BRE Mix Design Example 2

CALCULATE MIX PROPORTIONS OF TRIAL MIX 0.08 M^3 FOR THE FOLLOWING CONDITIONS:

- Characteristic compressive strength (f_c), 25 N/mm^2 at 28 days
- Portland cement class 42.5
- Slump required, 30–60 mm
- Maximum aggregate size, 40 mm (fine and coarse uncrushed). Use 1:1.5:3 proportions for 10:20:40 mm aggregate combination.
- Maximum free-water/cement ratio, 0.50
- Minimum cement content, 290 kg/m^3
- There are no previous control data but a margin of 10 N/mm2 is specified.
- Aggregate relative density = 2.5
- Fine aggregate, 90% passing a 600µm sieve

Table 1. Concrete Mix Design Form (BRE method) Job title: Example 2

stage	item		Reference or calculation	Values
1	1.1	Characteristic strength	Specified	.....25.....N/mm² at.....28.....days
				Proportion defective .....%
	1.2	Standard deviation	Fig. 3	..... N/mm² or no data ..... N/mm²
	1.3	Margin	C1	(k=.....) .....x.....=.....N/mm2
			Specified	..... 10..... N/mm²
	1.4	Target mean strength	C2	.....25.....+.....10.....=.....35..... .....N/mm²
	1.5	Cement strength class	Specified	42.5/~~52.5~~
	1.6	Aggregate type: coarse		~~Crushed~~/Uncrushed
		Aggregate type: fine		~~Crushed~~/Uncrushed
	1.7	Free-water/cement ratio	Table 2, Fig. 4	.....0.55.....
	1.8	Max. Free water/cement ratio	Specified	.....0.50..... Use the lower value .....0.50.....
2	2.1	Slump or VeBe time	Specified	Slump .....30-60.....mm or VeBe time.....NA.....s
	2.2	Max. Aggregate size	Specified	.....40.....mm
	2.3	Free-water content	Table 3	.....160.....kg/m³
3	3.1	Cement content	C3	.....160..... / .....0.50..... = ...320..... kg/m³
	3.2	Maximum Cement content	Specified	.....NA.....kg/m³
	3.3	Minimum Cement content	Specified	.....290.....kg/m³
			Do not use less than 3.3 or more than 3.2	..... 320..... kg/m³
	3.4	Modified free-water/cement ratio		.....NA.....
4	4.1	Relative density of aggregate (SSD)		.....2.5.....known/~~assumed~~
	4.2	Concrete density	Fig. 5	.....2330..... kg/m³
	4.3	Total aggregate content	C4	....2330..... - .....320..... - .....160..... = ...1850 kg/m³
5	5.1	Grading of fine aggregate	Percentage passing 600 micron sieve	.....90.....%
	5.2	Proportion of fine aggregate	Fig. 6	.....22.....%
	5.3	Fine aggregate content	C5	.....1850..... x .....0.22..... = ...407.....kg/m³
	5.4	Coarse aggregate content		..... 1850..... -. ..... 407..... = ..1443.....kg/m³

Quantities	Cement (kg)	water (kg or lt)	Fine aggregate (kg)	Coarse aggregate (kg)		
				10 mm Ratios: (1)	20 mm (1.5)	40 mm (3)
Per m³ (to nearest 5 kg)	320	160	407	262	393	786
Per trial mix of 0.08..... m³	26	13	33	21	32	64

Table 2. Approximate compressive strengths (N/mm^2) of concrete mixes made with a free-water/cement ratio of 0.5

Cement Strength Class	***Type of Coarse aggregate***	***Compressive strengths (N/mm^2) (age in days)***			
		3	7	28	91
42.5	Uncrushed	22	30	42	49
	Crushed	27	36	49	56
52.5	Uncrushed	29	37	48	54
	Crushed	34	43	55	61

1 N/mm^2 = 1 MN/mm^2 = 1 MPa

Table 3 Approximate free-water contents (kg/m^3) required to give various levels of workability

Slump (mm)		0-10	10-30	30-60	60-180
V-B (s)		>12	6-12	3-6	0-3
Maximum size of aggregate(mm)	Type of aggregate				
10	Uncrushed	150	180	205	225
	Crushed	180	205	230	250
20	Uncrushed	135	160	180	195
	Crushed	170	190	210	225
40	Uncrushed	115	140	160	175
	Crushed	155	175	190	205

Note: When coarse and fine aggregates of different types are used, the free-water content is estimated by the expression:

$$\frac{2}{3} W_f + \frac{1}{3} W_c$$

where W_f = free-water content appropriate to type of fine aggregate; W_c = free-water content appropriate to type of coarse aggregate.

