Plenary Session 1

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Opening address: the industrial view

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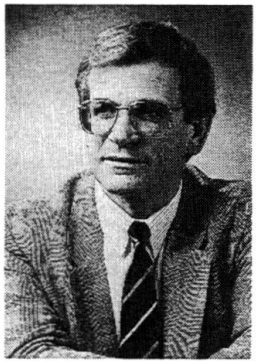

Rinus Platschorre was born in 1938. He studied Civil Engineering at the Technical School of Dordrecht. His professional carrier started at Bredero Contractors where he was involved in the execution of a great number of civil engineering and building structures. Gradually his interests shifted from purely technical to management aspects. Presently he is president of TBI Holdings, one of the largest building industry consortia in The Netherlands.

Synopsis

EUROCODE 1, in the process of publication in several parts as ENV, is the subject of this important colloquium. Not only so because of the great importance for the safety and economy of buildings and other civil engineering structures, provided by this central document. Also because of the opportunity to exchange information and experiences related to it.

The most important part, perhaps, of this colloquium is the demonstration of a determined ongoing process of preparation. The efforts so many people put in keeping this complex, time consuming and often discouraging work, going. I wonder how many of those workers sometimes question the return of their investments in this process. Question why they should continue to debate all those remarks time and again put forward by national specialists.

In this respect it could be interesting to know about some viewpoints about market developments. But also the great changes in society. A society getting more and more multi-functional, internationally oriented and, above all, consumer oriented. I am sometimes worried about the ignorant attitude of business people towards this fast going development. And I am convinced that we should anticipate on the requirements of those modern consumer groups. Because few imagination is needed to see that consumer behaviour will result in a much more complex set of requirements for the urban scenery. Requirements which will tend to the functioning of buildings and constructions to be the real centre point of design. Little room will be left for the present approach of "designing buildings first and adapting them for a function later".

The fundamental change in design philosophy for the urban environment can only be approached on an international market scale. No European member state can provide a market volume allowing companies to invest in such a development. Only the total European market shows a market size enabling investments in this development. For this particular reason, European codes and standards are of vital importance. At the same time bearing in mind that in opening up those opportunities for change in design towards the function of a building being the end product, codes and standards should provide room for those developments.

INTRODUCTION TO EUROCODE 1

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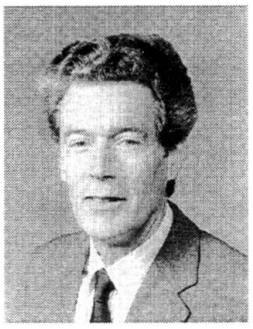

John Menzies, born 1937, is a graduate of the University of Birmingham, England. For many years he undertook research and development in structural engineering at the UK Building Research Establishment. He is now a consulting engineer, and is the Chairman of the CEN Committee TC250/SC1 responsible for the preparation of Eurocode 1.

SUMMARY

Eurocode 1 'Basis of Design and Actions on Structures' is a comprehensive code of practice providing information on basis of design and on all actions that it is normally necessary to consider in the design of building and civil engineering structures. This paper briefly describes the background to the preparation of Eurocode 1 and summarises its contents. The present position of its development is given with the plans for achieving publication as a European Standard (EN).

1. INTRODUCTION

1.1. Scope

1.1.1. When complete, this Eurocode, which is generally referred to as Eurocode 1, will serve two purposes. First it will provide details of the basis of design for building and civil engineering structures. Secondly, it will contain information on all actions which it is normally necessary to consider in the design of such structures. It will be a comprehensive code relating to a wide range of structures including buildings, bridges, towers, masts, silos, tanks, and chimneys. It will not, however, specifically cover exceptional structures such as nuclear reactors and dams, although the rules given for particular actions may be applicable to the design of these structures.

1.1.2. Eurocode 1 is the first in the series of nine Eurocodes which present common European rules for the design of building and civil engineering structures made of the major materials. The design of any particular structure on the basis of the Eurocodes is made by the use of the relevant Parts of Eurocode 1 together with the appropriate other Eurocodes which give the structural design rules for the specific structural materials.

1.2. Background

1.2.1. The preparation of the Eurocodes for the design of structures was initiated by the Commission of the European Communities in 1976 which established a Steering Committee made up of national delegations from the Member States to oversee the work. The work which was undertaken by drafting groups of experts under contract to the Commission, did not initially include development of rules for actions. It did

include the preparation of a draft code on common unified rules for all types of construction and common safety requirements. These rules were not operational but were provided as a basis for preparing the operational Eurocodes. The rules were published in 1984 [1].

1.2.2. In 1984 the Steering Committee agreed to a proposal that an enquiry on national codes and standards concerned with actions be undertaken by the Building Research Establishment (BRE) amongst Members States. The report of the enquiry concluded that the preparation of a Eurocode for Actions on Structures was feasible. With the agreement of the Steering Committee a small Task Group was established to advise on the steps necessary. The Task Group was supported by national bodies including the Building Research Establishment (BRE), Centre Scientifique et Technique due Batiment (CSTB), Institut für Bautechnic (IfBt), and the Danish Building Research Institute (SBI).

