facility
2 – Traffic Management Device – Automatic Speed Signs with added Psychological Signs
3 – Noise Reducing Road Surface
4 – Median Noise Barrier
5 – Noise Barrier with additional Solar Generators

Figure 2.2. Example of a multi-functional noise protection facility based on a scheme at Gleisdorf, Austria.

3. Railway Traffic Source Noise Reduction Measures

3.1. Identifying the Source

Before any mitigation measures to reduce source noise from railways can be considered, it is important to separate and identify those sources which are attributed to the movement of trains through normal operation and other sources of noise which relate to rail infrastructure.

3.2. Quieter Rolling Stock

With the exception of engine noise from diesel locomotives operating at full power, the dominant source noise from moving railway vehicles is produced by the wheels running over the track surface.

Rolling noise is dependent on many factors but primarily speed, the number of wheels and the type of braking system. Much of the variation in noise between different railway vehicles is due to the type of braking system. Older vehicles with cast-iron tread brakes lead to rough wheels and higher rolling noise emissions compared with more modern vehicles fitted with disc brakes/composition tread brakes. This difference between the two braking systems can be as much as 8 dB (A) depending on the type of vehicle.

Noise from individual railway vehicles is currently being managed through EU legislation during both the design stage and operation of new vehicles.

It should be considered that changes to rolling stock are longer-term interventions and it is therefore unlikely that train operators will replace middle-aged trains with new vehicles solely based on possible small improvements on noise emissions. However enhanced maintenance and suitable choice of vehicle, where this can be achieved, have a role to play in reducing noise at source.

3.3. Speed Restrictions

It was noted above that rolling noise is dependent on speed. Table 3.1 shows the reduction in noise emissions following the introduction of stricter speed restrictions.

Table 3.1 Reduction in Train Noise with Speed

Reduction in Speed (%)	Reduction in Noise dB(A)
10	0.9
20	1.9
30	3.1
40	4.4
50	6.0

Reducing train speeds by 10% would lead to a reduction in noise of about 1 dB (A) compared with a reduction of 6 dB (A) when train speeds are reduced by 50%. A reduction in noise of this magnitude will have a significant impact on reducing noise disturbance from railways, particularly during periods of the night.

However, whilst they may be effective in reducing noise, any consideration of the introduction of permanent speed restrictions would require a full appraisal of the wider objectives and possible disbenefits. For example speed reductions have the negative effect of increasing journey times and may reduce capacity on busy routes. This would encourage more people to travel by car which in turn would increase noise from road sources. Additionally, such speed reductions have the possibility of increasing the likelihood of nighttime freight movement, as speed restriction leads to line congestion during daytime hours. Finally, carbon emissions from train journeys may increase as a result of reduced fuel efficiency. This is especially so with regard to freight movements,

3.4. Infrastructure Maintenance

Routine maintenance, particularly related to the condition of the track, will have an impact on reducing wheel/track generated noise. The noise problems associated with rail corrugation and curve squeal can generate high noise levels. For example, a badly corrugated rail can increase noise levels compared with a smooth rail by as much as 20dB(A) i.e. an approximate quadrupling of perceived loudness, although typically this difference is between 3 to 4 dB(A).[5] Effective maintenance programmes, which could form part of a noise action plan, can minimise these effects.

Levels for grinding of the rail surface as part of a routine maintenance programme would assist in reducing this type of noise by approximately 3 to 4 dB(A) i.e. the approximate increase in noise over the period between intervention.

Curve squeal noise occasionally arises when railway vehicles run through tight curves at low speeds. It is characterised by a narrow-band noise emission at about 4 kHz. The source of this noise is attributed to the wheel to rail contact inducing frictional vibrations in the contact, which in turn causes structural oscillations of the rail and wheels. Due to its tonal nature, this source of noise can be very annoying and cause much disturbance. Application of a friction modifier to the top of the rail can be very effective but requires frequent application. This can be achieved by auto-trackside applicators often requiring a number of such applicators at a given location. However, this solution is not always successful and depends on the type of rolling stock using the track. Regular monitoring and routine maintenance programme would assist in limiting this type of noise.