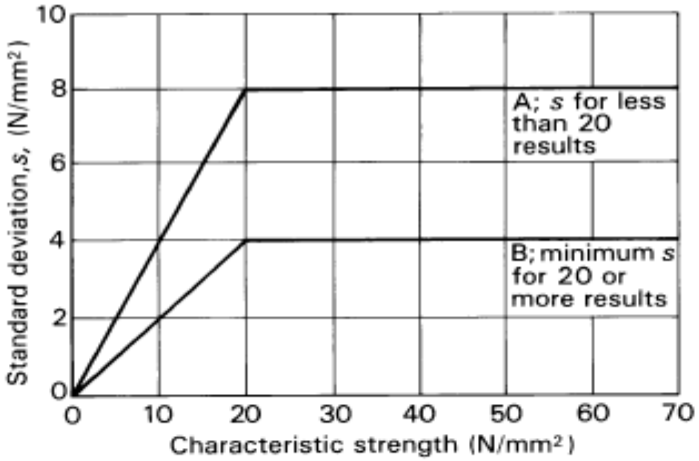

Figure 3
Relationship between standard deviation and characteristic strength

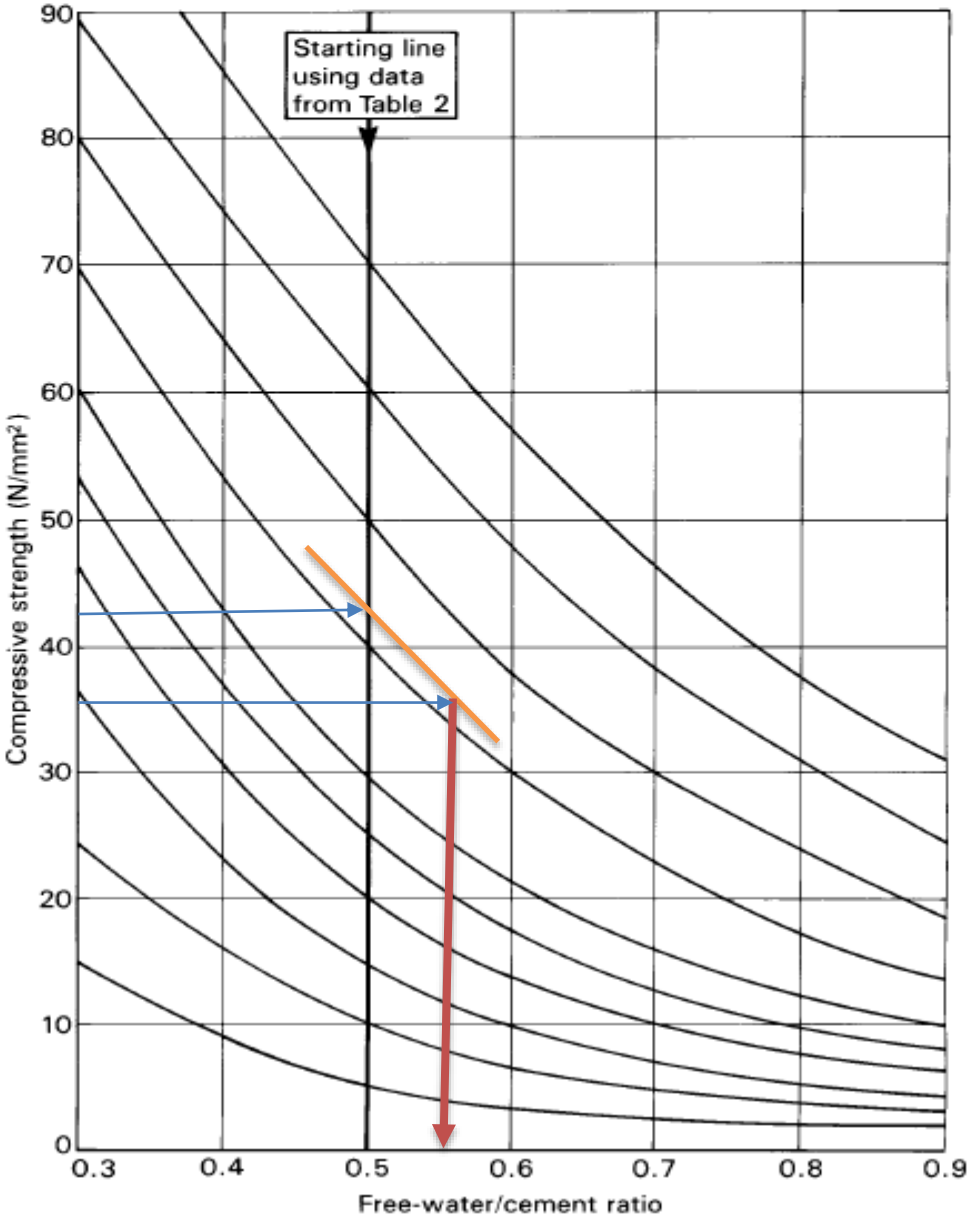

