STEEL FRAME DESIGN EXAMPLES

By the same author

MORE STEEL FRAME DESIGN EXAMPLES

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Preface to Third Edition

This book is primarily intended for students of structural steelwork design up to intermediate standard, and as an aid to young engineers gaining experience whilst engaged in professional practice.

It is assumed that the reader will have carried out some preliminary study in theory of structures and strength of materials which will enable him to appreciate the behaviour of simple structures, and steel as a material of construction.

The examples which follow are intended to give a broad outline of structural design using the medium of steel. This is accomplished in two ways, firstly by a thorough treatment of the design of structural elements, and secondly by demonstrating the arrangement of structural elements required to produce a safe and economical structure. Neither aspect can be viewed in isolation if the reader is to become a competent design engineer.

The diagrams and drawings illustrating the text should be viewed as typical details rather than as fully dimensioned working drawings. Students with no industrial experience may find it beneficial to make their own detailed drawings from the sketches given as a preliminary to the transition from the study of theory to the practice of design, a development that is not always easy to achieve. Drawings are an essential language of communication for the engineer and their importance should not be underestimated.

As far as is practicable, the provisions of BS 449 have been incorporated in the text. Students should not regard this specification in any other light than as a series of recommendations which form the basis for commercial design standards as well as professional practice.

The introduction of SI units into engineering is sufficient reason for a thorough revision of the text, but modifications in BS specifications regarding both design procedure and materials are equally important reasons for undertaking the task. In the ten years since the first edition was published the popularity of the triangulated framed structure has

diminished and the popularity of the portal type frame has increased and for this reason the section of the text dealing with triangulated framed structures has been reduced. (For details of portal type framing, see 'More Steel Frame Design Examples' by the same author.) On the other hand, more detailed consideration has now been given to connections between structural members.

The author is indebted to the many students, colleagues and correspondents whose constructive comments have resulted in additional material as well as improved presentation being incorporated in the third edition.

I. ROBB

Contents

List of Abbreviations

The following abbreviations have been used in the text and these follow the recommendations of BS 449, CP3 and CP114.

A	Cross-sectional area
BS	British Standard as issued by the British Standards Institution
B or b	Breadth
CP	Code of Practice for buildings as issued by British Standards Institution
D or d	Depth
dia	Diameter
E	Young's modulus of elasticity (taken as 210 kN/mm^2 for structural steel)
e	Lever arm
f	Stress, in a general sense
f_c	Calculated stress in axial compression
f_t	Calculated stress in axial tension
f_{bc}	Calculated compressive stress induced by bending
f_{bt}	Calculated tensile stress induced by bending
H	Horizontal reaction
I	Moment of inertia (second moment of area)
I_x, I_y	Moment of inertia measured about x or y axes
kg	Kilogramme
L	Overall length of member
l	Effective length of member
l_x, l_y	Effective length of member measured on the x or y axis of the member
M	Bending moment
m	Metre; m^2 square metre
mm	Millimetre; mm^2 square millimetre; m/s meter/second
N	Newton; MN meganewton; kN kilonewton; kNm kilonewton metre

P	Load in a general sense (used where W would cause confusion)
p_c	Allowable stress in axial compression
p_t	Allowable stress in axial tension
p_{bc}	Allowable compressive stress induced by bending
p_{bt}	Allowable tensile stress induced by bending
p	Unit wind pressure
q	Dynamic wind pressure
R	Reaction to a system of loads
r	Radius of gyration
r_x, r_y, r_v, r_u	Radius of gyration measured about x, y, v and u axes respectively
S1, *S2*, *S3*	Wind speed factors
T	Thickness of compression flange of a section
t	Thickness
UB	Universal beam section
UC	Universal column section
V, V_s	Basic wind speed and design wind speed respectively
W	Load or force
x	Major axis of a section
y	Minor axis of a section; also distance from an axis to a plane of investigation
z	Section modulus