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Discover, Learn, and Innovate in Civil Engineering

1. Determination of Specific Gravity of Aggregate (Coarse and Fine).

Objectives:

To determine the specific gravity of coarse and fine aggregate.

Apparatus Required

- Pycnometer
- Weighing balance

Materials required

- coarse Aggregate
- fine Aggregate.

Theory

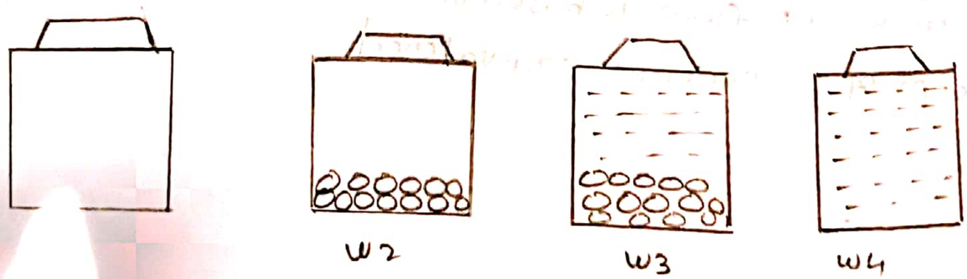
we know that specific gravity of any solid is the ratio of dencity of solids to the dencity of water at 4°c.

$$\text{ie. sp. gravity } (G) = \frac{\delta_s}{\delta_w}$$

where δ_s = density of solid

δ_w = density of water at 4°c.

This can also be expressed in terms of weight of pycnometer as used in this method.



Here, = weight of empty pycnometer

= weight of pycnometer + aggregate.

= weight of pycnometer + water + aggregate.

= weight of pycnometer + water (same level)

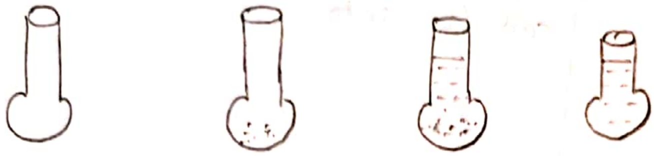


fig. for coarse aggregate

$$G = \frac{W_2 - W_1}{(W_2 - W_1) - (W_3 - W_4)}$$

Procedure

Initially, pycnometer was cleaned and dried in oven. It was weighed to find 'W_1'. Then sample was placed in optimum amount and weighed to find 'W_2'. It is then filled with water upto a certain height and weighed to find 'W_3'. Then the pycnometer was cleared and filled completely with water upto the same height and weighed to find 'W_4'. Then the value of G was computed.

Observation And Calculation

Sp. gravity of coarse aggregate:

weight of pycnometer = W_1 = 502.0gm

wt. of pycnometer and sample = W_2 = 1020.gm.

wt. of pycnometer and water with sample = W_3 = 1281 gm.

wt. of pycnometer and water (same level) = W_4 = 952 gm.

So,

$$\text{specific gravity} = \frac{W_2 - W_1}{(W_2 - W_1) - (W_3 - W_4)} = \frac{1020 - 502}{(1020 - 502) - (1281 - 952)}$$

$$= 2.74$$

Sp. gravity for fine aggregate.

wt. of pycnometer = W_1 = 0.0675 kg.

wt. of pycnometer + fine aggregate = W_2 = 0.180 kg

wt. of pycnometer + water + sample = W_3 = 0.2365 kg

wt. of pycnometer + water = W_4 = 0.171 kg

$$\text{Sp. gravity} = \frac{W_2 - W_1}{(W_2 - W_1) - (W_3 - W_4)} = \frac{0.180 - 0.0675}{(0.180 - 0.0675) - (0.2365 - 0.171)} = 2.394$$

sing

lusion | Result.

he specific gravity of a give sample of coarse aggregate is
nd to be 2·74

the specific gravity of a given sample of ~~coarse~~ fine aggregate
found to be 2.394.

ecaution

weight of pycnometer and sample should be taken carefully.

water level should be upto same level in the pycnometer
when it is filled only with water and with water and sample.

ERMINATION OF UNIT WEIGHT OF COARSE AND FINE AGGREGATE

Objective:

To determine the unit weight of coarse and fine aggregate.

Requirements

- Sample of coarse & fine aggregate.
- Mould of coarse aggregate, $\phi = 21.2cm$, $h = 28cm$
- Mould for fine aggregate, $\phi = 14.6cm$, $h = 17cm$

Theory

The weight of the material per unit volume is called unit weight denoted by γ and may have units as N/m^3 or kN/m^3 or so on. The higher the value of γ of a material, the more rigid it is and hence has more resistance upon applied load. The weight measured in known volume of mould is used to compute unit weight. It is however not same as G and appears slightly lower than $\gamma_w G_s$ as small voids are inclusive.

