Proceedings of the Institution of Civil Engineers
Geotechnical Engineering 156
July 2003 Issue GE3
Pages 121–124

Paper 13244

Keywords:
codes of practice & standards/ geotechnical engineering

Briefing

European geotechnical codes and standards

R. Driscoll, *BRE, Geotechnics Division*

1. INTRODUCTION

The geotechnical Eurocode and associated documents may have been a long time coming, but coming they are. Their official arrival will herald some changes in geotechnical practice in Britain and much of continental Europe; indeed, they may also bring change in other parts of the world where code writers have followed many of the principles adopted in the Eurocode.

It is therefore timely that this Briefing provides geotechnical practitioners with the latest information and gives them notice of what is to come over the next year or two.

In a collection of national design codes that have evolved over decades, sometimes in a rather piecemeal fashion, British engineers have been used to fairly detailed recommendations for what *should* be done, full of practical advice, some of it rather 'long in the tooth'. We have a comprehensive set of fairly up-to-date testing standards in BS 1377: 1990, and a recent revision of BS 5930: 1999 that is widely cited.

In theory, all this is to be withdrawn and replaced by a suite of *Euronorms*. Quite when and how the changeover will be completed remains to be seen.

2. THE SUITE OF EURO-DOCUMENTS THAT WILL FINALLY EXIST

At least for the next 10–15 years, we can expect the suite of geotechnical Eurocodes and Standards (so-called Euronorms, ENs) to consist of the following documents

(*a*) Eurocode 7 Geotechnical design—Part 1: General rules (EN1997-1)
(*b*) Eurocode 7 Geotechnical design—Part 2: Ground investigation and testing (EN1997-2)*
(*c*) a set of 'execution' standards
(*d*) a set of testing standards and technical specifications
(*e*) two ISO documents.

The first two of these have been produced by a Technical Sub-Committee (SC7) within the group producing all the structural Eurocodes (CEN TC 250); the execution standards have been produced by CEN Committee TC288, the testing standards by TC341 and the ISO documents by yet another, international committee.

EN1997-1, when it comes into official use, will be one of a set of structural Eurocodes (see Table 1). Each of these is proceeding to completion on a different date. Therefore full implementation of EN1997-1 cannot occur until a 'package' of Eurocodes is available. This would include, in the case of, say, a concrete foundation, EN1990, EN1991, EN1992 and EN1997 (see section 3 below, and Reference 1 for more information).

2.1. Eurocode 7—Part 1

Part 1 has now been completed and is undergoing translation from English into French and German ahead of a formal vote for adoption, around mid-2003; unanimous acceptance is expected. Here in the UK the British Standards Institution will publish Part 1 as BSEN 1997-1; a separate National Annex (see section 3). A description of the contents of Part 1 and a discussion of its main features and implementation in the UK may be found in Reference 2. A list of the contents is shown in Table 2.

2.2. Eurocode 7—Part 2

The conversion of the pre-standards ENV1997-2 and ENV1997-3, *Geotechnical design assisted by laboratory testing* and *field testing* respectively, has been under way for about a year. It was recently agreed to combine the two documents into a single Part 2, *Ground investigation and testing*: Part 2 will cover the topics listed in Table 3. It can be seen that the content covers material provided in both BS 5930 and parts of BS 1377.

2.3. The 'execution' standards

TC288, working in liaison with SC7, is producing a suite of 'execution' standards for 'special geotechnical works', to be used with EN1997-1: Table 4 lists them and their current status. There is some obvious correspondence with existing BS codes, for example BS 8004: 1986 (Foundations) and BS 8081: 1989 (Ground anchorages), bearing in mind that these BSENs are intended to deal only with construction-related matters and not with 'design'.

2.4. The testing standards and technical specifications

TC341, again working in liaison with SC7, is producing a suite of testing standards (ENs) and technical specifications (TSs) for

* EN1997-2 arose from the merger of two separate 'pre-standards': Part 2—Design assisted by laboratory tests (DD ENV1997-2: 2000) and Part 3—Design assisted by field tests (DD ENV1997-3: 2000).

