Concrete Mix Design – M 20 Grade Of Concrete

1. REQUIREMENTS

- a) Specified minimum strength = 20 N/Sq mm
- b) Durability requirements
- i) Exposure Moderate
- ii) Minimum Cement Content = 300 Kgs/cum
- c) Cement
- (Refer Table No. 5 of IS:456-2000)
- i) Make Chetak (Birla)
- ii) Type OPC
- iii) Grade 43
- d) Workability
- i) compacting factor = 0.7
- e) Degree of quality control Good

2. TEST DATA FOR MATERIALS SUPPLIED

a) CEMENT
i) Specific gravity = 3.05
ii) Avg. comp. strength 7 days = 46.5 more than 33.0 OK
28 days = 55.0 more than 43.0 OK
b) COARSE AGGREGATE
i) 20mm Graded
Type Crushed stone aggregate
Specific gravity = 2.68
Water absorption = 1.46
Free (surface) moisture = 0

Sieve analysis results

| IS Sieve size | Percent retained | Cumulative % retained | Percent passing |
|---------------|---------------------|--------------------------|--------------------|
| 40 mm | 0.00 | 0.00 | 100.00 |
| 20 mm | 0.60 | 0.60 | 99.40 |
| 10 mm | 73.50 | 74.10 | 25.90 |
| 4.75 mm | 22.90 | 97.00 | 3.00 |

Note : Conforming to Table 2 of IS:383-1970

c) FINE AGGREGATE (Coarse sand)

i) Type Natural (Ghaggar)

Specific gravity = 2.6

Water absorption = 0.5

Free (surface) moisture = 1.4 Sieve analysis results

| IS Sieve size | Percent retained | Cumulative % retained | Percent passing |
|---------------|------------------|--------------------------|--------------------|
| 10 mm | 0.00 | 0.00 | 100.00 |
| 4.75 mm | 5.20 | 5.20 | 94.80 |
| 2.36 mm | 3.00 | 8.20 | 91.80 |
| 1.18 mm | 8.60 | 16.80 | 83.20 |
| 600 microns | 25.80 | 42.60 | 57.40 |
| 300 microns | 32.80 | 75.40 | 24.60 |
| 150 microns | 20.70 | 96.10 | 3.90 |

Note : Conforming to grading Zone II of Table 4 of IS:383-1970

3. TARGET MEAN STRENGTH (TMS)

a) Statistical constant K = 1.65

b) Standard deviation S = 4.6

Thus, TMS = 27.59 N/Sqmm

4. SELECTION OF W/C RATIO

a) As required for TMS = 0.5

b) As required for 'Moderate' Exposure = 0.55

Assume W/c ratio of 0.5

5. DETERMINATION OF WATER & SAND CONTENT

For W/C = 0.6

C.F. = 0.8

Max. Agg. Size of 20 mm

a) Water content = 186 Kg/cum

b) Sand as percentage of total aggregate by absolute volume = 35 % Thus,

Net water content = 180.42 Kg/cum

Net sand percentage = 33 %

| Adjustments | | | | | | |
|-------------|--|-------------------------------|----|--------------|----|--|
| Sr. No. | Change in condition | Adjustment (in %) required in | | | | |
| | | Water content | | Sand content | | |
| | | Rate | W | Rate | Р | |
| i) | Sand conforming to Zone-II | 0 | 0 | 0 | 0 | |
| ii) | Decrease in CF by 0.1 (CF regd = 0.7) | -3 | -3 | 0 | 0 | |
| iii) | Each 0.05 decrease in W/C ratio Required W/c = 0.5 Decrease=0.6-0.5=0.1 | 0 | 0 | -1 | -2 | |
| iv) | For rounded agg | NA | | NA | | |
| то | TAL ADJUSTMENTS | | -3 | | -2 | |

6. DETERMINATION OF CEMENT CONTENT

W/c ratio = 0.5

Water content = 180.42 Kg/cum

Thus, Cement content = 360.84 Kg/cum Adequate for moderate exposure Say 360 Kg/cum

7. DETERMINATION OF COARSE AND FINE AGGREGATE CONTENT

Assume entrapped air as 2 %

Thus,

 $0.98 \text{ cum} = [180.42 + 360/3.05 + {1/0.33}*{fa/2.6}]/1000$

& 0.98 cum = $[180.42+360/3.05 + {1/0.67}*{Ca/2.68}]/1000$

Hence,

fa = 584 Kg/cum

Ca = 1223.8 Kg/cum

The final mix proportions of M-20 grade of concrete become:-

| Water | Cement | FA | CA | |
|--------|--------|------|--------|--|
| 180.42 | 360 | 584 | 1223.8 | |
| 0.50 | 1.00 | 1.62 | 3.40 | |

Note: 1 The above recommended mix design must be verified, by actual cube tests.

2 The mix design is based on the quality and grading of the materials actually supplied, by the client.

Any variation in quality and gradation will result in changes in the mix design.

This mix design was submitted by a regular contributor to this site. We are thankful to him for his excellent service.

Source: http://www.engineeringcivil.com/concrete-mix-design-m-20-grade-of-concrete.html