

### **BRE Mix Design Example 1**

- Characteristic compressive strength ( $f_c$ ) = 30 N/mm<sup>2</sup> at 28 days, with a 2.5% defective rate ( $k = 1.96$ )
- Portland cement class 42.5
- Slump required = 10–30 mm
- Maximum aggregate size = 20 mm (uncrushed)
- Fine aggregate: 70% passing 600  $\mu$ m sieve (uncrushed)
- Maximum free-w/c ratio = 0.55
- Minimum cement content = 290 kg/m<sup>3</sup>
- Maximum cement content = not specified.

Calculate the amount of cement, water, fine aggregate, coarse aggregate per trial mix of 0.05 m<sup>3</sup> of concrete.

**Table 1. Concrete Mix Design Form (BRE method)**

**Job title: example 1**

stage	item	Reference or calculation	Values
1	1.1	Characteristic strength	Specified { ..... <b>30</b> .....N/mm <sup>2</sup> at..... <b>28</b> .....days Proportion defective ..... <b>2.5</b> .....%
	1.2	Standard deviation	Fig. 3 ..... <b>NA</b> ..... N/mm <sup>2</sup> or no data ..... <b>8</b> N/mm <sup>2</sup>
	1.3	Margin	C1 ( <b>k=1.96</b> .....) ..... <b>1.96x8</b> ..... = ..... <b>15.68</b> .....N/mm <sup>2</sup> Specified ..... <b>NA</b> ..... N/mm <sup>2</sup>
	1.4	Target mean strength	C2 ..... <b>30</b> ..... + ..... <b>15.68</b> ..... = <b>46</b> .....N/mm <sup>2</sup>
	1.5	Cement strength class	Specified <b>42.5/52.5</b>
	1.6	Aggregate type: coarse	<del>Crushed</del> / <b>Uncrushed</b>
		Aggregate type: fine	<del>Crushed</del> / <b>Uncrushed</b>
	1.7	Free-water/cement ratio	Table 2, Fig. 4 <b>0.47</b> .....
1.8	Max. Free water/cement ratio	Specified <b>0.55</b> ..... } Use the lower value <b>0.47</b> .....	
2	2.1	Slump or VeBe time	Specified Slump <b>10-30</b> .....mm or VeBe time..... <b>NA</b> .....s
	2.2	Max. Aggregate size	Specified ..... <b>20</b> mm
	2.3	Free-water content	Table 3 ..... <b>160</b> kg/m <sup>3</sup>
3	3.1	Cement content	C3 ..... <b>160 / 0.47</b> ..... = ..... <b>340</b> kg/m <sup>3</sup>
	3.2	Maximum Cement content	Specified <b>NA</b> .....kg/m <sup>3</sup>
	3.3	Minimum Cement content	Specified <b>290</b> .....kg/m <sup>3</sup> Do not use less than 3.3 or more than 3.2 ..... <b>340</b> kg/m <sup>3</sup>
	3.4	Modified free-water/cement ratio	<b>NA</b> .....
4	4.1	Relative density of aggregate (SSD)	..... <b>2.6</b> ..... known/assumed
	4.2	Concrete density	Fig. 5 ..... <b>2400</b> kg/m <sup>3</sup>
	4.3	Total aggregate content	C4 ..... <b>2400 - 340 - 160</b> ..... = ..... <b>1900</b> kg/m <sup>3</sup>
5	5.1	Grading of fine aggregate	Percentage passing 600 micron sieve ..... <b>70</b> .....%
	5.2	Proportion of fine aggregate	Fig. 6 ..... <b>28</b> .....%
	5.3	Fine aggregate content	C5 } ..... <b>1900 X 0.28</b> ..... = ..... <b>532</b> kg/m <sup>3</sup> ..... <b>1900 - 532</b> ..... = ..... <b>1368</b> kg/m <sup>3</sup>
	5.4	Coarse aggregate content	

Quantities	Cement (kg)	water (kg or lt)	Fine aggregate (kg)	Coarse aggregate (kg)		
				10 mm	20 mm	40 mm
Per m <sup>3</sup> (to nearest 5 kg)	<b>340</b>	<b>160</b>	<b>532</b>	<b>456</b>	<b>912</b>	---
Per trial mix of <b>0.05</b> m <sup>3</sup>	<b>17</b>	<b>8</b>	<b>27</b>	<b>23</b>	<b>46</b>	---

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

Cement Strength Class	Type of Coarse aggregate	Compressive strengths (N/mm <sup>2</sup> ) (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<sup>2</sup> = 1 MN/mm<sup>2</sup> = 1 MPa

