

Contents

SYMBOLS	VI
1 INTRODUCTION.....	11
2 COMPONENT METHOD FOR STEEL TO CONCRETE JOINTS	13
2.1 Design method.....	13
2.2 Classification of joints	14
2.2.1 Asked accuracy	14
2.2.2 Stiffness	15
2.2.3 Resistance	17
2.2.4 Deformation capacity	18
2.3 Steel-to-concrete joints.....	19
2.3.1 Available models.....	19
2.3.2 Steel and composite structures	19
2.3.3 Concrete structures	21
2.4 Components for connections with anchor plate	22
3 COMPONENTS IN CONCRETE.....	23
3.1 Component model for headed studs	23
3.1.1 Headed studs in tension, component S.....	23
3.1.2 Headed studs in tension, component CC.....	24
3.1.3 Stirrups in tension, component RS.....	26
3.1.4 Stirrups in tension - bond failure, component RB.....	27
3.1.5 Headed studs in tension, component P.....	28
3.1.6 Headed studs in shear, component V	29
3.2 Combination of components.....	30
3.2.1 Combination of concrete cone and stirrups, $C1 = CC + RS/RB$	31
3.2.2 Combination of steel and pullout, $C2 = S + P$	31
3.2.3 Combination of all components, $C3 = CC + RS/RB + P + S$	32
3.2.4 Design failure load	32
3.2.5 Combination of tension and shear components	33
3.3 Simplified stiffness's based on technical specifications	33
3.3.1 Headed stud in tension without supplementary reinforcement	33
3.3.2 Headed stud in shear	34
3.3.3 Concrete breakout in tension.....	34
3.3.4 Pull out failure of the headed studs	35
3.3.5 Interaction of components for concrete and stirrups	36
3.3.6 Determination of the failure load.....	37
3.3.7 Friction	37
3.4 Base plate in bending and concrete block in compression	37

3.4.1	Concrete 3D strength	37
3.4.2	Base plate flexibility	39
3.4.3	Component stiffness	40
3.5	Concrete panel	42
3.6	Longitudinal steel reinforcement in tension	44
3.7	Slip of the composite beam	45
4	STEEL COMPONENTS	46
4.1	T-stub in tension	46
4.1.1	Model	47
4.1.2	Resistance	49
4.1.3	Stiffness	56
4.2	Threaded stud in tension	57
4.3	Punching of the anchor plate	57
4.4	Anchor plate in bending and tension	58
4.5	Column/beam flange and web in compression	61
4.6	Steel contact plate	61
4.7	Anchor bolts in shear	62
5	ASSEMBLY FOR RESISTANCE	64
5.1	Column base	64
5.2	Simple steel to concrete joint	66
5.3	Moment resistant steel to concrete joint	72
6	ASSEMBLY FOR STIFFNESS	74
6.1	Column base	74
6.2	Simple steel-to-concrete joint	76
6.3	Moment resistant steel to concrete joint	80
7	GLOBAL ANALYSIS INCLUDING JOINT BEHAVIOUR	80
7.1	Structural analysis	80
7.2	Examples on the influence of joint behaviour	84
7.2.1	Reference building structures	84
7.2.2	Design	86
7.2.3	Structural model	87
7.2.4	Analysis and discussion for Service Limit State	93
7.2.5	Analysis and discussion for Ultimate Limit State	96
8	TOLERANCES	98
8.1	Standardized tolerances	98
8.2	Recommended tolerances	101
9	WORKED EXAMPLES	103
9.1	Pinned base plate	103

9.2	Moment resistant base plate	105
9.3	Stiffened base plate	118
9.4	Column base with anchor plate	122
9.5	Simple steel to concrete joint.....	135
9.6	Moment resistant steel to concrete joint.....	144
9.7	Portal frame	153
10	SUMMARY	162
	REFERENCES	163