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Book Review

Environmental Noise Barriers. A Guide to their Acoustic and Visual Design, second edition (Price: £90). Benz Kotzen and Colin English, 2009. ISBN: 978-0-415-43708-0

In a society where the dominant source of background noise is transportation related, and as more is becoming known about adverse effects of exposure to noise, it is no surprise that attitudes towards noise mitigation are slowly beginning to change.

The Green Paper on Future Noise Policy (1996) was one of the first steps in developing a unified approach to noise reduction across the European Community. More recently the European Noise Directive 2002 (transposed into UK law through the Environmental Noise Regulations (2006)), required member states to undertake strategic noise mapping of large urban areas, major roads, major railways and major airports. As a result of this exercise draft action plans have been drawn up in order to "...manage noise issues and effects, including noise reduction if necessary".

Amongst the many approaches towards mitigating transportation noise, the environmental noise barrier remains one of the most widespread and versatile methods. The draft action plans are now available for inspection and it is clear that if they and their successors are to be implemented fully, environmental barriers would have to play a significant role.

There is no shortage of reference material on environmental barriers (including the first edition of the book under review) and with very little effort the interested reader can learn about almost any aspect, from analysis (physics of diffraction; analytical modelling; empirical modelling; modifications to reduce diffraction; novel shapes, sizes and alignments), to construction and materials, standards and legislation. Inevitably however, since the final design is an amalgamation of discrete areas of knowledge, much of the available information tends to be either concentrated on specific aspects or presents a very broad-brush approach. The Highways Agency's Design Manual for Roads and Bridges (DMRB) and Manual of Contract Documents for Highway Works (MCDHW) probably provide the most comprehensive and easily available reference material, although both documents are large and require a degree of experience in their use to extract all information relevant to environmental barriers, their design and construction.

The second edition of *Environmental Noise Barriers: A Guide to their Acoustic and Visual Design* is an update covering the 10 years that have elapsed since the first edition was published. The book is a compendium of concept-to-construction advice aimed at encouraging a more progressive attitude towards design and construction than has historically been demonstrated—particularly within the UK, where, the authors maintain, attitudes and policy compare rather unfavourably with elsewhere in Europe.

One question that might be posed is how applicable is this book worldwide? The preface to the first edition, reproduced in this second edition states "Our original purpose in writing this book was to create a source book for all those involved in the design of barriers in the UK... Nevertheless, we hope that, since the design principles in this book have universal application, it will be of use to barrier designers outside the UK too." Clearly, as stated, the fundamental principles behind barriers are no different wherever one may be, and much of the design philosophy may be applied regardless of location. Despite this much of the text appears to be aimed primarily at the UK/EU market and few of the references are from sources outside Europe.

In the UK environmental barriers may be incorporated into new or improved infrastructure to mitigate impacts on existing receptors or they may be a necessary part of new development in mitigating impact from existing infrastructure. In either event this book fulfils an important role in explaining the processes involved in the design and construction in such a way that the reader can appreciate some of the constraints and choices available, while gaining an understanding of how it may be possible to influence the final product. The book also manages to convey the message that an integral, cross-disciplinary approach is required for successful completion of the project. To that end the book combines acoustic design with visual and landscape design—incorporating chapters relating to each discipline and presenting examples of barriers which are aesthetically pleasing and demonstrate cooperation between disciplines. It is unfortunate in some respects that this latter requirement is opposed by a current trend towards increasing specialisation within engineering disciplines.

The target audience of the book is undoubtedly those involved most directly in the design of noise barriers—acoustic engineers and landscape architects. However there is potentially a secondary audience of others, such as other environmental specialists, architects or civil engineers who play a more prominent role in most major infrastructure

projects. Given the liberal provision of photographs and sketches, those involved in obtaining or providing funding for environmental barriers might also find the book of use, as would those responsible for construction—many of the illustrations would suggest rather more complex structural design requirements and financial outlay than those required for conventional timber barriers.

In 'Defining the need for barriers' there is a short section on policy with the emphasis placed on policy associated with infrastructure—roads in particular. This maybe because traffic is the major source of environmental noise in the EU (EU Green Paper), although information on guidance or policy associated with development adjacent to infrastructure and other Annex 2 (of the EIA Directive 85/337/EC) assessments, such as Planning Policy Guidance Note 24: Planning and Noise might have proved a useful addition. Many of these projects have as much, if not more scope for creative barrier design than do those within the highway boundary, where available land may be limited and design subject to stringent standards and approval procedures. Despite these observations, in the UK the most comprehensive methodology for assessment (and design) has been developed for road schemes and contained within the DMRB, and 'Defining the need for barriers' provides a very good summary of the DMRB process for new roads, from route option studies through to detailed design and mitigation with further ideas for improvement. There is also a very useful visual summary of the whole process, which puts the various stages into context.