Procedure

The aggregate were placed in respective moulds in 3 layers. Each layers was compacted so that most of the voids get removed and the particles becomes readjusted as much as possible. The volume of the empty mould, after the skimming process was measured. The weight of aggregate was measured and γ was computed.

OBSERVATION AND CALCULATION

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(i) For coarse aggregate.

weight of mould = $W1 = 3.34$ kg

Diameter $\phi = 21.2$ cm

Height of mould = 28cm.

So, volume of mould = $\frac{\pi}{4} * \left(\frac{21.2}{100}\right)^2 * 0.28 = 9.884 \times 10^{-3}\ m^3$

weight of mould + coarse aggregate = $W_2 = 19.295$ kg

So,

Unit weight = $\frac{W_2 - W_1}{\text{Vol. of mould}} = \frac{19.295 - 3.34}{9.884 \times 10^{-3}} = 1614.27\ kg/m^3$

ii) For fine aggregate.

weight of mould = $W1 = 1.62$ kg

Diameter of mould $\phi = 14.6$ cm

height = 17cm

Volume = $\frac{\pi}{4} \times (0.146)^2 \times 0.17 = 2.846 \times 10^{-3} m^3$.

So, wt. of mould + fine aggregate = $W_2 = 6.320$ kg.

Unit weight = $\frac{6.320 - 1.62}{2.846 \times 10^{-3}} = 1651.406\ kg/m^3$.

Result

Hence, (i) The unit wt. of coarse aggregate = $1614.27\ kg/m^3$

ii) The unit wt. of fine aggregate = $1651.406\ kg/m^3$.

Precaution

(i) The aggregate (coarse and fine) should be filled in the mould in three layers.

ii) After filling each layer, compaction for 25 times should be done with standard rod.

iii) The aggregate should be filled upto the brim of mould, not less and not more for accurate result

CONTENT

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① Sieve analysis of coarse aggregate.

sample taken = 5kg

sieve of size	wt of empty sieve	wt of sieve + coarse aggregate
40mm	0.95	0.895
28mm	1.1	0.915
25mm	1.740	0.825
20	2.515	0830
16	1.755	0.900
12.5	1.505	0.770
10	1.025	0.790
4.75	0.990	0.805
pan	0.725	0.695

(i) particle size analysis curve

(ii) Nominal size of coarse aggregate

(iii) fineness modulus.

Sieve analysis of fine aggregate

sample taken = 2kg

size of sieve	wt of sieve + fine aggregate	wt. of sieve.
4.75 mm	0.495	0.42
2.36 mm	0.375	0.325
1.18 mm	0.865	0.3500
600 μm	0.730	0.300
300 μm	1.01	0.320
150 μm	0.44	0.275
75 μm	0.39	0.340
Pan.	0.265	0.260

(i) particle size distribution curve

(ii) fineness modulus.

(iii) sand zone

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Specific gravity of coarse aggregate

weight of pycnometer = W_1 = 502.0 gm

wt. of pyconometer + sample = W_2 = 1020.0 gm

wt. of pycorometer + water + sample = W_3 = 1281 gm

wt. of pycorometer + water = W_4 = 952

$$\text{sp gravity} = \frac{(W_2 - W_1)}{(W_2 - W_1) - (W_3 - W_4)} = 2.74$$

sp. gravity of fine aggregate:-

wt. of pycnometer = W_1 = 0.0675 kg

wt. of pycnometer + fine aggregate = W_2 = 0.180

wt. of pycnometer + water + sample = W_3 = 0.2365

wt. of pycnometer + water = W_4 = 0.171

$$\text{sp. gravity} = \frac{W_2 - W_1}{(W_2 - W_1) - (W_3 - W_4)} = 2.394$$

Unit wt. of coarse aggregate

wt. of mould = W_1 = 3.34 kg   d = 21.2 cm

wt. of mould + coarse aggregate = W_2 = 19.295 h = 28 cm.

$$\text{density} = \frac{W_2 - W_1}{\text{Vol. of mould}} = 1614.27 \text{ kg/m}^3$$

$$\text{volume} = \frac{\pi}{4} \times d^2 \times h$$

$$= \frac{\pi}{4} \times (21.2)^2 \times (28)$$

$$= \frac{0.0395}{4} \text{ cc.}$$

unit wt. of fine aggregates

wt. of mould = W_1 = 1.62 kg

wt. of mould + fine aggregates = W_2 = 6.320 kg

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2. DETERMINATION OF MOISTURE CONTENT

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$$\text{density} = \frac{w_2 - w_1}{\text{Vol. of mould}} = 1651.406\ kg/m^3$$

dia = 14.6cm

ht = 17cm

Moisture content test coarse aggregate

S.No.	wt of can + sample	24 hrs after drying	Moisture content
33	73.0[redacted]gm.	72.5 gm	$\frac{73-72.5}{73-10} = 0.7936\%$
wt of can			
100gm			

Moisture content test of fine aggregate

S. No:-	wt. of can + sample	24hrs after drying	moisture content.
3			
wt. of	44.0gm	43.5gm	$\frac{44-43.5}{44-10.5} = 1.4925\%$
can			
10.5gm			

3. DETERMINATION OF MOISTURE CONTENT

Objective

To determine the moisture content of both fine and coarse aggregate

Requirements

- Sample of coarse and fine aggregate.
- Drying ovens.
- weighing balance
- cans.

