

STEEL BUILDINGS IN EUROPE

Single-Storey Steel Buildings

Part 9: Introduction to Computer Software

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Part 9: Introduction to Computer
Software

FOREWORD

This publication is part nine of the design guide, *Single-Storey Steel Buildings*.

The 11 parts in the *Single-Storey Steel Buildings* guide are:

- Part 1: Architect's guide
- Part 2: Concept design
- Part 3: Actions
- Part 4: Detailed design of portal frames
- Part 5: Detailed design of trusses
- Part 6: Detailed design of built up columns
- Part 7: Fire engineering
- Part 8: Building envelope
- Part 9: Introduction to computer software
- Part 10: Model construction specification
- Part 11: Moment connections

Single-Storey Steel Buildings is one of two design guides. The second design guide is *Multi-Storey Steel Buildings*.

The two design guides have been produced in the framework of the European project "Facilitating the market development for sections in industrial halls and low rise buildings (SECHALO) RFS2-CT-2008-0030".

The design guides have been prepared under the direction of Arcelor Mittal, Peiner Träger and Corus. The technical content has been prepared by CTICM and SCI, collaborating as the Steel Alliance.

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SUMMARY

This document contains details of freely available software to assist in design of single-storey steel buildings according to the Eurocodes.

1 INTRODUCTION

Design in accordance with the Eurocodes may be facilitated by the use of software. In many cases, the verifications required by the Standard can be readily programmed into simple spreadsheets or into more complex programmes, which minimise the manual effort and reduce the risk of numerical errors.

In many countries, software has been written for the purpose of facilitating design to the Eurocodes and has been made freely available. This publication presents a summary of software that is available, at March 2010. All the software listed in this document is freely available.

No endorsement of any of the software programmes listed in this document should be presumed. Equally, the omission of existing software from the listing does not imply that it is inappropriate, inaccurate or non-endorsed. More software will undoubtedly become available as design to the Eurocodes becomes more widespread.

Apart from the list of freely available software presented here, there are numerous software houses that provide comprehensive analysis and design packages, covering all aspects of steel building design, as described in this guide.

1.1 Software listing

In Section 2, software is listed under the following headings:

- Member design, such as beams and columns
- Composite construction
- Cellular beam design
- Analysis of frames
- Portal frames
- Simple connections
- Moment resisting connections
- Fire
- Seismic

For each item of software, the following details are listed:

- **Scope.** A general description of the software
- **Design Standard.** The design standard may be the published Eurocode, but may be early versions of the Standard. Users must ensure that the version of the Eurocode is appropriate.
- **National Annex.** Which National Annex is covered in the software, if any
- **Source.** Where the software can be obtained (web site)
- **Language.** The language used in the software

1.2 Use of software

No systematic review of the software listed in this document has been undertaken, so the user must verify that the software is appropriate for the design situation.

2 AVAILABLE FREE SOFTWARE

2.1 Member design, such as beams and columns

Software	Verifica di profili sottili piegati a freddo
Scope	Design and analysis of cold formed sections
Design Standard	EN 1993-1-3, EN10162
National Annex	Italian NTC2008
Source	http://www.promozioneacciaio.it/costruttori_schede.php
Language	Italian

Software	Corus sections interactive "blue book"
Scope	The Corus sections interactive "blue book" comprises design data for the Advance®, Celsius® and Hybox® ranges of sections. All design data is generated from the root software functions used to populate SCI P363: Steel Building Design: Design Data, in accordance with Eurocodes and the UK National Annexes and SCI P202: Steelwork Design Guide to BS 5950-1: 2000. Volume 1 - Section Properties - Member Capacities.
Design Standard	BS 5950 and BS EN 1993-1-1
National Annex	UK only
Source	http://www.corusconstruction.com/en/design_guidance/the_blue_book/
Language	English

Software	A3C (ArcelorMittal CTICM Columns Calculator)
Scope	<p>A3C is a new software that allows a structural designer to check the resistance of a member under bending moment and axial force according to EN 1993-1-1.</p> <p>The field of application covers rolled profiles.</p> <p>The ULS verifications include classification of the cross-sections, section resistance, flexural buckling, lateral torsional buckling, shear buckling and all interactions (M+N, M+V, M+N+V). Various design options are available (for example: Annex A or Annex B for interaction factors in EN 1993-1-1).</p> <p>A detailed calculation sheet can be edited and printed.</p>
Design Standard	EN 1993-1-1
National Annex	French National Annex as option
Source	http://www.arcelormittal.com/sections http://www.cticm.com
Language	English, French