1.2.3. An outline for a comprehensive Eurocode for Actions was proposed, together with suggestions for the first stages of the work, based on preparatory studies by Task Group members. The proposal was accepted by the Steering Committee in 1985.

1.2.4. An inherent feature of the proposed Eurocode 1 was that it would be suitable for structural design based on the limit state concept using the partial safety factor format.

1.2.5. Priority was first given in developing Eurocode 1 to the most important actions related to the design of building structures. The aim was to have the Parts covering these actions - gravity loads, imposed loads, snow loads, wind loads and actions due to fire - available for use when, or as soon as possible after, publication for experimental use by the European Committee for Standardisation (CEN) of ENV Eurocode 2: Part 1: Concrete Structures and ENV Eurocode 3: Part 1: Steel Structures.

1.2.6. The scope of the work was extended to include traffic loads on bridges (road and rail) and loads in silos and tanks leading in 1990 to completion of draft Eurocode documents [2] covering:

- General rules (for buildings
- Densities of building materials and stored materials
- Permanent actions due to gravity
- Imposed loads on floors and roofs
- Snow loads
- Wind loads : static actions
- Actions on structures exposed to fire
- Loads in silos and tanks
- Railways loads (in relation to bridges)

For traffic loads on road bridges reports were presented to the Commission of technical studies and giving proposals for drafting [3].

2. THE PARTS OF EUROCODE 1

2.1. Contents

2.1.1. The transfer of the technical work of preparation of the Eurocodes from the Commission of the European Communities to the European Committee for Standardisation (CEN) took place in 1990 [4]. The establishment of the programme of mandates of the Commission for the continuation of the work, led to a re-organisation of the framework of Eurocode 1 which is now defined in Parts with CEN reference numbers and contents broadly as follows:

ENV 1991-1 : 1994 : Basis of design

Part 1 establishes the principles and requirements for safety and serviceability of structures, describes the basis for design and verification and gives guidelines for related aspects of structural reliability. Contents include :

- fundamental requirements and limit states
- classifications concerning actions and environmental influences
- material properties and geometrical data
- modelling for structural analysis and resistance
- design assisted by testing
- verification by the partial factor method

ENV 1991-2-1 : 1995 : Densities, self-weight and imposed loads

Part 2.1: provides design guidance and actions for the structural design of buildings and civil engineering works including some geotechnical aspects for:

- densities of construction materials and stored materials
- self-weight of construction elements
- imposed loads on buildings

ENV 1991-2-2 : 1995 : Actions on structures exposed to fire

Part 2.2 being concerned with actions arising from exposure to fire is intended for use in conjunction with the fire design Parts of ENV 1992 to 1996 and ENV 1999 which give rules for designing structures for fire resistance. Contents include:

- design procedure and classification of actions
- fire design situations
- actions for temperature analysis (thermal actions)
- actions for structural analysis (mechanical actions)

ENV 1991-2-3 : 1995 : Snow loads

Part 2.3 provides guidance on loads imposed by snow which has fallen in calm air and in windy conditions for the structural design of buildings and civil engineering works. Contents include :

- classification of actions
- design situations
- representation of actions
- load arrangements

- snow load on the ground - characteristic value
- snow load shape coefficient

ENV 1991-2-4 : 1995 : Wind actions

Part 2.4 gives rules and methods for calculating wind loads on building structures up to a height of 200m, their components and appendages. It also gives rules for chimneys and other cantilevered structures, for highway and railway bridges up to 200m span, and for cycle track/footbridges up to 30m span. Contents include:

- classification of actions
- design situations
- representation of action
- wind pressure on surface
- wind forces
- reference wind
- wind parameters
- choice of procedures
- aerodynamic coefficients

ENV 1991-2-5 : Thermal actions

Part 2.5 gives rules and methods of calculating thermal actions on building structures, bridges, their components and appendages. Contents include:

- classification of actions
- assessment of actions
- temperature changes in bridges
- temperatures changes in buildings
- temperature differences in industrial chimneys, pipelines etc.

ENV 1991-2-6 : Loads and deformations imposed during execution

Part 2.6 provides principles and general rules for the assessment of actions and environmental influences which should be considered during the execution stage of buildings and civil engineering works. It also gives guidance for the assessment of actions which may be applied to temporary structures needed for the execution of permanent works. Contents include:

- classification of actions
- design situations
- representation of actions

ENV 1991-2-7 : Accidental actions

Part 2.7 refers to exceptional conditions applicable to the structure or its exposure caused by human activities, eg explosion or impact. It provides the general principles for the prevention of risk, the structural protection and the structural design. It gives the general basis for determining the accidental actions arising from impact and explosions and gives recommended numerical values for the most common cases. Contents include:

- classification of actions
- design situations
- impacts
- explosions

ENV 1991-3 : 1995 : Traffic loads on bridges

Part 3 specifies imposed loads (models and representative values) associated with road traffic, pedestrian actions and rail traffic which include, when relevant, dynamic effects and centrifugal, braking, acceleration and accidental forces. Contents include:

