

MIX DESIGN

- 1) Grade designation: M25
- 2) Type of cement: OPC
- 3) Max cement content: 150 kg/m^3
- 4) Max size of aggr. = 20 mm
- 5) Min. cement content = 300 kg/m^3
- 6) Max water-cement ratio = 0.5
- 7) Workability = 100 mm (slump)
- 8) Type of aggr. = crushed angular
- 9) chemical Admixture Type = Superplasticizers
- 10) Exposure condition = Severe (for RCC)

Test Data Materials :-

- a) cement used: OPC grade 43
- b) sp. gr. of cement = 3.15
- c) sp. gr. of:
 - i) coarse aggr. = 2.74
 - ii) fine aggr. = 2.7
- d) water absorption:
 - i) coarse aggr. = 0.5%
 - ii) fine aggr. = 1%
- e) sieve analysis:
 - i) coarse aggr. = passing from 20 mm IS sieve
 - ii) fine aggr. = Zone II from IS 383 table 4

Target strength :-

$$\begin{aligned}f_{ck} &= f_{ck} + 1.65 s \\ &= 25 + 1.65 \times 4 \\ &= 31.6 \text{ N/mm}^2\end{aligned}$$

Selection of w/c ratio :-

From table 5 of IS 456-2000,

max w/c ratio = 0.5

From the trial mixes, w/c ratio adopt = 0.45

$$0.45 < 0.5 \text{ . OK.}$$

Selection of water content :-

from table 2, IS 10262 : 2009,

max water content for 20 mm aggr. (25 to 50 mm slump)

$$= 186 \text{ lit}$$

$$\text{for 100 mm slump} = 186 + \frac{3+3}{100} \times 186$$

$$= 197 \text{ lit}$$

Calculation of cement content :

$$\text{w/c ratio} = 0.45$$

$$\text{water content} = 197 \text{ lit}$$

$$\therefore \text{cement content} = 197 / 0.45 = 437.78 \text{ kg/m}^3$$

Min. cement content = 320 kg/m³ for severe condition

$$\therefore 437.78 \text{ kg/m}^3 > 320 \text{ kg/m}^3$$

OK.

Proportion of vol. of C.A. and F.A.

from table 3 of IS 10262:2009, vol. of C.A.
20 mm size C.A. and F.A. (zone II) for w/c ratio 0.5
= 0.62

Here the w/c ratio = 0.45

$$\begin{aligned} \therefore \text{Vol. of C.A. for water cement ratio 0.45} \\ &= 0.62 + 0.01 \left[\begin{array}{l} \text{at the rate of } -/+ 0.01 \\ \text{for every change in w/c} \\ \text{ratio } +/- 0.05 \end{array} \right] \\ &= 0.63 \end{aligned}$$

$$\begin{aligned} \therefore \text{Vol. of F.A.} &= 1 - 0.63 \\ &= 0.37 \end{aligned}$$

Mix calculation :-

- Vol. of concrete = 1 m^3
- Vol. of cement = $\frac{437.78}{3.15} \times \frac{1}{1000} = 0.1389 \text{ m}^3$
- Vol. of water = $\frac{197}{1} \times \frac{1}{1000} = 0.197 \text{ m}^3$
- Vol. of all in aggr. = $1 - (0.1389 + 0.197)$
 $= 0.6641 \text{ m}^3$
- Mass of C.A. = $0.6641 \times 0.63 \times 2.74 \times 1000$
 $= 1146 \text{ kg}$
- Mass of F.A. = $0.6641 \times 0.37 \times 2.7 \times 1000$
 $= 663 \text{ kg}$

Mix proportion :

$$\text{Cement} = 437.78 \text{ kg/m}^3$$

$$\text{Water} = 197 \text{ kg/m}^3$$

$$\text{C.A} = 1146 \text{ kg/m}^3$$

$$\text{F.A} = 663 \text{ kg/m}^3$$

$$\text{W/c ratio} = 0.45$$

	cube No: Mix	
	without fibre	with fibre (5% Raw Fibre) & Admixture (0.4%)
7 days	3	3
14 days	3	3
28 days	3	3

Total No. of cube required = 18 NOS.

each dimensions = 0.15 m^3

$$\therefore \text{total vol.} = (0.15)^3 \times 18 = 0.06075 \text{ m}^3$$

$$\text{Required Cement} = 27 \text{ kg}$$

$$\text{C.A} = 70 \text{ kg}$$

$$\text{F.A} = 40.3 \text{ kg}$$

$$\text{Water} = 12 \text{ kg}$$

$$\text{Coconut Fibre} = 1.35 \text{ kg (5\% of cement)}$$

Materials for FRC (raw) cubes

OPC = 27 kg

Coarse Aggregates (20mm size) = 70 kg

Fine Aggregates = 40.3 kg

Normal fresh water = 12 kg

coconut Raw fibre = 1.35 kg

Admixture = BASF Rheobuild 918 or any
superplasticizer Admixture.

As per IS 10261:1990
 Nominal size coarse aggr. max 20mm
 Entrapped air as percent of vol. of concrete
 is 2%

$$V = 1 - 0.02 = 0.98 \text{ m}^3 = 980 \text{ lit.}$$

~~As per IS 10261:1990~~

$$\text{volume of cement} = \frac{437.78}{3.15} \times \frac{1}{1000}$$

$$= 0.1389 \text{ m}^3$$

$$\text{vol. of water} = \frac{197}{1} \times \frac{1}{1000} = 0.197 \text{ m}^3$$

$$\text{vol. of all in aggr.} = \cancel{0.98} (0.1:1)$$

$$= 0.98 - (0.139 + 0.197)$$

$$= 0.644 \text{ m}^3$$

$$\text{Mass of .C.A} = 0.644 \times 0.63 \times 2.74 \times 10^6$$

$$= \cancel{1002.13 \text{ kg}}$$

$$= 1111.87 \text{ kg.}$$

$$\text{Mass. of .P.A} = 0.644 \times 0.87 \times 2.7 \times 1000$$

$$= 643.36 \text{ kg.}$$

Wc/
 cement : 137.78 kg/m^3
 F.A : 643.36 kg/m^3
 C.A : 1097.67 kg/m^3
 water : 197 kg/m^3
 water cement ratio : 0.45

cube = 0.15 m^3
 Nominal Mix :- 7 day - 3 cube } 6 cube
 28 day - 3 cube

cement = 8.965 kg
 F.A = 13.028 kg
 C.A = 22.511 kg
 water = 3.98 kg

Adding 2% plastic aggregate by replacing
 (2 to 4%) by C.A. (of cement)

plastic = for 6 cube = 0.176 kg .
 (20mm)

~~plastic = for 6 cube = 0.176 kg~~

C.A = $(22.511 - 0.176) = 22.335 \text{ kg}$

remaining materials are same.