Theory

The water absorption of aggregate is determined by measuring the moisture content of it. The samples are weighed in atmospheric conditions, oven dried for 24hrs and the dry weight is measured.

$$\text{Then, moisture content} = \frac{\text{wt. of water in aggregate}}{\text{wt. of dry solid}} \times 100\%$$

Procedure

First, the cans were numbered, cleaned and weighed 'W_1'.

[Th]en, aggregates were kept in the cans and weighed to get 'W_2'.

[N]ow, the can containing aggregates were oven dried for 24 hrs.

[A]fter 24 hrs, the dry weight of aggregate was obtained by measuring its weight and subtracting the weight of empty cans from it. Then, by using appropriate relation, its moisture content was determined.

OBSERVATION AND CALCULATION:

(i) For coarse aggregate.

Can No.	wt. of can	wt. of can + sample	wt of can + sample 24hrs after drying	Moisture content
33	10.0gm	73.0gm	72.5gm	$\frac{73-72.5}{73-10} = 0.7936\%$

ii) For fine aggregate.

Can No.	wt. of can (gm)	wt of can + sample (gm)	wt of can + sample after 24hrs drying (gm)	moisture content
03	10.5	44.0	43.5	$\frac{44-43.5}{44-10.5}$ $= 1.4925\%$

Result:

Hence, (i) Moisture content of coarse aggregate = 0.7936%.

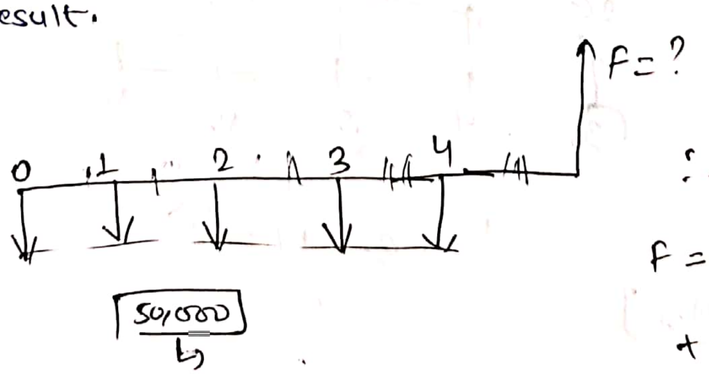
(ii) Moisture content of fine aggregate = 1.4925%.

Precaution

(i) Weight of sample and can should be taken carefully.

(ii) Reading of weight of sample should be taken after 24hrs for good result.

(H)



Here

$F = A(1+i)^N$

$= A(e^{rN})$

$\therefore$

$F = 50,000[e^{0.08\times5} + e^{0.08\times4} + e^{0.08\times3} + e^{0.08\times2} + e^{0.08\times1}]$.

$=$ Rs 3,19,849.98 Ans

and,

F=

SIEVE Analysis OF AGGREGATE [FINE AND COARSE].

Objective

(i) To draw particle size distribution curve for both coarse and fine aggregate.

ii) To findd fineness modulus of aggregate.

iii) To determine sand zone of fine aggregate and nominal size of coarse aggregate.

N+2   N+2 $-1+1=0$ $-2+1=-1$

Requirements

Test sieves conforming to IS : 460 - 1962 specification of 4.75mm, 2.36mm, 1.18 mm, 600 μm, 300 μm, 150 μm, 75 μm, Balance, stop watch fore fine aggregate.

$-1+1=0$ $-3+1=-2$ $-N+1$

nd for coarse aggregate, sieve sizes of 40mm, 28 mm, 25mm, 20mm, 16mm, 12.5mm, 10mm, 4.75mm and pan with balance, stop watch.

$-2+1=-1$ $-N.$

Theory

The process of dividing the ~~sample~~ of aggregate into fraction of ame particle size is called sieve analysis. The sieve analysis conducted to determine the particle size distribution in a sample f aggregate, which we call gradation. Many a time, fine aggregates re designated as coarse, sand, medium and fine sand. These assification do not give any precise meaning. what the supplier rms as fine sand may be really medium or even coarse sand. avoid this ambiguity, fineness modulus could be used as a yard ick to indicate the fineness of sand.

