

ACI 562M - 16 Method

Bibliography (5) – 2016

ACI 562M-16 (Chapter 06 § 6.4.3) requires that the cores have to be selected and removed in accordance with ASTM C42 and ASTM C823. The equivalent specified concrete strength is calculated using the following formula :

$$f_{ck,eq} = 0.9 * f_{c,m} * \left(1 - 1.28 * \sqrt{\frac{(k_c * V)^2}{n}} + 0.0015 \right)$$

Where :

$f_{ck,eq}$: equivalent specified strength of each concrete core (N/mm²)

$f_{c,i}$: measured strength of each core (N/mm²)

$f_{c,m}$: average core strength as modified to account for the diameter and moisture condition of the core (N/mm²) (see : ACI 214.4R-10 table 9.1)

n : q.ty of cores (-)

k_c : coeff. of variation modification factor (-)

V : coeff. of variation of the core strengths (-)
(according to ACI 562-13)

Table 6.4.3—Coefficient of variation modification factor k_c

n	k_c
2	2.4
3	1.47
4	1.28
5	1.20
6	1.15
8	1.10
10	1.08
12	1.06
16	1.05
20	1.03
25 or more	1.02

Coefficient of Variation due to in-place strength variation through-out the structure, V

Structure composed of	One member	Many members
One batch of concrete	0.067	0.084
Many batches of concrete		
Cast in place	0.120	0.130
Precast	0.090	0.103

NOTE : all linear interpolations are allowed

V : according to ACI 562-16

$$V = \frac{s}{f_{c,m}}$$

s : sample standard deviation

Table 9.1—Magnitude and accuracy of strength correction factors for converting core strengths into equivalent in-place strengths

	Factor	Mean value	Coefficient of variation V , %
$F_{\ell/d}$: ℓ/d ratio [†]	Standard treatment [*] :	$1 - \{0.130 - \alpha f_{core}\} \left(2 - \frac{\ell}{d}\right)^2$	$2.5 \left(2 - \frac{\ell}{d}\right)^2$
	Soaked 48 hours in water:	$1 - \{0.117 - \alpha f_{core}\} \left(2 - \frac{\ell}{d}\right)^2$	$2.5 \left(2 - \frac{\ell}{d}\right)^2$
	Dried [§] :	$1 - \{0.144 - \alpha f_{core}\} \left(2 - \frac{\ell}{d}\right)^2$	$2.5 \left(2 - \frac{\ell}{d}\right)^2$
F_{dia} : core diameter	2 in. (50 mm)	1.06	11.8
	4 in. (100 mm)	1.00	0.0
	6 in. (150 mm)	0.98	1.8
F_{mc} : core moisture content	Standard treatment [*] :	1.00	2.5
	Soaked 48 hours in water:	1.09	2.5
	Dried [§] :	0.96	2.5
F_d : damage due to drilling		1.06	2.5

*To obtain equivalent in-place concrete strength, multiply the measured core strength by appropriate factor(s) in accordance with Eq. (9-1).

[†]Constant α equals $3(10^{-6})$ 1/psi for f_{core} in psi, or $4.3(10^{-4})$ 1/MPa for f_{core} in MPa.

^{*}Standard treatment specified in ASTM C42/C42M.

[§]Dried in air at 60 to 70°F (16 to 21°C) and relative humidity less than 60% for 7 days.

where f_c is the equivalent in-place strength; f_{core} is the core strength; and strength correction factors $F_{\ell/d}$, F_{dia} , and F_{mc} account for effects of ℓ/d ratio, diameter, and moisture condition of the core, respectively. Factor F_d accounts for the effect of damage sustained during drilling, including microcracking and undulations at the drilled surface and cutting through coarse-aggregate particles that may subsequently pop out during testing (Bartlett and MacGregor 1994d). Table 9.1 shows mean values of strength correction factors reported by Bartlett and MacGregor (1995) based on data for normal-weight concrete with strengths between 2000 and 13,400 psi (14 and 92 MPa). The right-hand column shows coefficients of variation V that indicate uncertainty of the mean value. It follows that a 4 in. (100 mm) diameter core with $\ell/d = 2$ that has been soaked 48 hours before testing has $f_c = 1.0 \times 1.0 \times 1.09 \times 1.06 f_{core} = 1.16 f_{core}$.

9.1—Conversion of core strengths to equivalent in-place strengths

The in-place strength of the concrete at the location from which a core test specimen was extracted can be computed using the equation

$$f_c = F_{\ell/d} F_{dia} F_{mc} F_d f_{core} \quad (9-1)$$