Figure 4
Relationship between compressive strength and free-water/cement ratio

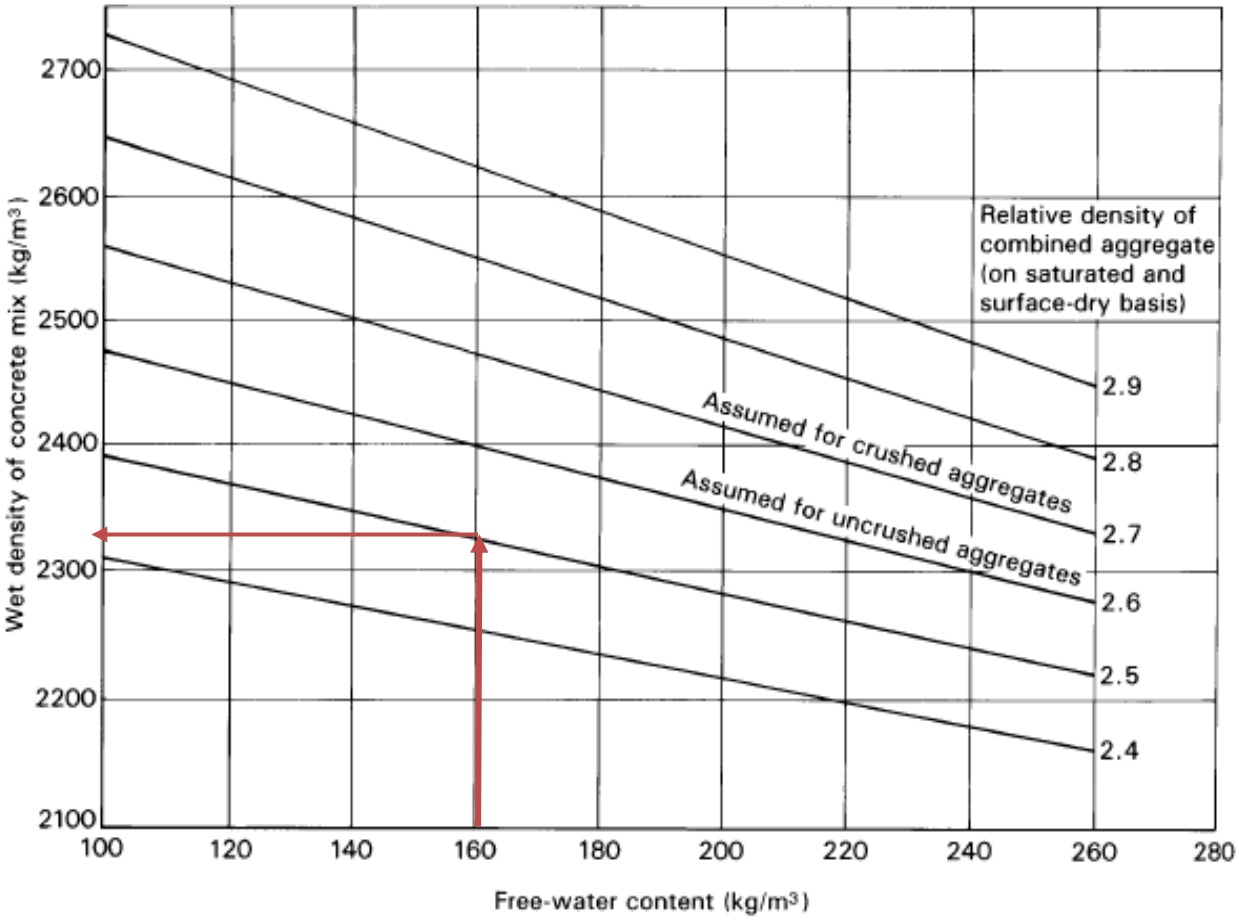

Figure 5 Estimated wet density of fully compacted concrete

