



## Technical Briefing

# Eurocode Implementation by the Highways Agency, UK

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### Introduction

The structural Eurocodes are a suite of design codes that will be introduced over the next five years and will effectively replace all national standards in European Economic Area countries. When Eurocodes are published they will become part of the application of the Public Procurement Directive. In public tender and public contracts technical specifications shall be formulated by referring to EN Eurocodes in combination with the Nationally Determined Parameters. The Nationally Determined Parameters (or NDPs) incorporate country specific data and safety factors in a National Annex (NA), which will accompany each Eurocode.

The Highways Agency has commissioned consultants Parsons Brinckerhoff (PB) and Atkins to assist with the development of a strategy for implementation, develop the technical content of the Design Manual for Roads and Bridges, and ensure that highway structures can be designed safely and economically using the Eurocodes. The contract commenced in 2003 and is scheduled to complete in 2010.

### Eurocodes

There are ten structural Eurocodes, which are further subdivided into a total of 58 parts, each containing specific technical rules relating to the design of structures.

For bridges, designers require a number of these parts; for example to design a concrete bridge: Eurocode 0, covering the basis of design; Eurocode 1, to determine the actions applied to the structure; Eurocode 2, to determine the resistance of the concrete; and Eurocode 7 to ensure that the structure has adequate foundations. Additionally, execution documents covering construction tolerances and other workmanship requirements are also necessary.

As a result of the interaction between the various codes, CEN has grouped the Eurocodes into packages, and therefore the programme leading to the withdrawal of the current British Standards is determined by the publication of the final part in any given package. It is expected that equivalent British standards will be withdrawn from 2009.

### National Annexes

Each Eurocode part will be accompanied by a National Annex (NA) that will contain country specific data relating to issues such as safety and climatic variations. The NA will be used in conjunction with the Eurocodes in a particular country. The NA is the responsibility of each national standards body; in the UK this is BSI.

Once the Eurocode part is published, the national standards body has two years to prepare the National Annex. Some of the NAs will be developed by the Building Research Establishment (BRE) funded by the Office of the Deputy Prime Minister (ODPM), and some, principally related to transportation structures, will be developed by the Highways Agency in consultation with the BSI Working Groups. Most of the NAs will be published before the end of 2007.

### Design Manual for Roads and Bridges

The Design Manual for Roads and Bridges (DMRB) currently supplements the provisions of the British Standards, and will perform a similar function for the Eurocodes under the banner of Non-Conflicting Complementary Information (NCCI). The Highways Agency has some specific requirements that are not covered by the Eurocodes, such as the design of integral bridges, and also has supplementary requirements to those contained in the Eurocodes. There are around 45 DMRB parts that are written to supplement the British Standards to some degree, and these all need to be redrafted to account for the Eurocode requirements. The Agency's strategy is to first review the Eurocode provisions, undertaking scoping studies to determine what Eurocode provisions need to be supplemented to maintain the Agency's expected levels of safety and value for money.



The opportunity will be taken to reduce the number of DMRB parts and only to include requirements that are essential to ensure safety, durability and economy of highway structures. It is intended that guidance material such as worked examples will be produced to supplement the already growing number of technical manuals and other material that experts and industry bodies are publishing in anticipation of the introduction of Eurocodes. The redrafting of the DMRB is at different stages of completion and is dependent on the availability of the associated Eurocode part. Most of the scoping studies are now complete, and early to mid stage drafts have been produced for a number of key documents, including a 'Basis of Design' part, which will serve as a gateway document stating the Agency's requirements for considering actions on structures; and the steel design part.

Some of the Eurocodes are not yet complete, and the majority of NAs are in development, with publication taking place around 2006-2007. As the DMRB will supplement these documents DMRB parts will not be complete until the parameters in the National Annexes are fixed. Therefore, publication of the DMRB parts will not begin until 2006.

### Pilot Studies

Parsons Brinckerhoff and Atkins have undertaken pilot studies using Eurocodes to design structures that have already been designed and built in accordance with British Standards and the DMRB. The objective is to identify more specific impacts arising from the use of Eurocodes and the differences arising as a result of Eurocodes when compared to current practice.