- classification of actions
- design situations
- road traffic actions and other actions specifically for road bridges
- pedestrian, cycle actions and other actions specifically for footbridges
- rail traffic actions and other actions specifically for railway bridges

ENV 1991-4 : 1995 : Actions in silos and tanks

Part 4 provides general principles and actions for the structural design of tanks and silos including some geotechnical aspects. Contents include:

- classification of actions
- design situations
- representation of actions
- loads on silos due to particulate materials
- loads on tanks from liquids
- material properties

ENV 1991-5 : Actions induced by cranes and machinery

Part 5 specifies imposed loads (models and representative values) associated with cranes on runway beams, stationary machines and transport vehicles which include, when relevant, dynamic effects and braking, acceleration and accidental forces. Contents include:

- actions induced by cranes on runways
- actions induced by machinery
- actions induced by transport vehicles

3. ORGANISATION AND THE PREPARATION WORK

3.1. CEN Sub-Committee TC250/SC1

3.1.1. The scope of the work of Sub-committee TC250/SC1 was initially agreed by TC250 as follows:

> 'To prepare and maintain European Standards in the field of structural design rules for building and civil engineering works covering general rules for determining actions for use in design, and special and additional rules for actions arising from gravity, imposed loads, snow, ice, wind, thermal actions, currents and waves, soil and water pressure, and traffic and pedestrian loads on

bridges; execution loads and deformations; actions from storage of bulk materials in silos and tanks, actions induced by cranes and machinery, accidental actions and actions on structures exposed to fire'.

3.1.2. Subsequently it was decided to transfer work on soil and water pressure to CEN/TC250/SC7 and to postpone work on ice loads and loads due to currents and waves until standards under preparation by the International Standards Organisation are completed.

3.1.3. The primary responsibility of Sub-committee TC250/SC1 is the elaboration of the rules for actions in Parts 2 to 5. Since Basis of Design concerns the specification of actions, the assessment of design resistance and design verification, the preparation of ENV 1991-1 : Basis of Design was undertaken under the guidance of the TC250 Coordination Group thus allowing all Sub-committees the opportunity of comment during the formative stages of the draft.

3.1.4. At the inaugural meeting of Sub-committee TC250/SC1 in Zurich in December 1990, the programme of work in accordance with the mandates was agreed and Project Teams were established.

3.1.5. The Project Teams have prepared drafts, with the assistance of the Sub-committee's technical secretaries and in consultation with national technical contacts, for approval by Sub-committee SC1 following CEN procedures. This procedure has provided rapid progress to agreement on harmonisation of actions for use in the design of structures.

3.2. Programme of Work

3.2.1. Essentially the first phase of work - the initial programme - was to advance the results achieved by the previous Task Group [3, 4] to produce European prestandards, (ENV).

3.2.2. The initial programme of work under the aegis of CEN has now been completed and ENV standards were issued by CEN/CS.

Part 1	October 1994
Part 2.1	February 1995
Part 2.2	February 1995
Part 2.3	February 1995
Part 2.4	May 1995
Part 3	March 1995
Part 4	May 1995

3.2.3. The preparation of the remaining parts of the Eurocode for Actions - Parts 2.5, 2.6, 2.7, and 5 - commenced in 1993. For these Parts the plan of TC250/SC1 envisages formal acceptance during 1996 so that the ENV standards can be issued by CEN/CS in 1997.

4. CONCLUSIONS

4.1. Scope

4.1.1. Eurocode 1 is a comprehensive code of practice providing information on basis of design and all actions which it is normally necessary to consider in the design of structures.

4.1.2. Eurocode 1 is being prepared specifically for use with Eurocodes 2 to 9. It anticipates design verification based on the limit state concept using the partial safety factor format.

4.2. Preparation

4.2.1. The initial programme of work to prepare Eurocode 1 is completed. European Prestandards (ENV) covering Basis of Design, Self-weight, Imposed loads, Actions due to fire, Snow loads, Wind loads, Traffic loads on bridges, and Bulk materials' loads in silos and tanks were issued during 1994/5.

4.2.2. Preparation of the remaining parts covering Thermal actions, Loads and deformations during execution, Accidental actions, and Actions induced by cranes and machinery is well advanced. Issue as ENV standards is planned in 1997.

4.3. Implications and Opportunities

4.3.1. The availability of the six main Parts of Eurocode 1 as ENV standards (and of the remaining four Parts as advanced drafts) provides the basis for the complete design of building and other structures to the Eurocodes, ie using actions from Eurocode 1 and resistance data from Eurocodes 2-9. The opportunity for the more rapid harmonisation of structural design across Europe now exists.

5. REFERENCES

5.1. Eurocode No. 1 : Common unified rules for different types of construction and material. Commission of the European Communities. 1984. EUR 8847.

5.2. Eurocode for Actions on Structures, Documents (1), (2), and (3). Draft: June 1990.

5.3. Concerning development of models of traffic loading and rules for the specification of bridge loads. Final report to the Commission of the European Communities - ref PRS/90/7750/RN/46 - November 1991.

5.4. BREITSCHAFT G. The conceptual approach of the Structural Eurocodes. IABSE International Conference 'Structural Eurocodes', September 1992.

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