1.0 STRENGTH AND CHARACTERISTIC OF CONCRETE

Table 3.1: Strength and deformation characteristics for concrete (*Ref. Section 3: MS EN 1992-1-1: 2010*)

Strength classes for concrete															Analytical relation / Explanation
f_{ck} (MPa)	12	16	20	25	30	35	40	45	50	55	60	70	80	90	
$f_{ck,cube}$ (MPa)	15	20	25	30	37	45	50	55	60	67	75	85	95	105	2.8
f_{cm} (MPa)	20	24	28	33	38	43	48	53	58	63	68	78	88	98	$f_{cm} = f_{ck} + 8$ (MPa)
f_{ctm} (MPa)	1.6	1.9	2.2	2.6	2.9	3.2	3.5	3.8	4.1	4.2	4.4	4.6	4.8	5.0	$f_{ctm} = 0.30 \times f_{ck}^{(\frac{2}{3})} \le C50/60$ $f_{ctm} = 2.12\ln(1 + (\frac{f_{cm}}{10})) > C50/60$
$f_{ctk,0.05}$ (MPa)	1.1	1.3	1.5	1.8	2.0	2.2	2.5	2.7	2.9	3.0	3.1	3.2	3.4	3.5	$f_{ctk,0.05} = 0.7 \times f_{ctm}$ 5% fractile
$f_{ctk,0.95}$ (MPa)	2.0	2.5	2.9	3.3	3.8	4.2	4.6	4.9	5.3	5.5	5.7	6.0	6.3	6.6	$f_{ctk,0.95} = 1.3 \times f_{ctm}$ 95% fractile
E_{cm} (GPa)	27	29	30	31	33	34	35	36	37	38	39	41	42	44	$E_{cm} = 22\left[\left(\frac{f_{cm}}{10}\right)\right]^{0.3}$ (f_{cm} in MPa)
ε_{c1} ($^0/_{00}$)	1.8	1.9	2.0	2.1	2.2	2.25	2.3	2.4	2.45	2.5	2.6	2.7	2.8	2.8	See Figure 3.2 $\varepsilon_{c1}(^0/_{00}) = 0.7 f_{cm}^{0.31} \le 2.8$
ε_{cu1} ($^0/_{00}$)	3.5									3.2	3.0	2.8	2.8	2.8	See Figure 3.2 for $f_{ck} \ge 50$ MPa $\varepsilon_{cu1}(^0/_{00}) = 2.8 + 27[\frac{98 - f_{cm}}{100}]$
ε_{c2} ($^0/_{00}$)	2.0									2.2	2.3	2.4	2.5	2.6	See Figure 3.2 for $f_{ck} \ge 50$ MPa $\varepsilon_{c2}(^0/_{00}) = 2.0 + 0.085(f_{ck} - 50)^{0.53}$
ε_{cu2} ($^0/_{00}$)	3.5									3.1	2.9	2.7	2.6	6.6	See Figure 3.2 for $f_{ck} \ge 50$ MPa $\varepsilon_{cu2}(^0/_{00}) = 2.6 + 35[(90 - f_{ck})/100]^4$
n	2.0									1.75	1.6	1.45	1.4	1.4	for $f_{ck} \ge 50$ MPa $n = 1.4 + 23.4[(90 - f_{ck})/100]^4$
ε_{c3} ($^0/_{00}$)	1.75									1.8	1.9	2.0	2.2	2.3	See Figure 3.4 for $f_{ck} \ge 50$ MPa $\varepsilon_{c3}(^0/_{00}) = 1.75 + 0.55[(f_{ck} - 50)/40]$
ε_{cu3} ($^0/_{00}$)	3.5									3.1	2.9	2.7	2.6	2.6	See Figure 3.4 for $f_{ck} \ge 50$ MPa $\varepsilon_{cu3}(^0/_{00}) = 2.0 + 35[(90 - f_{ck})/100]^4$