Software	LTBeam
Scope	<p>LTBeam software has been designed to calculate the critical moment for Lateral Torsional Buckling (LTB), in simple or complex situations.</p> <p>Even for simple cases, the critical moment is often a complex step in the process of verification of the LTB resistance. Moreover usual formulae do not allow the designer to take into account the specific restraint conditions of real cases. So they lead the designer to choose conservative assumptions. That is why LTBeam can be used to determine a more realistic value of the critical moment.</p> <p>LTBeam software is based on a modelling by beam elements that permits to take into account specific aspects like warping stiffness, position of the transverse loads from the shear centre, position of the lateral restraints, etc.</p> <p>LTBeam aims at facilitating the application of Eurocode 3, but it can be used with other codes, for a LTB verification based on the concept of critical moment.</p> <p>Even though the calculations are complex, LTBeam is very simple to use and it does not require special training provided that the phenomenon is well known by the user.</p>
Design Standard	n/a
National Annex	n/a
Source	http://www.cticm.com/spip.php?rubrique6
Language	French, English

2.2 Composite construction

Software	ABC V2.11
Scope	<p>ABC Software allows a structural designer to check the resistance of beams according to the European standards EN 1993-1-1 and EN 1994-1-1.</p> <p>The field of application covers simply supported beams, composite or non composite, made from a I-rolled profile.</p> <p>For composite beams, the connection can be ensured by either welded studs or HILTI connectors. Partial connection is allowed. At the construction stage, the composite beam can be fully propped or a propping can be defined. Appropriate verifications at the construction stage are carried out when necessary.</p> <p>The ULS calculations include the verification of the section resistance under bending moment and shear force, the resistance to lateral torsional buckling, the shear buckling resistance where necessary. The resistance to lateral torsional buckling is based on the critical moment calculated by a modal analysis performed by the LTBeam engine.</p> <p>A detailed calculation sheet can be edited and printed.</p>
Design Standard	EN 1993-1-1 and EN1994-1-1
National Annex	n/a
Source	http://www.arcelormittal.com/sections/index.php?id=119
Language	French, English

Software	ACP V1.02
Scope	Construction phase for composite solution. To check the LTB behaviour of composite and/or partially encased beams during erection
Design Standard	EN 1993-1-1 and EN1994-1-1
National Annex	n/a
Source	http://www.arcelormittal.com/sections/index.php?id=119
Language	English, French, German, Spanish, Portuguese

Software	ACD V3.06
Scope	ArcelorMittal composite column design according to Eurocode 4. Replaces CDD
Design Standard	ENV 1994-1-1
National Annex	n/a
Source	http://www.arcelormittal.com/sections/index.php?id=119
Language	English, French, German, Spanish

Software	Software compendium for steel and composite structures
Scope	This new software (currently a Beta version) for the analysis, calculation and design of steel and composite structures, has been developed by Consulting Engineers FHECOR with funding from the Association for the Advancement of Steel Technology (APTA) and ArcelorMittal. It is meant as a tool for use in design offices to facilitate the pre-design of structures or verification of existing projects and designs. It is not intended to compete with commercial software and can be used as a teaching tool for steel structures (levels of deformation, stresses, effective widths, section grade, etc.). as well as the development of checking examples.
Design Standard	It complies with Spanish CTE code and Eurocode 3, according to user's selection.
National Annex	n/a
Source	http://piem.fhecorconocimiento.es/
Language	Spanish

2.3 Cellular beam design

Software	ACB+ V2.01
Scope	<p>Cellular beams design</p> <p>ACB+ is a piece of software dedicated to the design of cellular beams made up from rolled profiles. It covers composite and non composite cellular beams, including curved beams.</p> <p>ACB+ includes practical tools for selecting the diameter and the spacing of the openings in accordance with fabrication requirements.</p> <p>ULS verifications are performed according to the principles of the Eurocodes (EN 1993-1-1 and EN 1994-1-1), with specific verifications for cellular beams (Vierendeel effect, web post buckling, etc).</p> <p>For SLS verifications, the deflections are calculated by taking into account the local bending due to the Vierendeel effect.</p> <p>ACB+ allows the designer to assess the fire resistance according to the principles of EN 1993-1-2 and EN 1994-1-2.</p>
Design Standard	EN 1993-1-1, EN 1994-1-1, EN 1993-1-2, EN 1994-1-2
National Annex	n/a
Source	http://www.arcelormittal.com/sections/index.php?id=120
Language	English, German, French, Italian

Software	Angelina™
Scope	<p>Angelina software has been especially designed for the calculation of a special type of beams with sinusoidal web openings, called Angelina beams, fabricated from hot rolled I-profiles. This new software covers both composite and non composite beams.</p> <p>ULS verifications are carried out according to the principles of the Eurocodes. They take into account the specific aspects of such beams, like local bending by Vierendeel effect. The deflections are also calculated by appropriate methods, in view to SLS verifications.</p>
Design Standard	EN 1993-1-1, EN 1994-1-1
National Annex	
Source	http://www.arcelormittal.com/sections/index.php?id=141
Language	English, French

2.4 Portal frames

Software	PORTAL Version 1.1
Scope	<p>PORTAL is a pre-design software for portal frames with single span, made of rolled sections. It includes an automatic calculation of the snow load and the wind action, elastic global analysis of the frame, verifications of the members, calculations of the deflections. The calculations are carried out according to Eurocodes (ENV 1993-1-1).</p> <p>The automatic pre-design is based on the weight criterion for a given steel grade, but sections can be defined by the user for performing verifications.</p>
Design Standard	ENV 1993-1-1
National Annex	Not suitable for National Annex application. Only partial safety factors may be user defined.
Source	http://www.arcelormittal.com/sections/index.php?id=118
Language	English, French

