

Steel Design to Eurocode 3

Introduction

Development of Eurocode 3

Aim: to create a common structural language

- And make allowances for National Choice through the use of a National Annex

National Annex

- Eurocode 3 allows some parameters and design methods to be determined at a national level.
- Where a national choice is allowed, this is indicated in the Eurocodes under the relevant clause.
 - values or methods to be used in a particular country are given in the National Annex.

Nationally Determined Parameters (NDPs)

- The recommended values of the parameters and design methods are collectively referred to as Nationally Determined Parameters (NDPs).
- NDPs determine various aspects of design but perhaps most importantly the level of safety of structures during construction and service.

Structure of Eurocode 3

Eurocode 3 is broken into **6 parts**:

- EN 1993-1 Generic rules
- EN 1993-2 Bridges
- EN 1993-3 Towers, masts and chimneys
- EN 1993-4 Silos, tanks and pipelines

- EN 1993-5 Piling
- EN 1993-6 Crane supporting structures

Eurocode 3 Part 1 has **12 sub-parts**:

- EN 1993-1-1 General Rules
- EN 1993-1-2 Fire
- EN 1993-1-3 Cold-formed thin gauge
- EN 1993-1-4 Stainless steel
- EN 1993-1-5 Plated elements
- EN 1993-1-6 Shells
- EN 1993-1-7 Plates transversely loaded
- EN 1993-1-8 Joints
- EN 1993-1-9 Fatigue
- EN 1993-1-10 Fracture Toughness
- EN 1993-1-11 Cables
- EN 1993-1-12 High strength steels

Key Differences between EC3 and BS 5950

There are several differences between EC3 and BS 5950:

BS 5950 Structure	EC3 Structure
Separate sections for different elements types e.g. Beams, Plate Girders, Compression members...	Sub-parts are based on structural phenomena e.g. Tension, Compression, Bending, Shear
	Sub-parts can be applied to any element
	The arrangement of the sub-parts means less duplication of rules

Different Axes

	BS 5950	Eurocode 3
Along the member		X
Major Axis	X	Y
Minor Axis	Y	Z

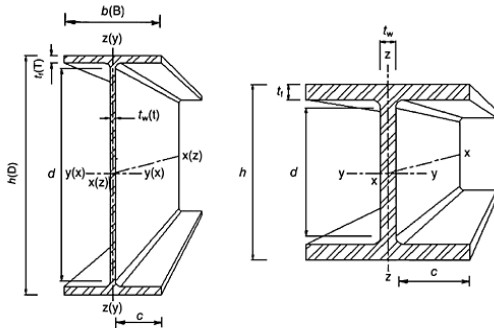


Figure 1 (Source: Arya (2009) Design of Structural Elements Pg.377)

Different Wording

'Action' – force or imposed displacement

- Permanent action (Dead Load)
- Variable action (Live Load)

'Effect' – internal force or moment, deflections

'Verification' – check

'Resistance' – capacity

Different Symbols

BS 5950	EC3	BS 5950	EC3	BS 5950	EC3
A	A	P	N	p_y	f_y
Z	W_{el}	M_x	M_y	p_b	$\chi_{LT} f_y$
S	W_{pl}	V	V	p_c	χf_y
I_x	I_y	H	I_w	r	i
I_y	I_z	J	I_t		

Informative subscripts

'Ed' means design effect

'Rd' means design resistance

Therefore:

N_{Ed} is an design axial force

N_{Rd} is the design resistance to the axial force

Gamma Factors

Partial factor γ_M	UK NA value	Application
γ_{M0}	1.00	Cross-sections
γ_{M1}	1.00	Member Buckling
γ_{M2}	1.25	Fracture

Omissions

Notable omissions:

- Effective lengths
 - Use BS 5950 effective lengths
- Formulae for M_{cr}
 - Use SN003 NCCI Document
- Deflection limits
 - Refer to National Annex