A further opportunity to reduce noise at source during planned maintenance or a renewals programme could be taken by replacing the remaining areas of jointed track with continuously welded rail where there is an opportunity and

[5] *Rail and wheel roughness – implications for noise mapping based on the Calculation of Railway Noise procedure: A report produced for Defra.* AEJ Hardy and RRK Jones. AEATR-PC&E-2003-002, AEA Technology plc. Derby.2004

benefit in doing so. Jointed track generates between 2 to 3 dB(A) more noise than continuously welded rail and therefore replacing jointed track with continuously welded rail would assist in reducing overall noise levels.

3.5. Sources Related to Rail Infrastructure

Managing noise from sources related to rail infrastructure and train movements may form part of a noise action plan. Transport Scotland as funders of and with the majority of powers for Scotland's Railways, Network Rail as Infrastructure Managers, ScotRail as current Franchisee and other parties affected have a part to play in the shaping and developing these local action plans.

4. Measures for Reducing Noise Propagation and Reflection

4.1. Applicability

The advice given in this section refers to propagation noise from road and rail sources. However, because the energy distribution across the sound spectra for rail and road noise is different, the acoustic performance of a particular measure will be different for each transport mode.

4.2. Noise Barriers

Noise barriers or screens are effective but are generally a costly measure. The location, height, length, and acoustic properties of a barrier determine its acoustic performance. Generally, to be effective, a barrier should be located close to the source, particularly, where a large area behind the barrier needs to be protected. The barrier height requirements will be determined, generally, by the height of the most exposed bedroom window of the building. To ensure the performance of the barrier is not compromised the length of the barrier should be sufficient to completely screen the traffic from view at the exposed facade. Transmission of noise through the barrier is governed by the surface mass of the screening material and the quality of construction. Any gaps or leakage should be avoided. Generally the surface mass requirement to effectively control the transmission of noise through the barrier is met by constraints regarding wind loading.

Noise barriers can be visually intrusive. However barriers with specially shaped top sections can be as effective in reducing noise as taller barriers. Barriers with sound absorbing material on the traffic side may reduce sound reflection to properties on the opposite side of the road or rail noise source. Where applicable, incorporating noise barriers within the safety fence in the central reservation of dual carriageway (median barriers), can improve the performance of roadside barriers, provided the median barrier is more than half the height of the roadside barrier. This method of enhancement can potentially increase performance of the roadside barrier by about 3 dB (A).

4.3. Building Facades

Streets which are flanked on both sides by multi-storey buildings can produce reverberant noise fields caused by reflections from building facades. The noise caused by reflection between facades depends on the geometry of the building layout and the sound absorption properties of both the building facades and the ground between the buildings. This reflection effect can cause an increase of 3 to 4 dB(A). Increasing the sound absorption properties of these surfaces for example by using a more porous road surface than traditional or by promoting “green wall” technology in building design would help to limit the increase in noise.

5. Measures for reducing noise transmission

5.1. Applicability

The advice given in this section refers to propagation noise from road and rail sources. However, because the energy distribution across the sound spectra for rail and road noise is different, the acoustic performance of a particular measure will be different for each transport mode.

5.2. Facade Insulation

Improved facade insulation is generally regarded as a last resort if other measures of reducing noise at source or along the propagation path fail to be sufficient. Offering grants to properties which have no sound insulation can be effective. Windows with secondary or double-glazing can achieve sound reductions of about 40 dB compared with a sound reduction of about 30 dB for single glazed windows. These performance figures are for well-sealed windows. Opening windows can reduce performance by 10 to 15 dB, however open double windows and other such designs can improve the level of sound reduction obtained via an open window. However to maintain the acoustic benefits some form of ventilation system is likely to be required.