Name	Euronorm reference
Eurocode: Basis of structural design	EN1990
Eurocode 1: Actions on structures	EN1991
Eurocode 2: Design of concrete structures	EN1992
Eurocode 3: Design of steel structures	EN1993
Eurocode 4: Design of composite steel and concrete structures	EN1994
Eurocode 5: Design of timber structures	EN1995
Eurocode 6: Design of masonry structures	EN1996
Eurocode 7: Geotechnical design	EN1997
Eurocode 8: Design of structures for earthquake resistance	EN1998
Eurocode 9: Design of aluminium structures	EN1999

Table 1. The structural Eurocodes and their EN numbers

Theme	Section
Overall approach	General
	Basis of geotechnical design
Ground investigation	Geotechnical data
Design aspects of construction activities	Supervision of construction, monitoring and maintenance
Design of specific elements	Fill, dewatering, ground improvement and reinforcement
	Spread foundations
	Pile foundations
	Anchorages
	Retaining structures
	Hydraulic failure
	Overall stability
	Embankments

Table 2. Contents of EN1997-1

soil and rock, to be used with EN1997-2: Table 5 lists the topics for which ENs are being prepared.

The more observant among you will have spotted that Table 5 covers only *in-situ* activities and testing. TC341 currently lacks the resources to write full laboratory testing specifications, and will use ISSMGE documents[3] to produce technical specifications for those tests shown in Table 6. As these will not be full Euronorms, they are termed *Technical Specifications* and are, as such, not mandatory. This will mean that the British National Annex may cite BS 1377.

2.5. The ISO material

Some 20 years ago, ISO formed a working group covering 'The identification and description of soils and rocks'. Under the Vienna Agreement, CEN and ISO agreed not to duplicate work items, and that the completed standards would be adopted by both. Accordingly, the documents shown in Table 7 are being produced.

3. IMPLEMENTATION

Each country is required, through its national standards body (BSI, in our case), to implement the Eurocodes by publishing them without alteration. The only specific local changes that are permitted must be implemented in a *National Annex*. As levels of safety implicit in the Eurocodes are a matter for individual Member States to stipulate, a CEN TC250 document states:

> The National Annex may contain . . . information on those parameters which are left open . . . to national choice, the NDPs (Nationally Determined Parameters), . . . i.e.:
>
> – values and/or classes where alternatives are given in the EN Eurocode [values for the partial γ factors[2]];
> – values to be used where a symbol only is given in the EN Eurocode;
> – country-specific data [e.g. depth of foundations to avoid frost heave or clay shrinkage];
> – the procedures to be used where alternative procedures are given in the EN Eurocode [choices in 'design approach' are given[2]];
> – decisions on the application of informative annexes [e.g. method for calculating settlement];
> – reference to non-contradictory, complementary information to assist the user in applying the Eurocode.

The British National Annex for EN1997-1 is currently in preparation and will address the above aspects, including reference to material deemed necessary for the safe application of the Eurocode. Furthermore, as our current national codes are generally of an advisory nature and very rarely, if at all, contradict the principles of the Eurocode, it is likely that we may continue to make reference to much of the practical

Section in prEN1997-2
Planning of ground investigations
– Commissioning of ground investigations
– Objectives, nature and extent of ground investigations
– Reporting of ground investigations
Drilling, sampling and groundwater measurements
– Objectives
– Drilling
– Soil sampling
– Rock sampling
– Groundwater measurements in soils and rocks
Field tests in soils and rocks
– Cone penetration and piezocone tests
– Pressuremeter test
– Rock dilatometer test
– Standard penetration test
– Dynamic probing test
– Weight sounding test
– Field vane test
– Flat dilatometer test
– Plate loading test
Laboratory tests on soils and rocks
– General requirements for laboratory tests
– Testing programme
– Preparation of soil specimens for testing
– Laboratory tests on soils
– Tests for classification, identification and description of soils
– Chemical testing of soils and groundwater
– Compressibility testing of soils
– Strength index testing of soils
– Strength testing of soils
– Compaction testing of soils
– Permeability testing of soils
– Laboratory tests on rocks

Table 3. Contents of EN1997-2

Topic
Drilling and sampling methods, and groundwater measurements
Cone and piezocone penetration tests
Dynamic probing and standard penetration test
Testing of geotechnical structures
Borehole expansion tests

Table 5. Testing standards in preparation

Topic
Water content
Density of fine-grained soils
Density of solid particles
Particle size distribution
Oedometer test
Fall cone test
Compression test
Unconsolidated triaxial test
Consolidated triaxial test
Direct shear test
Permeability test
Laboratory tests on rock

Table 6. Test specifications in preparation

advice that they contain but which is missing from the Eurocodes.