**Table 3 Approximate free-water contents (kg/m<sup>3</sup>) 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.

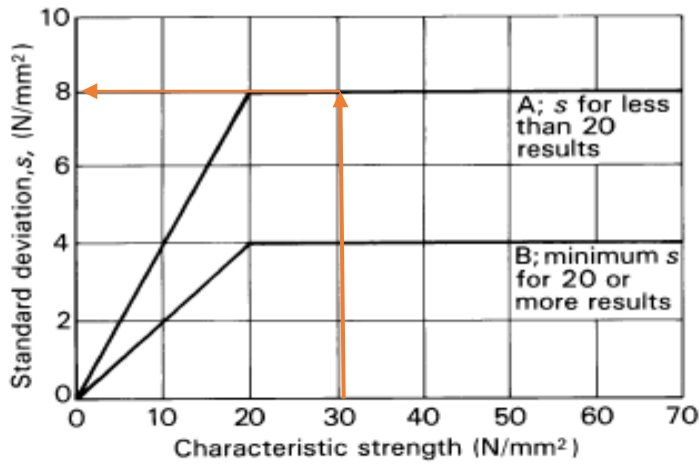


Figure 3  
Relationship between standard deviation and characteristic strength

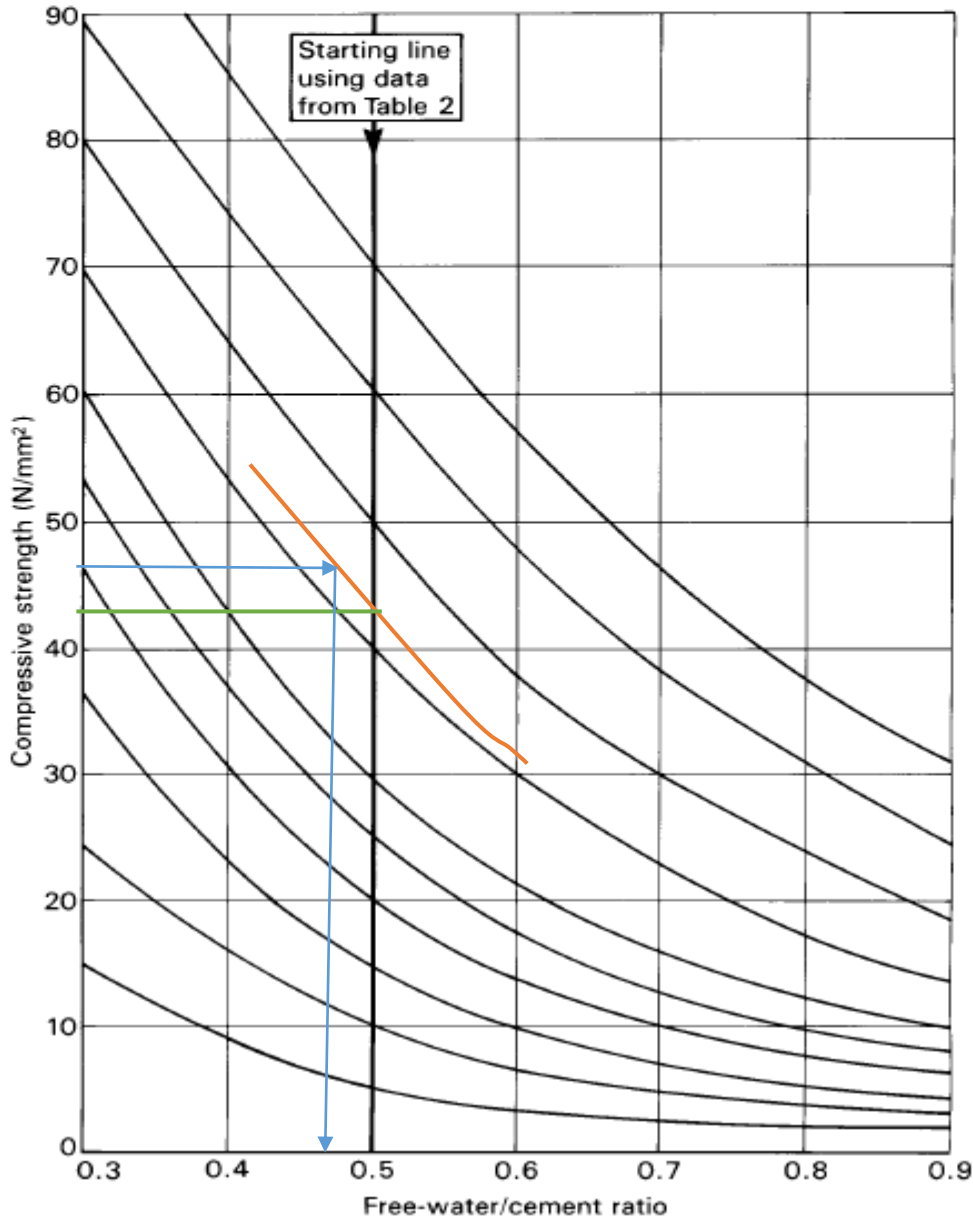


Figure 4  
Relationship between compressive strength and free-water/cement ratio

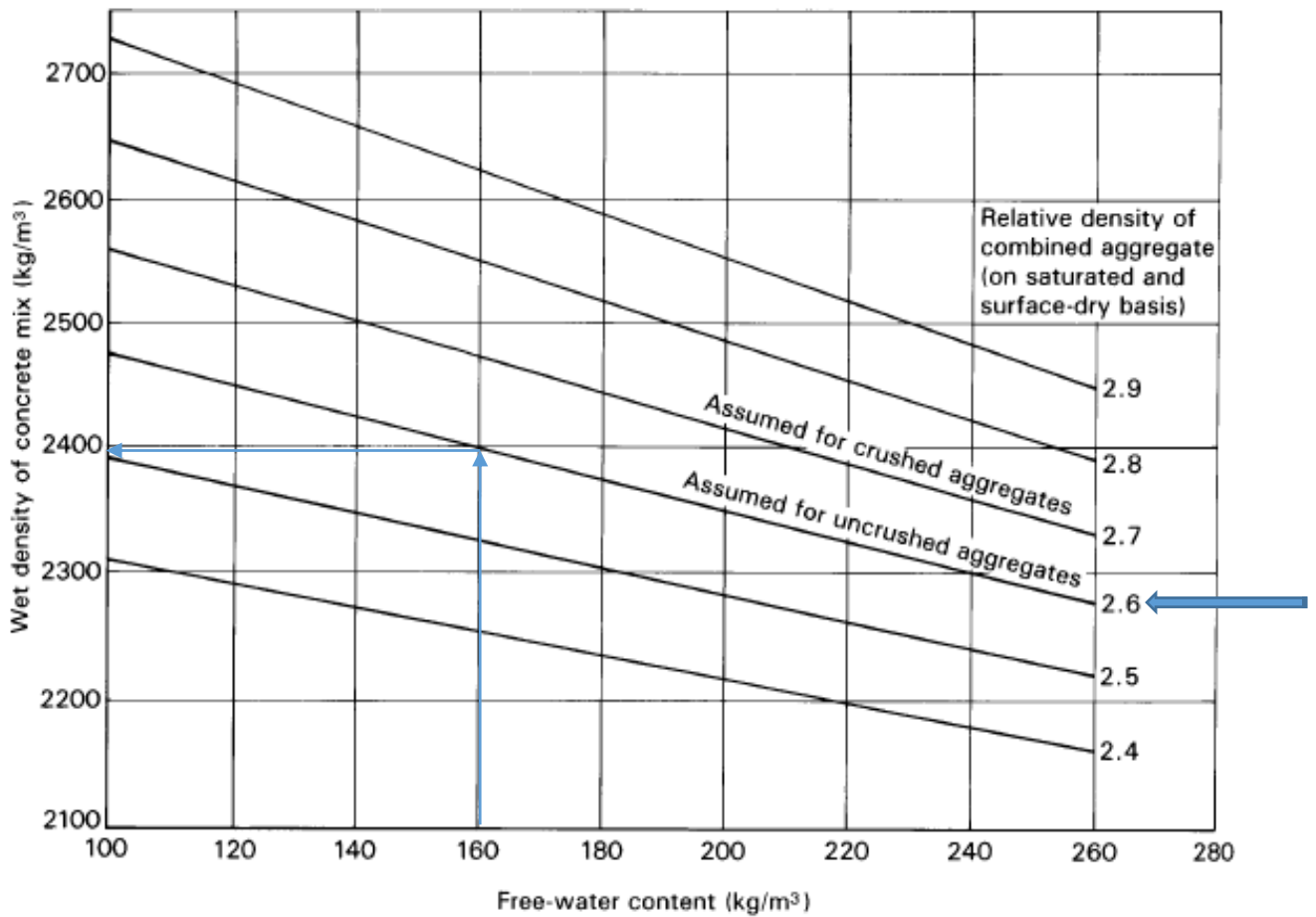