The following limit may be taken as guidance. fine sand; finess modulus : 2.2 - 2.6, Medium sand : FM - 2.6 - 2.9 and coarse sand : F.M : 2.9 - 3.2

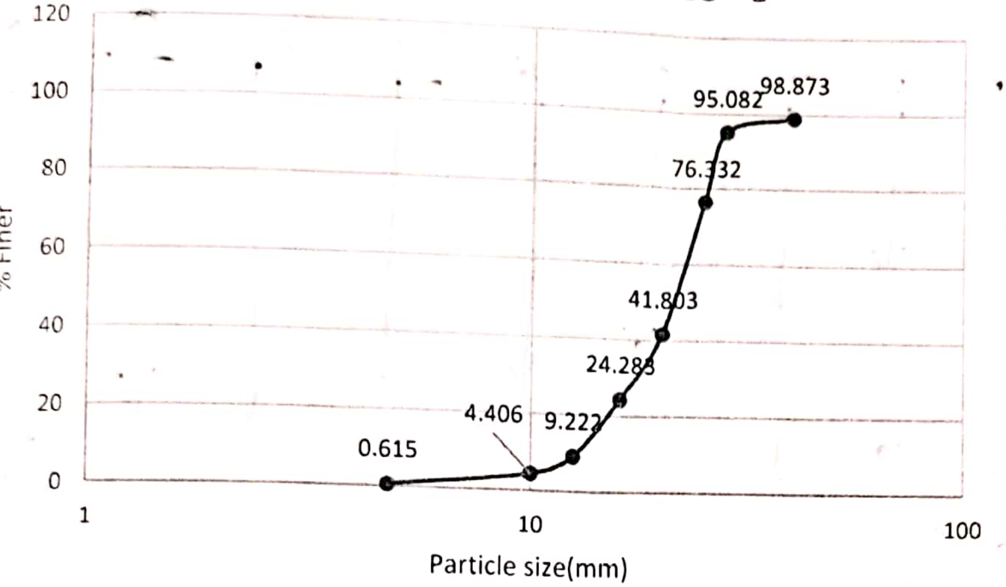
Calculation for sieve analysis of Coarse Aggregate

ieve e(mm)	Wt.of sieve + fine aggregate(kg)	wt of sieve(kg)	Wt retained(kg)	% retained	cumulative %retained	% Finer
40	0.95	0.895	0.055	1.127	1.127	98.873
28	1.1	0.915	0.185	3.791	4.918	95.082
25	1.74	0.825	0.915	18.75	23.668	76.332
20	2.515	0.83	1.685	34.529	58.197	41.803
16	1.755	0.9	0.855	17.52	75.717	24.283
12.5	1.505	0.77	0.735	15.061	90.778	9.222
10	1.025	0.79	0.235	4.816	95.594	4.406
4.75	0.99	0.805	0.185	3.791	99.385	0.615
an	0.725	0.695	0.03	0.615	100	0
otal			4.88	100		

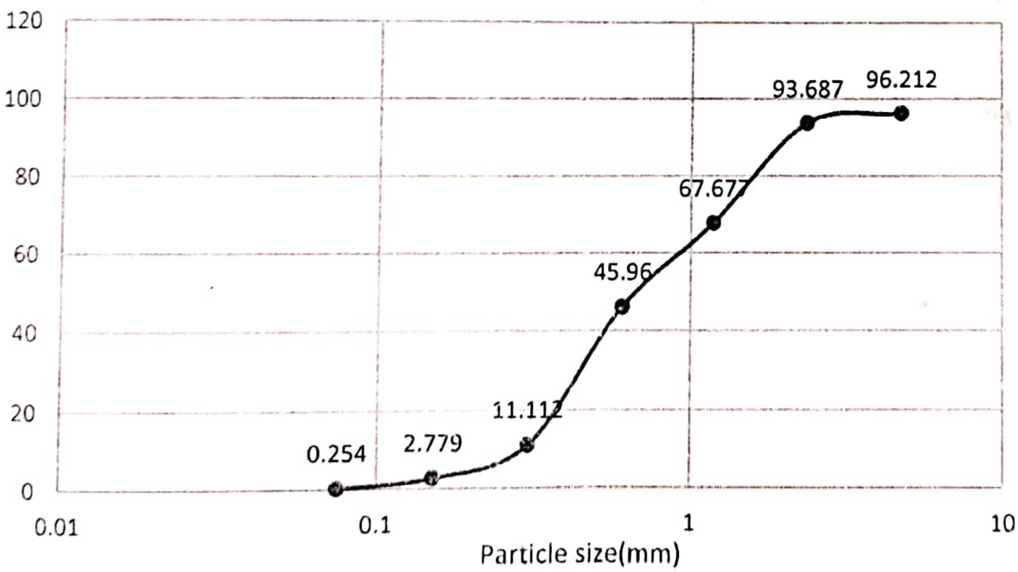
alculation for sieve analysis of Fine Aggregate

e nm)	Wt of sieve + fine aggregate(kg)	Wt of sieve(kg)	Wt retained(kg)	% retained	cumulative %retained	% Finer
.75	0.495	0.42	0.075	3.788	3.788	96.212
.36	0.375	0.325	0.05	2.525	6.313	93.687
.18	0.865	0.35	0.515	26.01	32.323	67.677
0.6	0.73	0.3	0.43	21.717	54.04	45.96
0.3	1.01	0.32	0.69	34.848	88.888	11.112
.15	0.44	0.275	0.165	8.333	97.221	2.779
075	0.39	0.34	0.05	2.525	99.746	0.254
	0.265	0.26	0.005	0.253	99.999	0.001
AL			1.98	99.999		

