PROPORTIONATION OF INGREDIENTS FOR CEMENT CONCRETE-A GENERAL PRACTICAL APPROACH

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1-Abstract:-

The technical paper revels that using of coarse sand in cement concrete is the main ingredient after cement because of lesser void ratio cum porosity to get mixtures higher density. Though the density of coarse sand is lesser than coarse aggregate by general practical approach, however increasing of the coarse aggregate quantity, usually reduce the strength of concrete. The result reveals the same standard as existing like M_{15}, M_{22}, & M_{25} with the increasing strength as well as reduction of quantity of coarse aggregate. The results are realistic of this test.

2-Key Words:-

Cement concrete, mixture, homogeneous, proportional, void ratio, density, fineness modulus, M_{15} and compressive strength etc.

3-Introduction:-

Since the introduction of concrete in different construction works like in buildings, roads, paver blocks, over head tanks, Hume pipes, bunkers, cilos, dams, retaining walls, bridges, fly over, sleepers for railway and poles etc, it has been an criteria to proportionate the ingredients of cement concrete, so as to get higher strength as well as good workability for the safety as well as durability, for the staying of structure for quite long to bear the effects against the environmental impact. The concrete has main ingredients like cement, coarse sand, coarse aggregate and water, which are mixed together-with to get homogeneous mix. The proportion is set in such a way to get minimum void ratio and higher density. Coarse aggregate has much more voids of big size, while coarse sand has lower void ratio of small size and cement has also lesser voids of small size, wherein each larger voids are are filled with smaller size aggregate like coarse aggregate voids are filled with coarse sand and coarse sand voids are filled with cement and finally all voids are filled with water to get proper consistency and hydration of cement, so as the plastic state of concrete may attain the shape of required size and after setting it may convert into harder mass to bear the incoming load

as well as developed bending moment/shear force/torsion. Wherever the developed forces come on the concrete, steel bars are placed before concreting to get reinforced cement concrete. The technical titled paper demonstrates the practically approach to get density of individual material and void ratios too, to get maximum density and minimum void ratio of mixture.

4-Limitations:-

The limitation as well as assumptions for general practical approach has been taken into account for getting proportion of cement concrete, which are as under.

1-Absorbance of water by little quantity of aggregate or mixture for very short time has been considered as negligible.

2-Surface water around the particle has been taken negligible.

3-Chemical reaction or hydration of cement with water considered negligible.

4-Weighing accuracy is limited to one gram.

5-Materials are of rough category, hence limited accuracy is there.

6-Quality of materials is of poor quality and not up to the mark and collected roughly means ideal sample collection was not there.

7-Silt content in fine/ coarse sand did not find.

8-Cement was old and bearing partly nodules.

9-Water-density has been taken 1 gram/c.c.

10-Void ratio has been determined by filling of water in air voids in aggregate.

11-Rough compaction was done through pelting with palm.

12-Room temperature was lump sum 23 degree.

13-Coarse aggregate size was approximately 8mm, fineness modulus for coarse sand was 1.75 and fine sand was 1.5.

14-All material during testing was considered dry.

15-Little volume or little weight nearly say 50 gram has been taken while testing. Hence results are not much more precise and reliable.

16-Data using through in tabulated form are just to get know and unreliable for construction work.

17-The result reflects to get know the procedure adopted in easy way, so as it may get understand easily with conceptual way of void ratio as well as density.

18-Ratio of concrete has been taken coarse aggregate :coarse sand :fine sand: cement.

19-Fine sand has been used in cement concrete to get homogeneity and workability.

5-Procedure:-

During practically testing of unrepresented sample of coarse aggregate, coarse sand, fine sand and cement following procedure has been taken into account.

1- Weight of glass conical flask by 60 gram and glass measuring cylinder by 128 gram.

Filled coarse aggregate in measuring cylinder up to volume say 31 gram and filled the water in conical flask up-to 105 grams. Now the water is poured into the measuring cylinder up-to the level of aggregate brim. The water entered in the voids of aggregate measured 20 gram.

Ws=weight of aggregate=175-128=47 gram.

Weight of solids + Weight of Water in voids=Ws+Ww=194-128=66 gram.

Vs=volume of solid=V-Vv=31-20=11
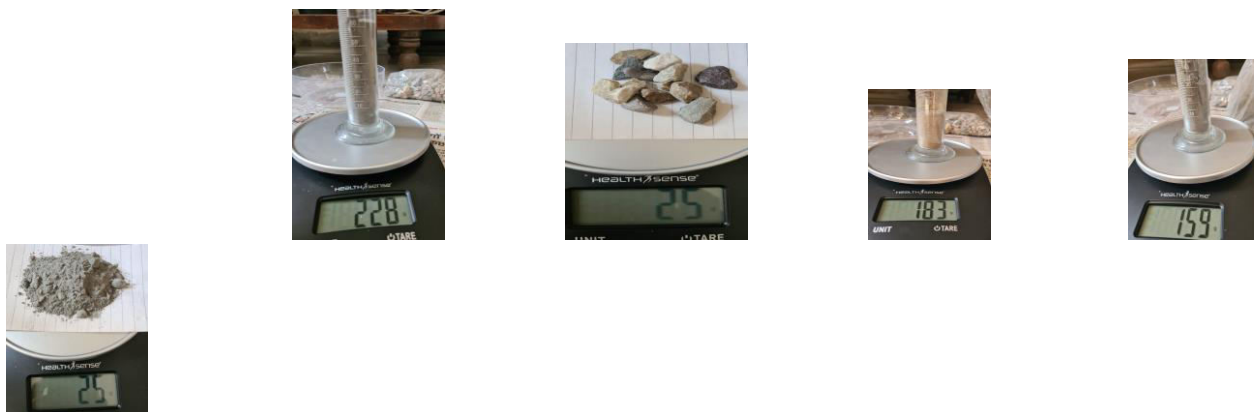
$e=Vv/Vs=$Void Ratio$=20/11=1.82$