Figure 5 Estimated wet density of fully compacted concrete

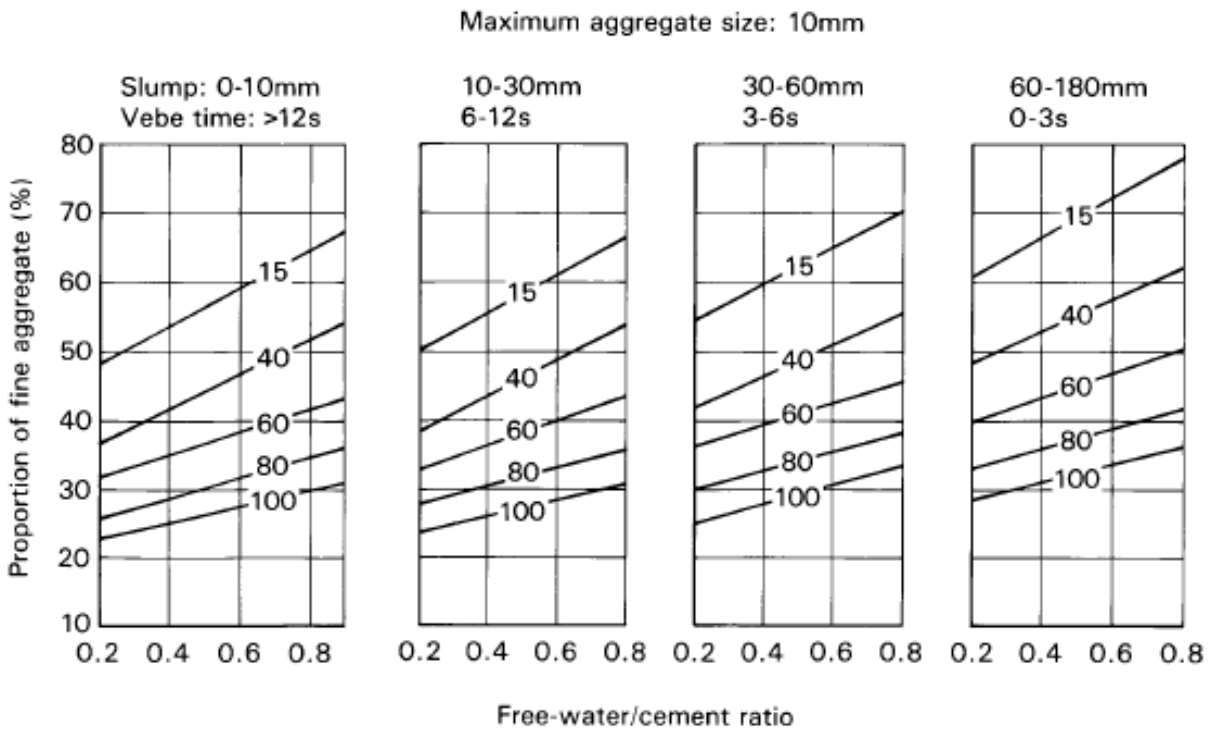


Figure 6 Recommended proportions of fine aggregate according to percentage passing a 600 µm sieve