Particle size analysis for coarse aggregate



Particle size analysis curve for fine aggregate



sand having fineness modulus more than 3.2 will be unusitable for making satisfactory concrete.

Procedure

i) Certain weight (5 kg for coarse aggregate and 2 kg for fine aggregate was taken in the sieves. Each of the sieves were weighed to determine their weight earlier.

ii) For fine aggregate, it was machine shaken for about 10 minutes and coarse aggregate was shaked manually for same amount of time.

iii) For fine aggregate, after 10 minutes of machine shaking, it should be shaked manually for about 2 minutes.

iv) Then, each of sieve was weighed to get the weight of sieve plus aggregate retained.

(v) From the observed data, percentage finer was calculated and particle size distribution curve was plotted for both coarse and finer particle aggregate.

CALCULATION

(i) for finer aggregate.

From the attached table, Σ cumulative % wt. retained = 8.362572

$$\text{So, fineness modulus} = \frac{382.572}{100} = 3.82$$

fineness modulus as observed is 3.82 > 3.2. So, it is unsuitable for making satisfactory concrete.

(ii) for coarse aggregate:

From the attached table, Σ cumulative % wt. retained = 449.384

$$\text{So, fineness modulus} = \frac{449.384}{100} = 4.49$$

H:

ce, (i) The fineness modulus of fine aggregate is 3·82 and it is found coarser to be used to make concrete.

(ii) The finessness modulus of coarse aggregate is 4·49.

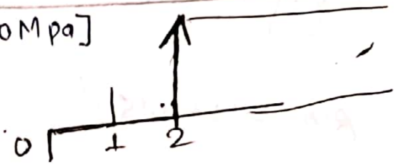
Caution

Care should be taken that loss of sample should not be more than 5%.

All the weight should be taken carefully.

$$\frac{A\{(i+1)^{N}-1\}}{i} = (F)$$

TITLE: ACI MIX DESIGN. [20 Mpa]



Objectives:

i) To design nominal mix using ACI method.

ii) To make concrete cubes and cylinder.

iii) To determine workability of the concrete mix.

iv) To determine the compressive strength of concrete cubes and cylinders at the end of 28 days.

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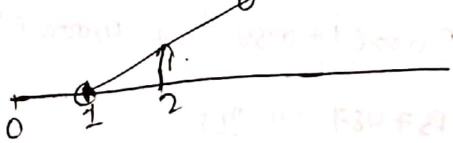
Theory

ACI committee mix design method established the following method for nominal mix design.

1) At first, target mean strength is determined, using characteristics strength.



$f_m = f_{ck} + k \cdot s$

where $k = 1.64$ = risk factor

s = standard deviation

$\frac{15,000}{0.1}\left[\frac{(1+0.1)^6 - 1}{0.1}\right] - \frac{6 \times 15,000}{0.1}$

2) w/c ratio from the strength point of view is determined. Find w/c ratio from durability point of view. Minimum of these two values is adopted.

2,57,301.5

3) Maximum size of aggregate to be used is determined.

4) Workability in terms of slump for the type of job in hand is decided.

5) The total water in kg/m³ of concrete is read from table with the selected slump and slected maximum size of aggregate. From table, approximate amount of accidentally entrapped air in non-air-entrained concrete.

7.8, 7.3

6) Cement content is computed by dividing total water content by w/c ratio.

7) From the table, the bulk volume of dry rodded coarse aggregate per unit volume of concrete is selected, for the particular maximum size of coarse aggregate and finess

modulus of fine aggregate

8) The weight of coarse Aggregate per m^3 of concrete is calculated by multiplying the bulk volume with bulk density.

9) The solid volume of C·A in one m^3 of concrete is calculated by knowing the specific gravity of coarse Aggregate

10) Similarly, the solid volume of cement, water and volume of air is calculated in 1 m^3 of concrete.

11) The solid volume of sand is computed by subtracting from the total volume of concrete, the solid volume of cement, coarse aggregate, water and entrapped air.

12) weight of fine aggregate is calculated by multiplying the solid volume of fine Aggregate by specific gravity of fine aggregate.