Software	Pre-design of one span of a portal frame
Scope	Pre-design of one span of a portal frame
Design Standard	EN 1993-1-1
National Annex	EN 1993-1-1 ANB 2008
Source	Online calculation on www.infosteel.be
Language	Dutch and French

Software	Pre-deSsign of a roof structure for residential buildings
Scope	Pre-design of a roof structure for residential buildings
Design Standard	EN 1993-1-1
National Annex	EN 1993-1-1 ANB 2008
Source	Online calculation on www.infosteel.be
Language	Dutch and French

2.5 Simple connections

Software	ACOP V1.02
Scope	Connection programme to design joints in steel building structures.
Design Standard	ENV 1993-1-8
National Annex	n/a
Source	http://www.arcelormittal.com/sections/index.php?id=118
Language	English, French, German

Software	Unioni bullonate
Scope	Bolted joints. Scheda di calcolo (ZIP – 4 Mb)
Design Standard	EN 1993-1-8
National Annex	Italian NTC2008
Source	http://www.promozioneacciaio.it/costruttori_schede.php
Language	Italian

Software	Unioni saldate
Scope	Welded joints.
Design Standard	EN 1993-1-8
National Annex	Italian NTC2008
Source	http://www.promozioneacciaio.it/costruttori_schede.php Scheda di calcolo (ZIP 500 kb).
Language	Italian

Software	Verifica collegamenti a squadretta
Scope	Joint design.
Design Standard	EN 1993-1-1 and EN 1993-1-8
National Annex	Italian NTC2008
Source	http://www.promozioneacciaio.it/costruttori_schede.php Scheda di calcolo (ZIP – 600 Kb).
Language	Italian

Software	Dimensionamento unioni travature reticolari
Scope	Joint verification of the trusses, bolted and welded
Design Standard	EN 1993-1-1 and EN 1993-1-8
National Annex	Italian NTC2008
Source	http://www.promozioneacciaio.it/costruttori_schede.php Scheda di calcolo (ZIP – 650 Kb)
Language	Italian

2.6 Moment resisting connections

Software	PlatineX
Scope	PlatineX is an on-line software that covers the design of moment connections made of rolled profiles (European I and H sections), according to EN 1993-1-8. Various geometries are possible for beam-to-beam connections (apex connections) and beam-to-column connections. This piece of software checks the validity of the dimensions defined by the user (edge distances, distance between bolts, etc). If the geometry is valid, it calculates the moment resistance, the shear resistance, the axial resistance and the flexural stiffness. A detailed calculation sheet can be edited and saved as PDF file.
Design Standard	EN 1993-1-8
National Annex	French NA
Source	http://www.steelbizfrance.com/prog/platinex/
Language	French

2.7 Fire

Software	ArcelorMittal Ozone 2.2.6
Scope	Gas temperature in the event of fire according to EN 1991-1-2, corresponding steel temperature according to EN 1993-1-2 and simplified resistance check.
Design Standard	EN 1991-1-2 and EN 1993-1-2
National Annex	n/a
Source	http://www.arcelormittal.com/sections/index.php?id=122
Language	English

Software	Software LUCA
Scope	LUCA is software accompanying a design guide for industrial halls in fire conditions. This tool calculates displacements and additional horizontal forces that appear in industrial halls during fire enabling the engineers to consider their effect in the design in order to avoid collapse or risk of human life. Software was developed within RFCS project RFS2-CR-2007-00032.
Design Standard	EN 1991-1, EN 1993-1-2
National Annex	n/a
Source	http://www.arcelormittal.com/sections/index.php?id=122
Language	English, French, Spanish

Software	AFCB V3.08
Scope	Composite beam design in case of fire
Design Standard	ENV 1994-1-2
National Annex	n/a
Source	http://www.arcelormittal.com/sections/index.php?id=122
Language	English, French, German

Software	AFCC V3.06
Scope	Composite column design in case of fire
Design Standard	ENV 1994-1-2
National Annex	n/a
Source	http://www.arcelormittal.com/sections/index.php?id=122
Language	English, French, German

Software	Fracof
Scope	Composite floor slabs This software designs composite floor slabs at elevated temperatures by taking into account the enhancing effects of the membrane action in slab. FRACOF also checks perimeter beams and provides a critical temperature for each of them.
Design Standard	EN 1994-1-1, EN 1990, EN1991-1
National Annex	n/a
Source	http://www.arcelormittal.com/sections/index.php?id=122
Language	English and French

2.8 Seismic

Software	INERD 1.0.0
Scope	Innovation for earthquake design. INERD concept is a composite constructive system to improve the robustness and the safety of reinforced concrete frame structure
Design Standard	
National Annex	
Source	http://www.arcelormittal.com/sections/index.php?id=128
Language	English