



DESIGN OF TUBULAR STEEL STRUCTURES

Training and Education for the Implementation of Eurocode 3

Preface

Contents:

1. Background and objectives
2. Dissemination, copyright and disclaimer
3. Structure of the set of lectures
4. Presentation and layout



1. Background and objectives

In 1975, the Commission of the European Community decided on an action programme in the field of construction, whose objective was the harmonisation of technical specifications. The Commission took the initiative to establish a set of harmonised technical rules for the design of construction works which, in a first stage, would serve as an alternative to the national rules in force in the Member States and, ultimately, would replace them.

As a first step, the Commission, with the help of a Steering Committee with Representatives of Member States, conducted the development of the Eurocodes programme. This first generation of the Eurocodes was published in the beginning of the 1990's as the so-called ENV version of the Eurocodes.

At this time, the Commission and the Member States of the EU and EFTA decided to transfer the preparation and the publication of the Eurocodes to the European Committee for Standardisation (CEN) in order to provide them with a future status of European Standard (EN). The transition of the ENV Eurocodes to EN standards, the so-called conversion of the Eurocodes, is nearly completed. Nearly all documents have been finalised by the relevant CEN project teams; most have been published in the meantime. At present, the majority of the documents is available in three languages (English, French and German) and the National Annexes, which provide some national adaptations, are under preparation by the National Standardisation Bodies. It is expected that the EN Eurocodes will formally be introduced by the Member States in 2010.

In other words, the Eurocodes will be soon the unique design standards for construction industry in Europe. Furthermore, the Eurocodes will be exported worldwide. However, few material is available to support the application and the teaching of the Eurocodes.

With respect to the design of steel structures and especially as far as steel structures made with hollow sections are concerned, complementary material to available books such as the CIDECT book for students ("Hollow Sections in Structural Applications" by J. Wardenier) should be made available.

Teachers (in universities) and technical marketing responsables (in industry) have not enough available time to prepare updated material for training and education, or sometimes do not have the required background as they have not been involved in the development of the Eurocodes.

To support teaching the use of the ENV version of the Eurocode 3 (and Eurocode 4), a full set of lectures (presentations in PowerPoint format and lectures in Word format) has been produced few year ago in the frame of a large project funded by the European Commission. The project was called SSEDTA and has been completed in 2000. This material is freely available without any copyright. However, it is no more in line with the forthcoming EN versions of the Eurocodes. Few projects are running to prepare such material (e.g. STEEL project), but these lectures are general lectures for the design of steel structures. No special attention is given to hollow sections. Quite a number of worked examples are given, but typically focussing on structures made of



open sections.

Therefore, CIDECT has decided to launch a project in order to prepare updated material to support training and education for the implementation of the new EN version of Eurocode 3. The objective is to support the promotion and the application of the forthcoming EN standards for the construction industry (Eurocodes). As these standards do not contain sufficient background information (and certainly no worked examples) to ensure a safe and economic use of the design standards, additional and complementary information is required.

With financial support from CIDECT, this project has been carried out by the ArGEnCo Department of the University of Liège (Belgium) and by Feldmann + Weynand GmbH (Aachen, Germany) in cooperation with the University of Karlsruhe. The following authors contributed to the preparation of the CIDECT lectures:

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The present set of lectures is the outcome of this CIDECT project entitled “Design of Tubular Steel Structures - Training and Education for the Implementation of EN version of Eurocode 3”. The aim is to support education on the design of steel structures. However, special attention is brought to the application of tubular steel structures. The whole material consists of a preface and 21 lectures, in total more than 630 PowerPoint slides and nearly 400 pages of accompanying text.

The material – hereafter called CIDECT lectures – is intended to be made available to teachers but it can also be used by industry to prepare information or technical seminars on tubular construction.

2. Dissemination, copyright and disclaimer

The CIDECT lectures have been prepared with the financial support of CIDECT. However, they are made available without any copyright. The full set of lectures is available at the CIDECT web site (www.cidect.com), and can be downloaded for free. Since the files are not protected, it is explicitly allowed that the user modifies the content of the PowerPoint presentations and of the lectures according to his personal needs. The user may even customise the material by using his own name and the name and logo of his school, university or company. However CIDECT would appreciate if a reference to the CIDECT organisation and to the origin of the material is kept.