5.3. Combined Measures

Where noise action plans involve combined measures to reduce noise, it is important to be aware that the overall noise reduction may not be simply the sum of the noise reductions expected from each measure separately. For example, where the reduction in noise provided by a low noise surface is expected to be 2 dB(A) compared with a reduction of 7 dB(A) if a noise barrier was constructed, the combined reduction if both measures were implemented is likely to be less than 9 dB(A). This is due to the differing effectiveness of these two measures at reducing noise across the frequency spectra important to both road traffic noise, and the sensitivity of human hearing to sounds at these different frequencies. Both measures are effective in reducing noise at high frequencies, above about 500 Hz which corresponds to the frequency range most sensitive to human hearing. Although noise from road traffic is spread across the frequency range 20 Hz to 5 kHz, it is dominated by low frequency noise in the range 20 to 500 Hz. In terms of perception, the low frequency noise from road traffic becomes more important as the higher frequency noise is reduced. The progressive reduction in noise at the higher frequency range of the traffic noise spectra provides less impact on the perception of noise as these measures are introduced.

It is important to add that although the combined effectiveness of these measures may not be additive, nevertheless, there may be advantages of combining measures. For example, where the height of a noise barrier is visually intrusive, the addition of a low noise surface may provide adequate noise reduction to allow a lower noise barrier to be constructed which is visually more acceptable without any loss in overall performance.

Appendix A Useful Documents

1 *Alternative methods for the management of nght-time freight noise in London*, MJ Ainge, et al, Published Report PPR286 Transport Research Laboratory, Crowthorne House, Nine Mile Ride, Wokingham. 2008.

2 *A review of current research on road surface noise reduction techniques.* P G Abbott, P A Morgan (TRL) and B McKell (AECOM). Published Report PPR 443. Transport Research Laboratory, Crowthorne House, Nine Mile Ride, Wokingham. 2010.

3 *Design Manual for Roads and Bridges (DMRB) HA 213/08, Volume 11, Section 3, Part 7: Noise and Vibration.* The Highways Agency, Scottish Government, Welsh Assembly Government, The Department for Regional Development Northern Ireland. 2008.

4 *HARMONOISE Prediction Model for Road Traffic Noise.* G R Watts. Published Report PPR 034. Transport Research Laboratory, Crowthorne House, Nine Mile Ride, Wokingham. 2005.

5 *M27 Trial of Highway Noise Barriers as Solar Energy Generators*, Published Project Report PPR178: Transport Research Laboratory, Crowthorne House, Nine Mile Ride, Wokingham. 2005.

6 *Practitioner Handbook for Local Noise Action Plans: Recommendations from the SILENCE Project.* European Commission under the 6th Framework Commission. (http://www.silence-ip.org/site/)

7 *Rail and wheel roughness – implications for noise mapping based on the Calculation of Railway Noise procedure: A report produced for Defra.* AEJ Hardy and RRK Jones. AEATR-PC&E-2003-002, AEA Technology plc. Derby.2004.

8 *Technical Guidance: Candidate Noise Management Areas to Noise Management Areas.* Environmental Quality Directorate, Scottish Government,2009. (http://www.scotland.gov.uk/Resource/Doc/299264/0093316.pdf)

9 *Technical Guidance: Noise Action plans: Candidate Quiet Areas to Quiet Areas.* Environmental Quality Directorate, Scottish Government, 2010. (http://www.scotland.gov.uk/Resource/Doc/299253/0093315.pdf)

10 The Scottish Noise Maps at **http://scottishnoisemapping.org/**

11 *Traffic Calming: Traffic and Vehicle Noise.* Traffic Advisory Leaflet 6/96. Traffic Management Division, Department for Transport. 1996

12 *Traffic Noise Reduction Toolkit.* G R Watts, P G Abbott and P M Nelson. Published Project Report PPR 047. Transport Research Laboratory, Crowthorne House, Nine Mile Ride, Wokingham. 2005.