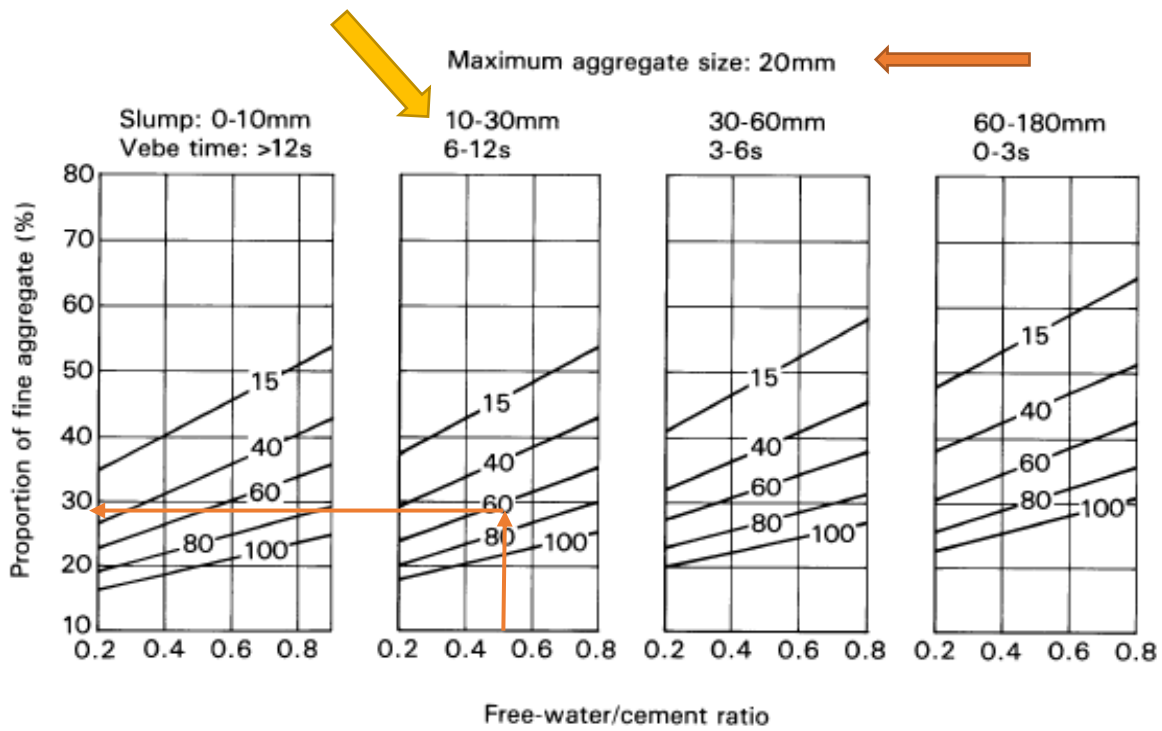


Figure 6 (continued)

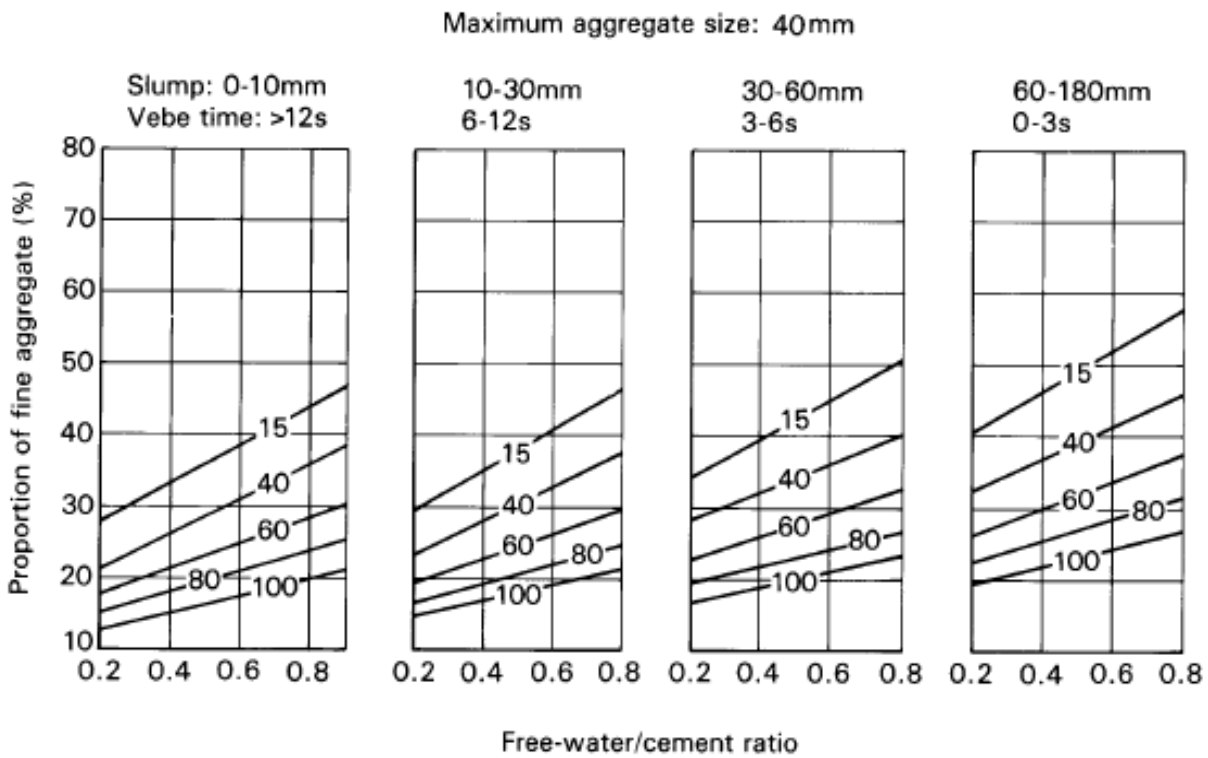


Figure 6 (continued)