Zeitschrift: IABSE reports = Rapports AIPC = IVBH Berichte
Band: 61 (1990)

Sonstiges

Introduction

Composite steel concrete construction refers to stuctural systems in which concrete and structural steel are so connected that they act compositely in order to take full advantage of the respective properties and performance of both materials.

The last twenty years have seen major advances in our understanding of how composite steel concrete construction behaves and this system of construction is now well established and recognized as an economical structural method.

In response to the intensive research activity, design codes were elaborated and some of them have been subjected to continual changes. Among the several codes the Commission of the European Communities intends to issue, Eurocode 4 «Design of Composite Structures» will provide the most updated information for the design and fabrication of composite steel concrete construction.

Well aware of the exceptionally valuable contents of Eurocode 4 and of the need to introduce worldwide the relevant guidelines and rules, IABSE decided to take benefit of the Brussels Symposium to organize the present short course. In this respect, the guidance provided especially by Mr. Golay, Executive Director of IABSE, is particularly acknowledged.

During the short course the basics and recent important developments achieved in the field of behaviour and design or construction of composite steel concrete elements were taught by leading experts who have been personally involved in the technical discussions which led to the elaboration of Eurocode 4.

The following comments – which are not intended to review the contents of the different lectures – highlight some general conclusions regarding the spirit of what has been presented and discussed during the course.

- Eurocode 4 is concerned with composite steel concrete slabs, beams, girders, columns and frames which are used in buildings subjected to predominantly static loading. Therefore, the design rules cannot be extended to bridges without a special care being taken.
- All the Eurocodes have to refer to a unified limit state format. More especially for composite construction the safety concept must degenerate into the concepts used respectively in Eurocode 2 and Eurocode 3 for concrete and steel constructions. While in Eurocode 2 the partial safety factors are applied to the material properties, they are applied to the strength function in Eurocode 3. This leads to an inconsistency which is solved temporarily in Eurocode 4 by distributing the safety factors on both the material properties and the strength function.
- In order to facilitate the work of the designer, several rules of Eurocode 4 or of other Eurocodes are simplified rules. The designer must keep in mind that such simplified methods are subject to well defined restrictions for their applicability and to fabrication requirements.

- Presently, Eurocode 4 is limited to structures with material properties not exceeding 355 N/mm² for the yield strength of steel and 50 N/mm² for the 28-day cylinder strength of concrete. Higher steel grades are now produced, with a yield strength up to 690 N/mm². Of course, such high strength steels are likely to make the serviceability conditions much more governing and perhaps determining compared to the ultimate limit states. In addition, the width-to-thickness ratio (b/t) for compression elements enabling the classification of cross-sections depend on the yield strength. There is thus an urgent need for improving and/or implementing the rules to account for such steel qualities.
- Serviceability conditions are presently not extensively detailed in Eurocode 4 and it appears from the discussions that there is also a need for further investigation in this respect. This conclusion is not only restricted to Eurocode 4 but can be extended to other European codes.
  When serviceability is determining for the design, it has been demonstrated that partial connection is the most economical solution. The present restrictions for the application of such a connection between steel and concrete are probably not definitive and improved rules have to be expected in the near future. For the safety check of longitudinal shear of composite slab, the partial connection method should become a valuable alternative.
- An interesting survey of the recent evolution in the field of composite bridges demonstrates how the improved knowledge in the behaviour of the materials, the development of more powerful devices and last but not least, the creativity of the design engineer have resulted in new erection procedures, new shapes of sections and larger spans.
  It must be emphasized that composite bridges with much innovation have been built while Eurocode 4 was already at the initial stage of drafting. It shows that sometimes design engineers are ahead of the codes.
  Anyway collecting all the available theoretical and experimental information and putting it in the format of a code is useful for most structural and civil engineers.
- While being still imperfect and incomplete, Eurocode 4 reflects probably the best of recently acquired knowledge among practicing engineers and researchers. Undoubtedly, it will have a profound influence on structural design in the forthcoming years, not only in Europe but also in many overseas countries.

It is a pleasant duty to express my sincere thanks to the sponsors and their staff without whom the organization of the course would not have been possible, to the lecturers for their exceptional personal efforts in preparing their contributions and to all the participants for their attendance and constructive collaboration.

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