'Acoustic performance of barriers' explores some of the acoustic principles behind barrier design and the way in which these can be used or manipulated in a practical way—for example the problem with reflected sound and how this maybe reduced, or how modifications to the diffracting edge can be used to increase performance. One of the problems with roadside barriers is that low frequencies are less attenuated than high frequencies, resulting in a perceived change in the overall character of traffic noise despite an overall decibel reduction. Therefore it is interesting to read of one such modification, an active noise control system that performs best at low frequencies. Specification of acoustic performance is conventionally through a single number rating, derived in current standards by laboratory testing of insulation and absorption characteristics of panels. Current proposals are discussed in this chapter to extend these Standards for measurement of acoustic performance of both barriers and diffracting edges in situ, which have the obvious advantage of enabling the performance of any type of barrier to be quantified in a manner unhindered by laboratory limitations.

'Types of barrier and barrier materials' explores the construction of typical barriers with an overview of DMRB guidance. The authors observe that DMRB guidance is essentially a design checklist but is not comprehensive and should be used with other guidance. My own observation is that potential designers of barriers would do well to remember that where safety considerations are paramount, the DMRB process exemplifies good practice, and its design procedures are underpinned by strict technical requirements—for example barriers 3 m or higher require Technical Approval, a rigorous check process requiring information on the adjacent highway, proposed site, structure, requirement for road restraint system (safety barriers) and geotechnical conditions. However, examples presented in the chapter do demonstrate a stark contrast to the often-seen utilitarian barriers resulting from a conventional approach to engineering design, and demonstrate what may be achieved by considering how the final product will integrate with the landscape.

'Contemporary issues, developments and considerations' touches on issues surrounding barriers, such as the additional uses they could be put to whilst fulfilling their main function. One such suggested function is to protect 'important wildlife sites' or to enhance the biodiversity of an area. Attention is drawn to potential impacts of noise on birds, bats and other species and reference is made to research on the effect of traffic noise on birds, although this is by no means comprehensive (or, as more recent research might suggest, conclusive). Mention might also have been made of some of the UK and European legislation responsible for providing protection to wildlife. This legislation can, and does have profound implications on any type of construction where disturbance of the ground is necessary, and many engineering projects are now driven by environmental issues at both design and construction stages. Other benefits explored are how barriers may be used to reduce air pollution alongside roads, and the incorporation of photovoltaic cells on barriers to produce energy—although I sensed a clash in the latter respect with aesthetic sentiments expressed elsewhere in the book.

In reviewing this book I have read nothing that I would actively disagree with, and many of the proposals could do nothing but enhance our surroundings. Many of the examples and much of the contents, however, relate to barriers adjacent to roads and I feel that an opportunity might have been missed. As mentioned previously there are essentially three scenarios where barriers may be required—adjacent to new infrastructure and closely linked with scheme design; adjacent to existing infrastructure but associated with development of adjacent land; and retrospectively applied to existing infrastructure. The procedures and requirements for each case are different, and it would have been useful if the text had drawn this distinction and perhaps given some indication of how some of the illustrated constructions came to be built. In order to do full justice to many of the suggested measures one would ideally need to be involved with designing new barriers adjacent to new infrastructure. Unfortunately this is not an opportunity that many will be able to take advantage of. Apart from one or two exceptions UK road building has been scaled down in recent years and the emphasis placed on maintenance and improvement schemes within the road corridor, such as widening or Active Traffic Management. For barriers to be most effective they need to be near to the noise source, and on roads this means in the verge or at the back of the hard shoulder. In these locations all sorts of restrictions apply and the creative designer may find his/her options accordingly narrowed. On the other hand with the increasing pressure for housing, more and more pressure is being placed on areas adjacent to heavily trafficked roads where opportunity may lie for the designer who will find fewer restrictions. It is a minor point, and does not detract from my overall impression of the book but I feel that the

emphasis could perhaps have been equally placed on private development, associated policy and the opportunities that these present.

In undertaking this review I have also been acutely aware of not having commented (other than superficially or obliquely) on those chapters which are more specific to the landscape architect. These aspects are however integral to the purpose of the book, and as someone who has been involved in the design of a number of environmental barriers, I feel I have learnt a lot about how to improve the process by involving landscape design, and perhaps thinking beyond the mere need to reduce noise levels for what often turns out to be the most economic product. During the course of reading the book and discussing it with others, many have commented on the more pleasing (and, in some instances, spectacular) barriers they have personally observed on the continent, which I would have to concede adds further weight to the underlying principle behind the book.

Finally, perhaps I should point out that the authors note in the Preface “Our travels allowed us to view many of those barriers which had made the greatest impression on us a decade ago... we were surprised to see how dated the more elaborate designs looked after 10 years’ service” a sentiment from which one might, perhaps inadvertently conclude, it could be better to err on the side of tradition after all—or, in other words to sit on the fence.

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