<u>mix design</u> for 20Mpa

(i) Targeted strength (σt) $= 20 + 4 * 1.65 = 26.6$ Mpa.

ii) W/c ratio $\Rightarrow W/C = \frac{0.55 - 0.62}{30 - 25} * (26.6 - 25) + 0.62 = 0.5976$

Durability condition, min (0.55, 0.5976)

$\Rightarrow W/C = 0.55$

iii) free water content

$= \frac{160 - 180}{40 - 25} * (28 - 25) + 180 = 176 \, kg/m^3$.

iv) % of air entrapped $= \frac{1 - 1.5}{40 - 25} \times (28 - 25) + 1.5 = 1.4\%$

v) W/c = 0.55

so, $\frac{water}{cement} = 0.55 \Rightarrow$ Cement $= \frac{176}{0.55} = 320 \, kg/m^3$.

vi) Fineness modulus (f.M.) = 2.828

and max. size of aggregate = 28 mm.

Dry bulk volume (for 25mm) $= \frac{0.67-0.65}{2.80-3} \times (2.828-3)+0.65 = 0.6672$

For 40mm, dry bulk volume $=0.7072$

So, for 28mm size, dry bulk volume $=0.6752$

vii) Mass of coarse aggregate $= 1614.27 * 0.6752 = 1089.95 kg/m^3$.

viii) $1 - \frac{1.4}{100} = \frac{176}{1000} + \frac{1089.95}{2.74\times10^3} + \frac{x}{2.394\times10^3} + \frac{320}{3.15\times10^{-3}}$

$\Rightarrow x = 743.63 kg/m^3$.

Hence, cement : sand : Aggregate = 320 : 743.63 : 1089.95
= 1 : 2.324 : 3.406 with water 178 kg/m³.

So, weight of water = 1.759 kg
weight of sand = 7.40 kg
weight of aggregate = 10.85 kg
weight of cement = 3.186 kg

OBSERVATIONS AND CALCULATIONS.

Cube No.	~~strength~~ compressive load (kN)	weight kg	comp. strength MPa	Density of concrete. (kg/m3)
1	251	2.475	25.1	2475
2	241	2.555	24.1	2555
3	253	2.455	25.3	2455

Cylinder No.	Compressive load (kN)	weight kg	strength.	Density, kg/m3.
1	123 ~~kN~~	9.675	15.66	2339.58

Splitting test

Cylinder No.	Compressive load	weight (kg)	Tensile strength	Density
2	89 kN	3.720	$T = \frac{2P}{\pi DL} = 9.833$ MPa	2368.23 kg/m³.

Workability observed from slump test:-

The slump test was performed and slump as observed was 5mm.

92,000

DISCUSSION AND CONCLUSION.

As observed from splitting test, the tensile strength of concrete as observed was 2.83 Mpa. In general, tensile strength is generally taken 10% of fck = 2Mpa. so, the observed tensile strength is more than the value specified ie 10% of fck.

The 28 days cube strength is in agrement with the designed value of strength. The 28 days cylinder strength is generally taken 0.8 * cube strength. so, the observed value of 28 da cylinder strength is 15.66 Mpa which is more or less in agreem with the theoritical value. The average value of density of concrete as observed was 2438 kg/m3.

TITLE: IS DESIGN METHOD. [25 Mpa]

Objectives:

i) To design nominal mix using IS method.

ii) To make concrete cubes and cylinders.

iii) To determine workability of the concrete mix.

iv) To determine the compressive strength of concrete cubes and cylinders at the end of 28 days.

Theory:

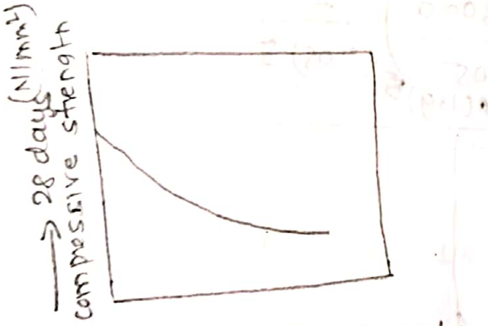
IS design method established the following steps for nominal mix design.

1) At first, determine the target strength, using characteristics strength.

$f_m = f_{ck} + K \cdot S$ where $K = 1.64$ = risk factor.
S = standard deviation.

2) Selection of w/c ratio.

(a) From the curve, determine the w/c ratio and check for durability condition.



(3) select the ~~water content~~ air content from the table for maximum size of aggregate

4) Water content and percentage of fine aggregate in total aggregate by absolute volume are selected from the table for medium (<35 Mpa) and high (>35Mpa) strength concrete. Also, necessary adjustment are to be made in water content and Percentage of sand.

5) Cement content is calculated using determined w/c ratio and water content.

6) Aggregate content may be calculated from following relation:

$$V = \left(w + \frac{c}{Sc} + \frac{1}{P} * \frac{fa}{Sfa}\right) * \frac{1}{1000}$$

Coarse aggregate, $Ca = \frac{1-P}{P} * Fa * \frac{Sca}{Sfa}$

where V = Absolute volume of fresh concrete which is equal to the volume of concrete in m3 minus volume of entrapped air.