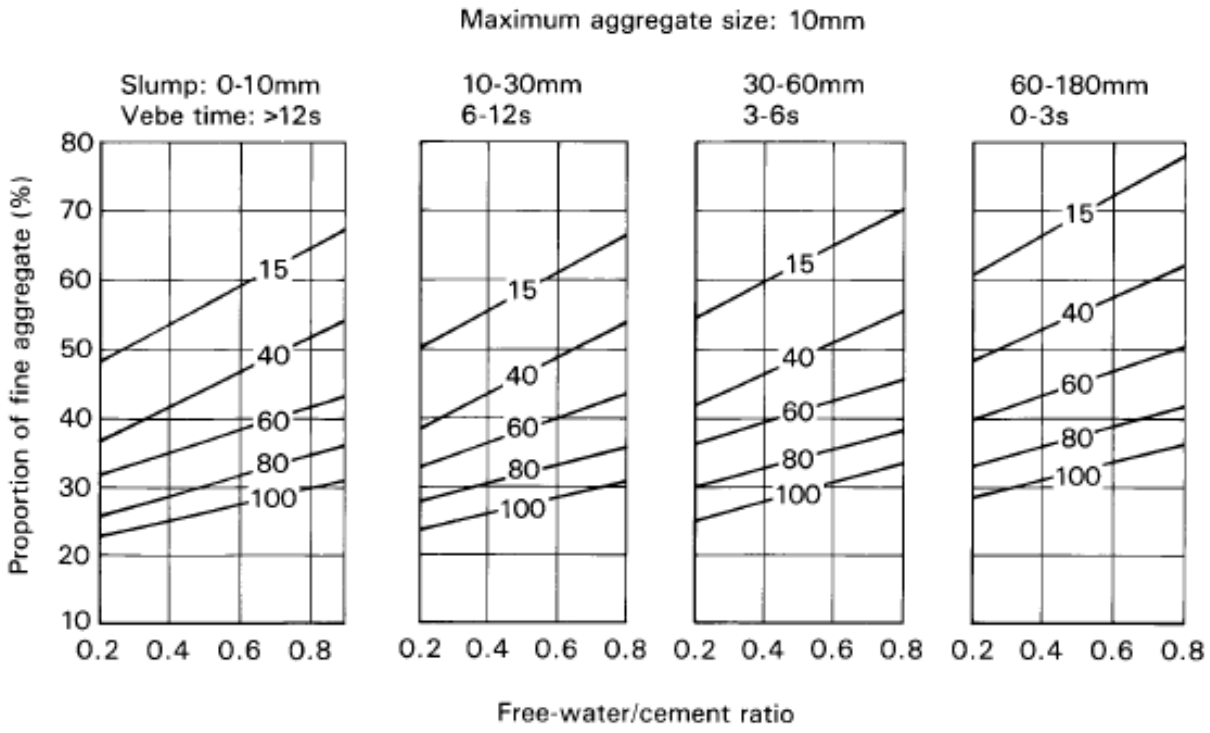

Figure 6 Recommended proportions of fine aggregate according to percentage passing a 600 µm sieve

