**Dr. Vithalrao Vikhe Patil Foundation's**

**DR. VITHALRAO VIKHE PATIL COLLEGE OF ENGINEERING, AHMEDNAGAR.**

Ref.No. CEA/CED/TESTING/18-19/40 Date: - 13/11/2018.

Name of Party & Address:- M/S Krishi Infratech, Banglore-560085.
Subject :- Design mix of concrete grade M – 20
Name of work: Construction of Major Bridges from Ch. 223000 to Ch. 260000M in Connection with Ahmednagar - Beed- Parli Vaijinath new Broad Gauge Line Project.
Testing Charges : Rs.30,000/-
Paid Vide Receipt No. : - 06934 Date: - 21/09/2018.

## CONCRETE MIX DESIGN M20
**(Ref. – IS – 10262 – 2009 Method)**

**A| Design Stipulations :**

| | |
|---|---|
| a) Characteristic compressive strength Required in the field at 28 days | = 20 N/mm$^2$ |
| b) Maximum size of aggregate | = 20 mm |
| c) Workability of concrete | = Good |
| d) Compaction factor | = 0.92 |
| e) Slump value | = 100 mm |
| f) Degree of Quality control | = Good |
| g) Type of Exposure | = Moderate |
| h) Chemical admixture type | = Supplied by party |

**B| Test Data for Materials:-**

**1| Cement**

| | |
|---|---|
| a) Type of cement | = Birla Shakti OPC- 53 Grade |
| b) ) i) 7 days compressive strength of cement | = 37.60 N/mm$^2$ |
| ii) 28 days compressive strength of cement | = 55.53 N/mm$^2$ |
| c) Specific gravity of cement | = 3.15 |
| d) Fineness of cement (by dry sieve analysis) as per IS 269-1969 | = 1 % |
| e) Initial setting time | = 118 min |
| f) Final setting time | = 179 min |
| g) Soundness of cement | = 0.5 mm |

PRINCIPAL
Dr. Vithalrao Vikhe Patil
College of Engineering
Ahmednagar

**2] Aggregate and Sand –**

| Test property | Coarse Aggregate | | Fine Aggregate |
|---|---|---|---|
| | 20 mm | 12.5 mm | Crushed Sand |
| Specific gravity | 2.85 | 2.93 | 2.75 |
| Water absorption (%) | 0.76 | 0.75 | 0.51 |
| Aggregate Impact Value (%) | 9.3 | 12.00 | --- |
| Aggregate Crushing Value (%) | 14.33 | 15.00 | --- |

**3] Sieve analysis:-**

**a) Coarse Aggregate:-**

| IS Sieve Size | % Passing | |
|---|---|---|
| | 20 mm | 12.5 mm |
| 80 mm | 100 | 100 |
| 40 mm | 100 | 100 |
| 20 mm | 61 | 100 |
| 10 mm | 37.5 | 97.2 |
| 4.75 mm | 1 | 2.6 |
| 2.36 mm | 0.4 | 0.02 |
| Pan | -- | --- |

**b) Fine Aggregate (Sand):–**

| IS Sieve size | Percentage Passing |
|---|---|
| 10 mm | 100 |
| 4.75 mm | 96.25 |
| 2.36 mm | 30.25 |
| 1.18 mm | 17.25 |
| 0.600 mm | 12.75 |
| 0.300 mm | 11.25 |
| 0.150 mm | 7.75 |

**C) Fine Aggregate (Crushed Sand):–**

| IS Sieve size | Percentage Passing |
|---|---|
| 10 mm | 100 |
| 4.75 mm | 98.13 |
| 2.36 mm | 70.68 |
| 1.18 mm | 37.93 |
| 0.600 mm | 28.95 |
| 0.300 mm | 18.98 |
| 0.150 mm | 14.33 |
| Retained weight on following sieves: | |
| 0.75 mm (weight) | 29.5 gms |
| Pan Weight | 254 gms |

PRINCIPAL
Dr. Vithalrao Vikhe Patil
College of Engineering
Ahmednagar

**4] Target Mean Strength:-**

$= 20 + 4.0 \times 1.65 = 26.6\ N/mm^2$.

**5) Selection of Water Cement Ratio**

From table 5 of IS 456-2000, Maximum water-cement ratio = 0.50

Based on experience adopt water-cement ratio as 0.49

**6) Selection of Water Content**

a) Maximum water content for 20mm aggregate = 186 litre
b) Water cement ratio = 0.49
c) Sand content = 40 %
d) Entrapped air in concrete = 2 %

**5] Requirement per Cu. M . of concrete :-**

1) Water content = 186 Lit
2) Sand content = 40 %
3) Cement content = 380 kg/m$^3$
   [By IS 456: 2000 Table No. 05 = 300 Kg/m$^3$ ]
4) Entrapped air = 2 %

**6] Actual Quantities Required For Cu.M. of Concrete In Kg .**

| Water | Cement | Fine Aggregate | Coarse Aggregate |
|---|---|---|---|
| 186 | 380.00 | 920.00 | 1152 (20mm = 691 + 10 mm=460) |
| 0.49 | 1 | 2.43 | 3.04 |

Mix proportion by mass

Note :- After adjustment for absorption & surface moisture .

| Mix No. | Cement in kg | Quantities of materials per m$^3$ of concrete | | | | | | Workability (CF) | Concrete Characteristics Compressive Strength(N/mm$^2$) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Crushed Sand in kg (100%) | Coarse Aggregate in kg | | Water in kg | Admixture in kg | Corrected W/C | | 7 days | 28 days |
| | | | 20 mm | 10 mm | | | | | | |
| I | 400 | 890.15 | 662.13 | 441.41 | 160 | 4.00 | 0.45 | 0.88 | 16.20 | 25.45 |
| II | 360 | 880.10 | 656.53 | 437.69 | 180 | 3.60 | 0.53 | 0.90 | 15.10 | 21.50 |
| III | 380 | 920 | 691 | 460 | 186 | 3.60 | 0.49 | 0.90 | 17.54 | 27.12 |

Adopt Trial Mix No. – III :

| Water | Cement | Fine Aggregate | Coarse Aggregate |
|---|---|---|---|
| 186 | 380.00 | 920.00 | 1152 (20mm = 691 +10 mm=460) |
| 0.49 | 1 | 2.42 | 3.03 |

PRINCIPAL
Dr. Vithalrao Vikhe Patil
College of Engineering
Ahmednagar

**7] Actual quantities required per batch of cement in kg after adjustment for water absorption and surface moisture.**

1) Cement = 50 kg
2) Crushed Sand = 121.50 kg
3) Coarse Aggregate = 152 kg( 20 mm Fraction = 91.2 kg
   10 mm fraction = 60.8 kg)
4) Water = 24.5 kg
5) Admixture = 450 gms
6) W/C = 0.49

This test results are based on samples received in the laboratory

Tested By

| Dr. S. L. Hake | H.O.D. | Principal |
|---|---|---|
| Laboratory In-charge | Dept. of Civil Engg. | Dr.V.V.P.C.O.E. Ahmednagar |

PRINCIPAL
Dr. Vithalrao Vikhe Patil
College of Engineering
Ahmednagar