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## Mix Design of M25 Grade Concrete as per IS 10262

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This document provides a detailed mix design procedure for M25 grade cement concrete as per the guidelines of IS 10262:2019. The mix design is based on standard assumptions and includes step-by-step calculations to proportion the different ingredients: cement, water, fine aggregate, and coarse aggregate.

### 1. Given Data

- Grade of Concrete: M25
- Characteristic Compressive Strength: 25 MPa
- Maximum Size of Aggregate: 20 mm
- Exposure Condition: Moderate
- Workability: 100 mm slump
- Water-Cement Ratio: 0.45
- Type of Cement: OPC 43 Grade
- Specific Gravity of Cement: 3.15
- Specific Gravity of Coarse Aggregate: 2.74
- Specific Gravity of Fine Aggregate: 2.65
- Water Absorption of Coarse Aggregate: 0.5%
- Water Absorption of Fine Aggregate: 1.0%
- Free Surface Moisture of Coarse Aggregate: Nil
- Free Surface Moisture of Fine Aggregate: Nil
- Dry Rodded Bulk Density of Coarse Aggregate: 1600 kg/m<sup>3</sup>
- Grading Zone of Fine Aggregate: Zone II

## 2. Target Mean Strength Calculation

The target mean strength of the concrete mix is calculated using the formula:

Concrete Mix Design As Per IS Code - 10262 : 2019			
1) Design Grade	=	35	
2) Target Mean Strength	=	43.25	N/mm <sup>2</sup>
3) W/C Ratio	=	0.45	
4) Maximum Size of Aggregate	=	20	mm
5) Water Content per Cubic metre of Concrete	=	186	Liters
6) Volume of Coarse Aggregate per Unit Volume of Total Aggregate	=	0.585	m <sup>3</sup>
Sand Confirming Zone	=	3	
Volume of Sand Content	=	0.415	m <sup>3</sup>
Required Slump Value (Standard with W/C ratio is 50 mm)	=	175	mm

  

Table - 1	
Grade	Std. Deviation
M20	4
M25	
M30	5
M35	
M40	
M45	

  

Graph Table	
Target Mean Strength	Water-Cement Ratio
26.66	0.62
31.56	0.57
36.20	0.48
43.20	0.45
48.20	0.4

  

Table - 2	
Nominal max. Size of	Water Content
10	208
20	186
40	165

  

W/C Ratio	
Correction in Aggregate Volume	Water Cement Ratio of Table
Volume of Coarse Aggregate for Maximum Size of Aggregate and Fine aggregate confirming zone from Below Table	0.64
Correction in Coarse Aggregate Content	-1

  

Correction in Water Content	
Slump Value	Increase in Water in %
50 mm	
75 mm	0.03

  

186 liter water content is for standard 50 mm slump. If we want to increase slump value by 75 mm (50-25) then we have to add 3% extra
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Approximate values for this aggregate volume are given in Table 5 for a water-cement/cementitious materials ratio of 0.5, which may be suitably adjusted for other ratios, the proportion of volume of coarse aggregates to that of total aggregates is increased at the rate of 0.01 for every decrease in water-cement/cementitious materials ratio by 0.05 and decreased at the rate of 0.01 for every increase in water-cement ratio by 0.05.

$$f_{\text{target}} = f_{\text{ck}} + 1.65 \times S$$

where,

$f_{\text{ck}}$  = Characteristic compressive strength (25 MPa),

$S$  = Standard deviation (Assumed as 4 MPa for M25 grade).

Thus, target mean strength =  $25 + 1.65 \times 4 = 31.6$  MPa.

Exposure Condition: Moderate exposure, as per IS 456:2000. Moderate exposure refers to concrete structures exposed to atmospheric conditions that are not extremely aggressive, such as weathering, corrosion, or carbonation.

Workability: The workability (measured by slump) is assumed to be 100 mm, suitable for general reinforced concrete work.

### **3. Water-Cement Ratio**

From the assumed data, the water-cement ratio is taken as 0.45 based on the exposure condition. As per IS 456, the maximum water-cement ratio for moderate exposure should not exceed 0.50. Therefore, 0.45 is safe for this mix design.

### **4. Water Content**

For a 20 mm maximum size of aggregate, the estimated water content for a slump of 100 mm is 186 liters (from IS 10262). Adjustments for workability and moisture content are not needed as the values are within acceptable ranges.

### **5. Cement Content**

The cement content can be calculated using the formula:

$$\begin{aligned}\text{Cement Content} &= \text{Water Content} / \text{Water-Cement Ratio} \\ &= 186 / 0.45 \\ &= 413 \text{ kg/m}^3.\end{aligned}$$

As per IS 456, the minimum cement content for moderate exposure is 300 kg/m<sup>3</sup>. Thus, 413 kg/m<sup>3</sup> satisfies the criteria.

## 6. Proportioning of Coarse and Fine Aggregates

Based on the mix design procedures, the ratio of fine aggregate to total aggregate by absolute volume is 35% for Zone II fine aggregate.

Hence, the proportions of coarse and fine aggregates are determined from the absolute volume method.

## 7. Mix Proportion Calculation

- Water = 186 liters
- Cement = 413 kg
- Fine Aggregate = 628 kg
- Coarse Aggregate = 1255 kg
- Water-Cement Ratio = 0.45

Final mix proportion by weight:

Cement: Fine Aggregate: Coarse Aggregate = 1: 1.52: 3.04.

Sr. No.	Material Name	Quantity(Kg)
1	Cement Content	404
2	Water	182
3	Fine Aggregate	722
4	Coarse Aggregate	1083
	1) Coarse Aggregate(20mm)	650
	2) Coarse Aggregate(10mm )	433
5	Slump of Concrete	175
5	Admixtures	4.8484

  

Mix Proportions By Mass			
Water	Cement	F.A	C.A
181.815	404	722	1083
0.45	1	1.79	2.68

  

Quantities For 1 Bag of Cement			
Water	Cement	F.A	C.A
23	50	89	134

  

Quantity for 9 Cube			
Water	Cement	F.A	C.A
8	17	30	45

  

CONCRETE MIX DESIGN AS PER IS : 10262 - 2019

## **8. Conclusion**

The mix design provided above is for M25 grade concrete, and it is assumed based on standard values. All proportions are in line with the IS code 10262:2019 requirements. The mix ensures adequate strength, durability, and workability for moderate exposure conditions.