As there will not exist full European laboratory test specifications for the foreseeable future, the British National Annex will also refer to BS 1377 and to parts at least of BS 5930. It is envisaged that any parts of BS documents that do contradict the principles of the ENs will be withdrawn by amendment. For EN1997-2, if we wish to make reference in a National Annex to BS 5930 and those parts of BS 1377 not satisfactorily replaced by equivalent ENs, it may be necessary to withdraw some BS clauses that state that things 'should' be done but where the equivalent EN clauses will state that things 'shall' be done.

4. THE TIMETABLE

The likely timing of the roll-out of the geotechnical Eurocode parts is as follows.

TC288 document	Title	Current status
BS EN1538: 2000	Diaphragm walls	Published by BSI
BS EN1537: 1999	Ground anchors	
BS EN1536: 1999	Bored piles	
BS EN12063: 1999	Sheet piling	
BS EN12699: 2000	Displacement piles	
BS EN12715: 2000	Grouting	
BS EN12716: 2001	Jet grouting	
PrEN14199	Micro piling	prEN dated April 1998; conversion to EN in progress
PrEN14475	Reinforcement of fills	prEN dated March 2002; CEN enquiry stage
PrEN14490	Soil nailing	
PrEN288011	Deep mixing	Drafting
	Deep vibration	
	Deep drainage	

Table 4. CEN TC288 documents

Standards delivered	Equivalent BS 5930 clause	Date published
Soils		
14688-1: Identification and description	41	2002
14688-2: Classification principles and quantification of descriptive characteristics	42	FDIS,† publication 2003
Rocks		
14689-1: Identification and description	44.2	FDIS, publication 2003

† Final Draft International Standard.

Table 7. ISO Standards

(*a*) Mid-2004: BSI publishes BS EN1997-1 with National Annex (also BS EN1997-2).
(*b*) Mid-2004: BSI issues the draft British National Annex of Part 1 for public comment.
(*c*) Test standards and technical specifications are published as completed by TC341.
(*d*) ISO documents, as completed.

Following a suitable period of 'coexistence' (maximum three years) after the publication of the last part of a 'package' of Eurocodes, the national codes and standards will be withdrawn. In the case of, say, the package enabling the concrete foundations for a building to be designed, this is likely to be around the end of 2007.

5. AND FINALLY ...

It is recognised that the transition from tried-and-tested methods that have developed through experience over decades may not be welcomed, nor will it be quick. To help engineers understand the new approaches embodied in the Eurocodes, guidance documents have been and are being written. Anyone wishing to understand the general principles of Eurocode 7 is recommended to read the 'Commentary' on the trial ENV document,[4] and a description of the changes to the ENV in the final Code may be found in Reference 2.

A series of Designer's Guides is in preparation for each of the Eurocodes; the Guide for EN1997-1 is expected to appear around the end of 2003, when the code is published by CEN.

REFERENCES

1. GULVANESSIAN H. and DRISCOLL R. Eurocodes: the new environment for structural design. *Proceedings of the Institution of Civil Engineers—Civil Engineering*, 2001, **144**, 3–7.
2. DRISCOLL R. and SIMPSON B. EN1997 Eurocode 7: geotechnical design. *Proceedings of the Institution of Civil Engineers—Civil Engineering*, 2001, **144**, 29–54.
3. ISSMGE. *Recommendations of the ISSMGE for Geotechnical Laboratory Testing*. DIN, Berlin, 1998.
4. SIMPSON B. and DRISCOLL R. *Eurocode 7: A Commentary*. CRC Ltd, London, 1998.

Please email, fax or post your discussion contributions to the secretary by 1 January 2004: email: mary.henderson@ice.org.uk; fax: +44 (0)20 7799 1325; or post to Mary Henderson, Journals Department, Institution of Civil Engineers, 1–7 Great George Street, London SW1P 3AA.