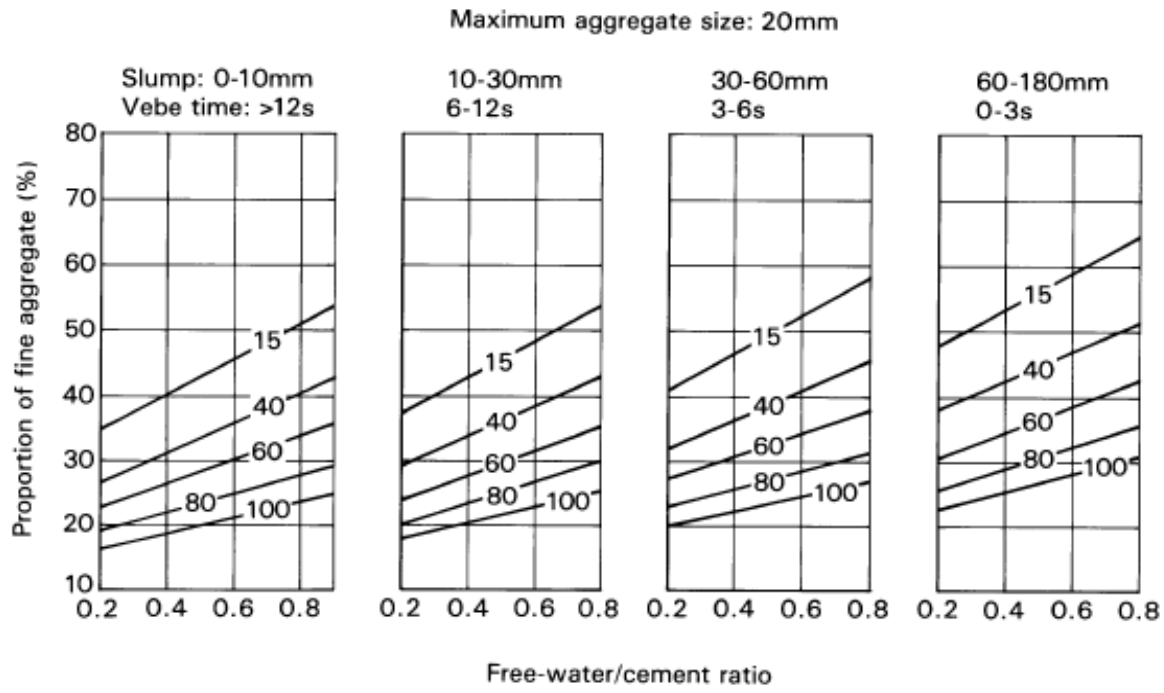

Figure 6 (continued)

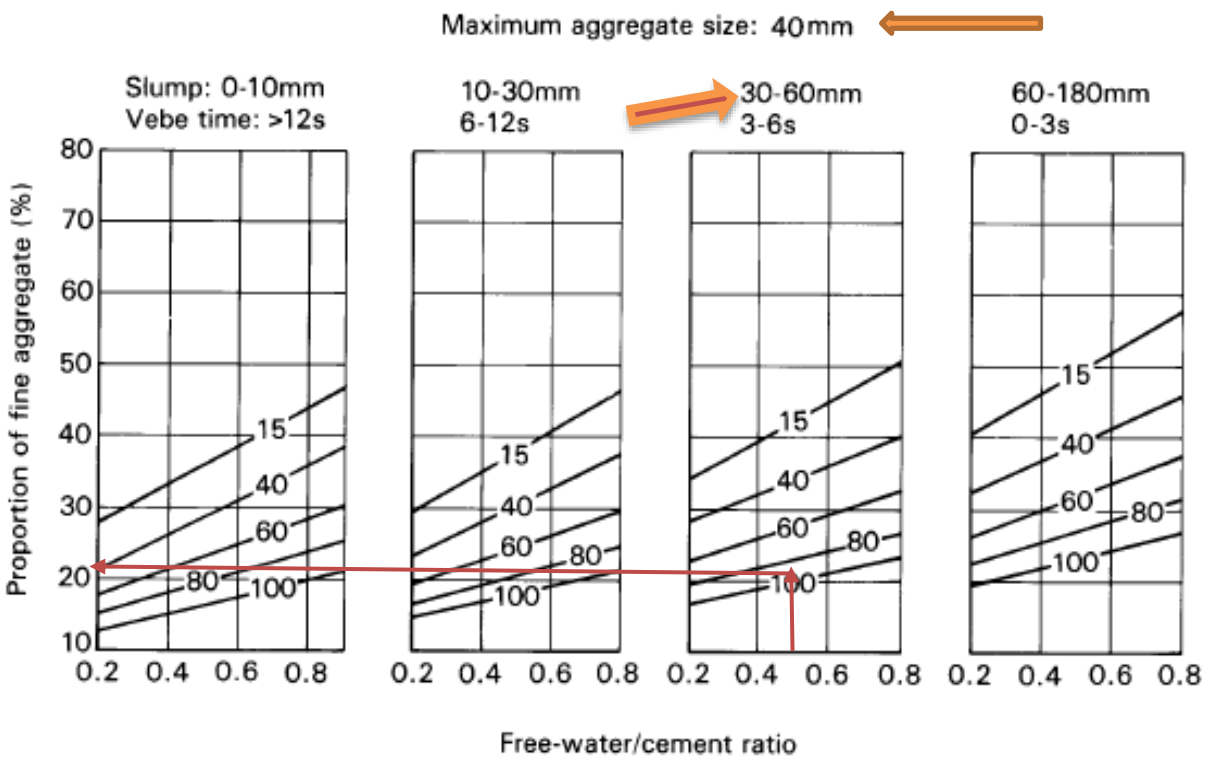

Figure 6 (continued)