The studies have shown that, although there is initial concern from designers as to the number of documents and scatter of rules, there is little change in the technical approval procedures. Eurocodes have been found to be less prescriptive than BS5400 and there is more reliance on first principles and finite element modelling. The results of the pilot studies can be summarised as below:

- The number of documents will increase and initially design costs will rise. With greater choice of software and guidance documents both from the UK and abroad it is anticipated that design costs will be broadly comparable over time.
- The studies have shown there is a little change in the capacity and sizes of members derived in designs using Eurocodes when compared to designs to BS5400. On average it is expected that construction costs will be same or be slightly lower. As the documents are less prescriptive there will be greater scope for economy and innovation.
- The impacts for construction will not be fully realised until the execution documents are complete. The initial indications are their effects will be minimal.

Further pilot studies on different types of bridges will be undertaken to address some of the issues not covered under the previous work. The Agency intends to undertake pilot studies in live contracts in due course when all the Eurocode parts and the associated DMRB are substantially complete.

### Effects on the Highways Agency

The introduction of Eurocodes will change the way we design and procure our bridges in the UK. Not only will Eurocodes and European product standards change the content of the DMRB, but they will also change our specifications and construction practices. European product standards for construction materials in particular have for a number of years required assimilation into the DMRB and associated specifications. The Highways Agency's Asset Assurance Group will be responsible for the approval process for structures. The Agency will need to communicate the principal issues related to Eurocodes that will arise during the approval process, and develop the procedural policy to deal with these requirements.

The reshaping of the DMRB will result in significant activity for Technical Project Boards (TPBs) who approve the DMRB and for our publishers. TPBs consist of representatives from the three Overseeing Organisations: Scotland, Northern Ireland and Wales, along with CSS, other directorates in Agency and the industry at large.



The Agency's approach is to resolve programme risks that exist internally and external risks that arise from the large number of inter-dependencies and stakeholders before implementation.

### Outstanding Issues

There are a number of unresolved issues. One of the most significant of these is the approach to the assessment of structures, which draws heavily from the rules in the British Standards, likely to be withdrawn by BSI around 2010. There has been a huge resource input to R & D and standards development in support of the UK Bridge Assessment Programme to identify relaxations and rules suitable for structures built to earlier code requirements. In many cases historic structures have been built to empirical rules that do not bear close scrutiny using contemporary standards. For these reasons it is unlikely to be practical to switch to assessments based on the Eurocode and the Agency is now considering how to manage this important area of work in the future.

Several issues remain to be addressed at European level. There isn't currently a European policy with respect to departures from the Eurocode standards; whether any departures will be permitted; and who would be responsible for managing any departures if they are permitted. There is a need for care and maintenance of the Eurocodes once they are published, and there remain issues about how a group would be set up for this purpose for each Eurocode, and how it would be funded. Further issues exist with respect to residual British Standards, which will be required to cover some aspects that are currently covered that will not be replaced by the Eurocodes. This is an issue that must be addressed by BSI.

### Eurocode Implementation at the National Level

The UK Government Department responsible for the implementation of Eurocodes, the Office of the Deputy Prime Minister (ODPM), commissioned the Institution of Structural Engineers (IStructE) to produce a National Strategy for Eurocode Implementation. The IStructE appointed representatives from all sections of the structural engineering industry to the committee, including representative from the Highways Agency. The committee delivered their report to ODPM in Summer 2004, highlighting the myriad of issues that remain in respect of the UK structural engineering industry's interests in the implementation of the Eurocodes. ODPM has accepted the findings of the report and a selection of recommendations are being taken forward.

One of the recommendations is the establishment of a standing committee for the Eurocodes, with terms of reference to monitor, update and modify the strategy for the implementation of Eurocodes in the UK. The standing committee is meeting regularly under the chairmanship of Professor David Nethercot of Imperial College to discuss implementation issues. The representatives from ODPM, the Highways Agency and experts from the industry meet to discuss issues and the way forward on implementation.

### Conclusion

All Eurocode parts are expected to be complete before the end of 2005 and some countries will be implementing them from 2006 onwards. However, the Agency intends to continue with the British Standards until all the DMRB parts are complete and the British Standards are withdrawn. This is expected to happen around 2010.

There is little doubt that the Eurocodes are based on strong scientific foundations and there will be greater scope for innovation, probably resulting in structures that provide better value for money. The Highways Agency has commissioned consultants to provide expert advice throughout the implementation programme. However, there remains a considerable amount of work to be done between now and 2010, and this will require increasing engagement throughout the Agency and its supply chain as the Eurocodes and DMRB migrate from technical development to usage for structural design.

### Acknowledgement

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