W = mass of water (kg) per m3 of concrete.

C = mass of cement per m3 of concrete.

Sc = specific gravity of cement.

p = ratio of fine aggregate to total aggregate.

fa = mass of F.A. (kg) per m3 of concrete.

Ca = mass of coarse aggregate (kg) per m3 of concrete.

Sfa = Specific gravity of fine aggregate.

Sca = Specific gravity of coarse aggregate.

7) The proportion calculated above is based on the assumption that aggregate are saturated and surface dry condition. If any change in moisture condition, correction are to be made.

Calculations

(i) Target mean strength (ftk) = 25 + 1.65×4 = 31.6 Mpa.

(ii) water/cement ratio = 0.4375, from durability condition w/c = 0.5

minimum (0.4375, 0.5) = 0.4375.

(iii) % of air entrapped = 1.6%

(iv) water content = 177.6 kg/m3

so, w/c ⇒ 0.4375.

⇒ c = 405.943 kg/m3.

(v) Sand percentage = 33%

(vi) Compaction factor (C.F.) = 0.8

correction factor in sand = −3.25%.

https://civinnovate.com/civil-engineering-notes/

Sand % of sand = 29.75%

vii) So, $V = \left(w + \frac{c}{S_c} + \frac{1}{p} * \frac{M_{fa}}{S_{fa}}\right) * \frac{1}{1000}$

$\Rightarrow 0.984 = \frac{177.6}{1000} + \frac{405.943}{3.15 \times 10^3} + \frac{1}{0.2975} * \frac{M}{2.39 \times 10^3}$

$\Rightarrow M_{fa} = 481.74 \, kg/m^3$.

So, $M_{ca} = \frac{M_{fa}}{S_{fa}} \left(\frac{1-p}{p}\right) \times S_{ca}$.

$= \frac{481.74}{2.39 \times 10^3} \times \left(\frac{0.7025}{0.2975}\right) \times 2.74 \times 10^3$

$= 1304.14 \, kg/m^3$

So, C:S:A = 405.943 : 481.74 : 1304.14

$\Rightarrow$ C:S:A = 1 : 1.1867 : 3.213.

So, mass of cement = 3.973 kg

mass of sand = 4.715 kg

mass of aggregate = 12.763 kg

weight of water = 1.738 kg

OBSERVATIONS

calculation of workability (compaction factor)

$$C.F. = \frac{\text{weight of uncompacted concrete (kg)}}{\text{weight of compacted concrete (kg)}}$$

$$= \frac{9.6 \, kg}{11.77 \, kg}$$

$$= 0.816$$

~~Hence~~, The concrete is designed for ~~workability~~ C.F. of 0.8. Hence, the compaction factor (C.F.) found is 0.816.

Observations for strength of concrete :-

Cube No.	weight kg	comp load
1	2.6	222 KN
2	2.505	207 KN
3	2.55	215 KN

cylinder No.	weight (kg)	Comp. load (KN)
2	3.8	70.
1	3.8	

splitting test

cylinder No. 1 splitting test was conducted. and load obtained was 57 KN.

Calculation

compressive strength	Cube No.	Density of concrete (kg/m3)
22.2 Mpa.	1	2600
20.7 MPa	2	2505
21.5 Mpa.	3	2550

compressive strength	cylinder No.	Density of concrete
8.91 Mpa.	1	2418.8 kg/m3.

from splitting test

Tensile strength for cylinder 1 $= \frac{2P}{\pi DL} = \frac{2*57}{\pi \times 0.1 \times 0.2}$ = 1.814 Mpa.

CONCLUSION

The strength determined in lab is different from the designed strength. The reasons may be different. These reasons are:-

1) Not curing the concrete for 28 days.
2) Non presence of uniform even surface on which load is applied.
3) Personal errors like errors in calculation, weighing of aggregates and water etc.

TITLE: DOE MIX METHOD [30MPa].

Objective

i) To design nominal mix using DOE Mix method.

ii) To make concrete cubes and cylinders.

iii) To determine workability of the concrete mix.

iv) To determine the compressive strength of concrete cubes and cylinders at end of 28 days.

Theory

DOE design method established the following steps for nominal mix design.

i) At first, determine the target strength, using characteristics strength

$f_m = f_{ck} + ks$. where $k = 1.64$ = risk factor.
s = standard deviation.

ii) Find w/c from graph and check for strength and durability

iii) Determine the free water content depending upon maximum size of aggregate to get the concrete of specific workability.

iv) Calculate the cement content.

v) Determine the wet density of concrete depending upon free water content and relative density of combined aggregate

vi) Calculate the total aggregate as total aggregate = $\gamma_0 - w_c - w_w$

where γ_0 = wet density of concrete
w_c = cement content
w_w = free water content

vii) Determine the proportion of fine aggregate depending upon w/c, maxm size of aggregate, grading of fine aggregate and workability level.

viii) Fine aggregate content (kg/m³) = Total aggregate * % of fine aggregate.

ix) Coarse aggregate = Total aggregate - fine aggregate.

x) Adjust the mixing water quantity based on the moisture content of aggregate.

xi) Find the proportion of ingradient.