Care has been taken to ensure that all data and information in the CIDECT lectures is factual and that numerical values are accurate. To the best of our knowledge, all information in the CIDECT lectures is accurate at the time of publication. CIDECT, its members and the authors assume no responsibility for errors or misinterpretation of the information contained in these lectures or in its use. The CIDECT lectures are provided “as they are” and the authors will not be able to accept further assistance or help with respect to the content or background of the lectures.



3. Structure of the set of lectures

The lectures will be grouped in several modules in order to provide a clear and simple structure of the material. The following modules are proposed:

Module 1	Introduction to the new Eurocodes
Module 2	Structural analysis and design
Module 3	Member design
Module 4	Design of joints
Module 5	Fatigue design
Module 6	Fire design
Module 7	Worked examples

The following table presents the individual lectures within each module and the expected lecturing time for each lecture. In total, the complete programme would cover about 16 hours.



Design of Tubular Steel Structures

Preface

MODULE	LECTURE	LECTURING TIME
Module 1 Introduction to the new Eurocodes	Lecture 1 Introduction to the new Eurocodes	30 min
	Lecture 2 Introduction to Eurocode 1	30 min
	Lecture 3 Introduction to Eurocode 3	30 min
	Total	1,5 hours
Module 2 Structural analysis and design	Lecture 4 Structural idealisation and analysis	45 min
	Lecture 5 Frame classification and joint representation	30 min
	Lecture 6 Choice of structural analysis and consequences on design	45 min
	Total	2,0 hours
Module 3 Member design	Lecture 7 Local buckling and cross-section classification	30 min
	Lecture 8 Members in tension	30 min
	Lecture 9 Members in bending and shear	45 min
	Lecture 10 Members in compression	45 min
	Lecture 11 Members in bending and axial force	45 min
	Total	3,25 hours
Module 4 Design of joints	Lecture 12 Generalities on joint design	90 min
	Lecture 13 Welded connections	90 min
	Lecture 14 Bolted connections	90 min
	Total	4,5 hours
Module 5 Fatigue design	Lecture 15 Introduction to fatigue design according to Eurocode 3	60 min
	Total	1,0 hour
Module 6 Fire design	Lecture 16 Introduction to fire design according to Eurocode 3	60 min
	Total	1,0 hour
Module 7 Worked examples	Lecture 17 Frame analysis – Column members check	45 min
	Lecture 18 Design of beam-to-column bolted joints	45 min
	Lecture 19 Design of a welded joint in a lattice girder	30 min
	Lecture 20 Fatigue in a lattice girder joint	30 min
	Lecture 21 Multiplanar joint	15 min
	Total	2,75 hours



4. Presentation and layout

Each lecture will consist of:

- A *summary sheet* for the tutor: the summary sheet (1 or 2 pages) provides the teachers a short summary, the objective of the lecture, the pre-requisites and some notes for the tutor, for example the estimated lecturing time;
- A *PowerPoint presentation*: the PowerPoint presentations are directly ready for being used by a teacher. However, as said in Section 2, the user may customise them by adding his name and/or logo and name of his school, university or company;
- A *lecture text*: the lectures will provide details concerning the presented material, i.e. the concepts and principles of the Eurocode 3, some design rules as well as explanations about their background. In addition, for some lectures detailed worked examples are provided. These worked examples are all collected within Module 7. All lectures are presented in a format, that on the right hand side of the main text, references to the relevant sections and clauses in the Eurocodes are indicated, so that the reader can easily find the link between the lectures and the Eurocodes. Note: In order to give the user the possibility to modify the text of the lecture, they are provided as Microsoft Word file (format MS Word 2003). However, as it happens sometimes, the formatting of the files may change according to the local settings of the user's PC. Therefore, PDF versions of all lectures are provided, presenting the lectures in the original layout.

*Refs. to
relevant
EN's are
given here*