$n=$porosity$=Vv/V=20/31=0.64$

Density= Yd=Ws/Vs=47/11=4.27 gram/c.c.

2- For coarse sand

 Ws=weight of coarse sand=183-128=55 gram.

Weight of solids + Weight of Water in voids=Ws+Ww =189-128=61 gram.

Vs=volume of solid=V-Vv=32-06=26

e=Vv/Vs=Void Ratio=06/26=0.23

n=porosity=Vv/V=06/32=0.18

Density=Yd=Ws/Vs=55/26=2.11 gram/c.c.

3-For fine sand

Ws=weight of aggregate=200-128=72 gram.

Weight of solids + Weight of Water in voids=Ws+Ww=220-128=92 gram.

Vs=volume of solid=V-Vv=50-22=28

e=Vv/Vs=Void Ratio=22/28=0.78

n=porosity=Vv/V=22/50=0.44

Density =Yd =Ws/Vs=72/28=2.577 gram/c.c.

4-For cement

Ws=weight of aggregate=159-128=31 gram.

Weight of solids + Weight of Water in voids=Ws+Ww=172-128=44 gram.

Vs=volume of solid=V-Vv=30-14=16

e=Vv/Vs=Void Ratio=16/30=0.53

n=porosity=Vv/V=16/30=0.53

Density =Yd=Ws/Vs=31/30=1.033 gram/c.c.

5-For Mixture of 1:1:1:1=coarse aggregate: coarse sand : fine sand : cement

Ws=weight of aggregate=228-128=100 gram.

Weight of solids + Weight of Water in voids=Ws+Ww=248-128=120 gram.

Vs=volume of solid=V-Vv=62-20=42

e=Vv/Vs=Void Ratio=20/42=0.47

n=porosity=Vv/V=20/62=0.32

Density= Yd=Ws/Vs=100/42=2.38 gram/c.c.

6-For ratio 4:2:1:1= coarse aggregate: coarse sand: fine sand: cement

Ws=weight of aggregate=172-128=44 gram.

Weight of solids + Weight of Water in voids=Ws+Ww=178-128=50 gram.

Vs=volume of solid=V-Vv=24-02=22

e=Vv/Vs=Void Ratio=02/22=0.09

n=porosity=Vv/V=06/22=0.27

Density = Yd=Ws/Vs=44/22=2.00 gram/c.c.

6-Conclusion in Tabulated Form:-

Conclusion of observation as approached practically is below in tabulated form to get know like bird eye view.

SL.No.	POINTS	COARSE AGGREGATE	COARSE SAND	FINE SAND	CEMENT	RATIO 1:1:1:1	RATIO 4:2:1:1
1	Yd	4.27 gm/cc	2.11 gm/cc	2.57 gm/cc	1.033 gm/cc	2.38 gm/cc	2.00 gm/cc
2	e	1.82	0.23	0.78	0.53	0.47	0.27
3	n	0.64	0.18	0.44	0.53	0.32	0.25

7-Average result by Theoretical calculation:-

So far the data as taken practically and shown in tabulated form has been averaged in different form like density, void ratio and porosity against their mix proportions.

Mix proportion-1:1:1:1

Average void ratio = e =(1.82+0.23+0.78+0.53)/4 =3.36/4=0.84

Average porosity = n= (0.64+0.18+0.44+0.53)/4=0.447

Average density Yd= (4.27+2.11+2.57+1.03)/4=9.98/4=2.5 gm/c.c.

Mix proportion-4:2:1:1

Average e= [(4)(1.82)+(2)(0.23)+0.78+0.53]/8=1.13

Average density== [(4)(4.27)+(2)(2.11)+2.57+1.03]/8=3.11 gm/c.c.

8-Result:-

So far the result, as in tabulated form, is there, the study reveals that equal proportion of concrete ingredients, have better density than increasing coarse aggregate as well as coarse sand in concrete. Better density results, the better compressive strength .Though the coarse aggregate has better density as individual. However coarse aggregate has itself better strength due to being its particle solid. The second test result of concrete, the higher the coarse aggregate quantity, lesser the strength. If the proportion is set further like 3:2:1:1, then strength or density may be lesser than ratio 1:1:1:1. Here the practical approach of cement concrete ingredients represents the same strength standard like 8:4:1,6:3:1,4:2:1,3:1.5:1 and 2:1:1 have more successive strength. The ratios are taken as coarse aggregate, coarse sand and cement.

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