Mix design for 30 Mpa.

i) Targeted strength (ft) = 30 + 5×1.65 = 38.250 Mpa.

(ii) water cement ratio (w/c) = 0.3875 and durability = 0.45

So, minimum (0.3875, 0.45) = 0.3875

iii) maximum size of aggregate = 28mm

So, for free water content

$$y - y_1 = \frac{y_2 - y_1}{x_2 - x_1}(x - x_1)$$

$$\Rightarrow y = \frac{190-210}{40-20}(28-20)+210$$

= 202 kg/m3

iv) w/c = 0.3875 ⇒ C = 521.29 kg/m3.

v) wet density = 2300 kg/m3.

vi) wt. of aggregate = 2300 − 521.29 − 202

= 1576.71 kg/m3.

vii) % of fine aggregate = 35%

viii) wt of fine aggregate = 0.35 × 1576.71 = 551.8 kg/m3

wt. of coarse aggregate = 1024.862 kg/m3.

C:S:A = 521.29 : 551.848 : 1024.662

= 1 : 1.058 : 1.966.

So, wt. of cement = 5.10 kg

wt of water = 2.377 kg

wt. of ~~fine~~ coarse aggregate = 10.03 kg

wt. of fine aggregate = 5.40 kg

AW, method

AW of an investment

$$= \frac{R - E - CR}{L_3}$$

AW ⇒ annual equivalent receipt − annual equivalent expenses − capital recovery

AW(i) = PW(i) * (A/P, i%, N)

OBSERVATIONS AND CALCULATIONS.

workability as observed from the slump test for this nominal mix was zero.

observations for 28 cube strength and calculation

cube No.	compressive load (KN)	weight kg	Comp. Strength (MPa)	Density of Concrete (kg/m3)
1	301	2.545	30.1	2545
2	184	2.375	18.4	2375
3	287	2.490	28.7	2490

observations for 28 cylinder strength and calculation.

cylinder No.	compressive load (KN)	weight (kg)	Comp. strength (MPa)	Density of Concrete (kg/m3)
1	85	3.740	10.822	2380.96

for splitting test

cylinder No.	compressive load (KN)	weight (kg)	Tensile strength MPa	Density of concrete (kg/m3)
2	57	3.530	$\frac{2P}{\pi D L} = 1.81$	2217.27

DISCUSSION AND CONCLUSION.

As observed from the calculation, tensile strength of concrete is 1.81 mpa. and according to IS code 456, Tensile strength = $0.35\sqrt{fck} = 0.35\sqrt{30} = 1.91$ Mpa. which is near to the observed value. Also, the data observed for the 28 days compressive strength are in agreement with the designed value except for cube No. 2. It is because of not proper curing of the cube. The average value of density as observed was 2408 kg/m3

Also, The cylinder strength must be 0.8 * cube strength. But the observed value is not in agreement with this Statement. The reasons behind this are many and some hese are listed as:-

t proper curing

ot maintaining ~~of~~ even surface at which load is to be pplied.

ersonal errors like errors in calculations, errors in weighing etc.

xposure conditions might not be the same under which design made. etc.

MASONRY WALL DESIGN.

Objective:-

1) To prepare masonry wall of size 160 mm * 115 mm * 400mm.

2) To find out 28 days strength of masonry wall.

THEORY:

Masonry wall refers to the wall ~~pre~~ made by brick, stones or any other masonry elements. bound by mortar. Mortar is prepared by mixing cement with sand, or lime with surkhi etc. Masonry structure is one of the primary structure that is used in the rural areas in the developing countries. But in urban areas the use of masonry structure is not used nowadays.

~~But~~ Nowadays, the masonry walls are used as infill wall.

The infill walls are used as non-load bearing structure in frame structure.

Procedure:-

i) Bricks required to build wall ~~are~~ were taken and were dipped in the water.

ii) 1:3 mortar is prepared by taking 3 kg of cement and 9 kg of sand. 70% of wt. of cement = 2.1 kg of water was taken.

iii) Sand and cement was mixed properly and water was added to the mix to prepare the mortar.

iv) A layer of brick was laid and mortar was put over the brick and the wall of required dimension was prepared.

v) After 28 days, breaking (Compressive strength) test of the masonry wall was performed.

Calculation.

Breaking load = 148kN

Area of cross section = 502.92 cm^2

$$\text{compressive strength} = \frac{\text{Breaking load}}{\text{Contact area}}$$

$$= \frac{148}{502.92} = 2.94\,\text{Mpa}$$

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