

Introduction

4. Limitation of Stress	1
4.1 Verification at the Serviceability Limit States	1
4.1.1 Permissible Stresses	1
Example 4.1.1-1 Verification of the stresses in concrete and in steel reinforcement	2
4.2 Service Load Stress-Straight-Line Theory	3
4.2.1 Analysis for Stresses-Section cracked and elastic	3
Example 4.2.1 Compute the stresses in concrete and steel reinforcement for a given bending moment	4
Example 4.2-2 Compute the specified load stress in concrete and steel	5
Example 4.2-3 Compute the stress in concrete and steel	7
Example 4.2-4 Check the stresses of concrete and steel for a given bending moment and axial load	8
Example 4.2-5 Verify the stresses in concrete and in steel reinforcement	9
Example 4.2-6 Verify the stresses in concrete and in steel reinforcement	11
Example 4.2-7 Check the stresses in concrete and in steel reinforcement	11
Example 4.2-8 Check the stresses in concrete and reinforcement caused by a bending moment M_t and external normal tension load	13
Example 4.2-9 Verify the stresses in concrete and in steel	14
Example 4.2-10 Verify the stresses in concrete and in steel, the cross-section caused by a bending moment and normal compression force	16
Example 4.2-11 check the stresses in concrete and in steel reinforcement	17
Example 4.2-12 Determine the entire area of steel reinforcement	19
Example 4.2-13 Compute the steel and concrete stresses	20

Example 4.2-14 Verify the stresses in concrete and in steel of a T-beam	22
Example 4.2-15 Verify the position of the neutral axis of a T-beam	24
Example 4.2-16 Design the flexural reinforcement for the I-beam	25
Example 4.2-17 Verify the stresses in concrete and in steel of a T-beam	26
Example 4.2-18 Verify the stresses in concrete and in steel of a T-beam	27
Example 4.2-19 Verify the stresses of concrete and steel of a T-column	29
Example 4.2-20 Verify the stresses in concrete and in steel of a T-beam	30
Example 4.2-21 Design the flexural reinforcement for the T beam	32
Example 4.2-22 Assessment of tension parts of PPRCB according to limit state of crack width	33
Example 4.2-23 Assessment the risk of longitudinal cracks due to increased pressure stress concrete	39
Example 4.2-24 Limitation of concrete stress due to an increased creep	41

5. Deformation Behaviour of Reinforced Concrete Beams 44

5.1 Deformation Behaviour of Reinforcement Concrete Beams for I, T and rectangular sections	49
5.1.1 Specimen and Material Details	50
5.1.2 Loading and Instrumentation Details	50
5.1.3 Methods	52
5.1.4 Discussion and Analysis of the Result	54
5.2 Determination of Strain Energy on Reinforced Concrete Beams	55
5.2.1 Methods	55
5.3 Crack Development and The Strain Energy in Reinforced Concrete Beams	58
5.3.1 Formation, Development and Width of Cracks	59
5.3.2 Evaluation of Cracks	59

Example 5-1 Calculate the distance of the first an inclined shearing crack of reinforced concrete beam	63
Example 5-2 To assess the crack width perpendicular to the centreline of the reinforced concrete slab	65
Example 5-3 Assessment according to limit state the widths of perpendicular cracks	66
Example 5-4 The calculation of the stress in the reinforcement after full cracking	69
Example 5-5 Calculation of shear crack widths on a reinforced concrete beam according to CEB - FIP	71
5.4 Methods	73
Example 5.4-1 Calculation of deflections for rectangular reinforced concrete beam	73
Example 5.4-2 Detailed calculation of the coefficient χ for rectangular cross-section	75
Example 5.4-3 Evaluation of deflections due to shear forces and bending moments	75
Example 5.4-4 The calculation of the stress in the reinforcement after cracking and crack width determination	76
Example 5.4-5 Theorem of reciprocity of virtual work	84
Example 5.4-6 The calculation of loads using trapezoidal rules	90
Example 5.4-7 Calculation of ideal load	93
Example 5.4-8 Calculation of the deflection by the ideal of loads	94
6. Behaviour and Conception of Timber Structures	95
Example 6-1 : Compute the stress in Rafter for a given bending moment and external force at the section	96
Example 6-2 : Compute the stress in Rafter for a given bending moment and external force at the section	96
6.1 How Structural Systems Carry The Load - Timber Engineering	97
6.2 Structural Design	112
6.2.1 Proposal for a family house roof using steel elements	113
Example 6.2.1-1 Dimensioning reinforcement in piles	115

Example 6.2.1-2 Static scheme rafters as a simple beam	116
Example 6.2.1-3 Static scheme of rafter with overhangs from left	117
Example 6.2.1-4 Rafter with overhanging ends of the right and of the left	117
Example 6.2.1-5 Rafter as a continuous beam	118
Example 6.2.1-6 Buckling calculation	119
Example 6.2.1-7 Calculation of the thickness t and stress	119
Example 6.2.1-8 Design dimensions of the timber elements	119
Example 6.2.1-9 Design dimensions of the timber elements	120
6.3 Concentric compression members	121
Example: 6.3-1 Calculation of carrying capacity of the column	124
Example 6.3-2 Calculate the required width of the support of beam on column	125
Example 6.3-3 Top chord of truss beam be designed dimensions of the elements	125
Example 6.3-4 Assessment of wooden column	127
7. Profiled steel sheeting	128
7.1 Structural steel	128
7.1-1 Profiled steel sheeting	128
7.2 The permanent load	129
7.3 Methods of analysis and design	130
7.3-1 Ultimate limit state	130
7.3-2 Bending failure and bending strength	131
7.3-3 Anchorage failure, anchorage fatigue resistance and anchorage strength	131
7.3-4 Shear failure	132
7.3-5 Design of the slab for point and line load	133
7.3-6 Reinforcement of the support	133
7.3-7 Typical structural details of composite slabs	134
7.3-8 Serviceability limit state for composite slabs	137
Example 7.1 Composite steel and concrete joists	142

8. Masonry	152
8.1 Unreinforced masonry walls subjected to vertical loading	152
8.1-1 Verification of unreinforced masonry walls	152
8.1-2 Characteristic compressive, flexural and shear strength of masonry wall	152
Example 8.1	157
Example 8.2	159
Example 8.3	160
9. Terminology	161
10. Realisation Projects	169