13 WHO Guidelines for Community Noise - A Complete, Authoritative Guide on the Effects of Noise Pollution on Health, World Health Organization 1999

14 Speed and Road Traffic Noise The role that lower speeds could play in cutting noise from traffic the UK Noise Association, Paige Mitchell, 2009

Appendix B Relevant Organisations

Organisations	Details
Managers	
Local Authorities	**Responsible for all Local Government functions within their areas.**
Regional Transport Partnerships	Established on December 1, 2005 (there are seven) to strengthen the planning and delivery of regional transport so that it better serves the needs of people and businesses.
The Scottish Government	The devolved government for Scotland is responsible for most of the issues of day-to-day concern to the people of Scotland, including health, education, justice, rural affairs, and transport.
Transport Scotland	An agency of the Scottish Government and is accountable to Parliament and the public through Scottish Ministers. They manage the trunk road and railway network and concessionary travel schemes working in partnership with private sector transport operators, local authorities, the wider Scottish Government, and the Regional Transport Partnerships.
Delivery Partners	
DB Schenker Rail (UK)	Previously known as **English, Welsh and Scottish Railway** (**EWS**), is the largest British rail freight company.
First ScotRail	**Current operator of the Scottish Passenger Rail Franchise.**
Freightliner Group Limited	The second largest rail freight operator in the UK, after **DB Schenker Rail (UK).**http://en.wikipedia.org/wiki/DB_Schenker_Rail_(UK).
Network Rail	Owner and operator of the rail infrastructure in Scotland. They run, maintain and develop the track, signalling system, rail bridges, tunnels, level crossings, viaducts and key stations.
Traffic Scotland	Provides a coordinated traffic management service for Scotland's strategic road network. The site gives live traffic conditions and planned roadworks.
Professional Organisations	
Institute of Acoustics (IOA)	The UK's professional body for those working in acoustics, noise and vibration, it was formed in 1974.
Association of Noise Consultants (ANC)	Established in 1973 to represent the interests of noise consultants in the UK.
Chartered Institute of Logistics and Transport (CILT)	The pre-eminent independent professional body for individuals associated with logistics, supply chains and all transport throughout their careers.
Environmental Protection UK (EPUK)	A national membership-based charity, playing a leading role in environmental protection in the UK since 1898. They seek changes in policy and practice to minimise air, noise and land pollution, bringing together stakeholders to inform debate and influence decision-making.
Heads of Planning Scotland	They promote planning at local and national levels by providing a forum for discussion and study of subjects connected with planning.
Institute of Civil Engineers (ICE)	A registered charity that strives to promote and progress civil engineering.
Institute of Environment Assessment and Management (IEMA)	The professional membership body for promoting best practice standards in environmental management, auditing and assessment for all industry sectors.

Railway Safety and Standards Board (RSSB)	A not-for-profit company owned and funded by major stakeholders in the railway industry, but is independent of any one party. They build industry-wide consensus and facilitates the resolution of difficult cross-industry issues. They provide knowledge, analysis, a substantial level of technical expertise, powerful information and risk management tools.
Royal Environmental Health institute Scotland (REHIS)	An independent, self-financing registered Scottish charity whose main objectives are for the benefit of the community to promote the advancement of Environmental Health.
Society of Chief Officers of Transportation Scotland (SCOTS)	Provides a Local Authority forum and policy advice on a national basis on all matters affecting transportation
The Chartered Institute of Highways and Transportation	A learned society concerned specifically with the planning, design, construction, maintenance and operation of land-based transport systems and infrastructure.
Other Governmental Organisations	
Architecture and Design Scotland	The champion for excellence in place making, architecture and planning. Aims to support the creation of places that work, which provide people with real choices and, are ultimately, places where people want to be.
Non-Governmental Organisations	
The UK Noise Association	A campaigning organisation only. They bring together a unique coalition of key organisations lobbying on different aspects of noise