Prophecy of 28 days Strength of Fresh Concrete with in Few Minutes

B.G.S.S.RAJESH[1], S.JAYARAM[2]

[1]4TH B.Tech, Department of Civil Engineering, Sasi Institute of Technology and Engineering, Tadepalligudem, Andhra Pradesh, India-534101
Email: sunny.book.sb@gmail.com
[2]4TH B.Tech, Department of Civil Engineering, Sasi Institute of Technology and Engineering, Tadepalligudem, Andhra Pradesh, India-534101
Email: sjayaram96@gmail.com

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Abstract - *This paper discusses about the earlier and easy prediction of 28 days compressive strength of the fresh concrete matrix irrespective to their mix (but cement content & W/C ratio are taken into consideration as they play a major role in strength aspects). Along with that, its procedure with required graphs taken from concern codal provisions, its advantages & limitations are also included in this discussion.*

Key Words: **Graph of Crushed &Uncrushed aggregates, 28days strength, Mix Design.**
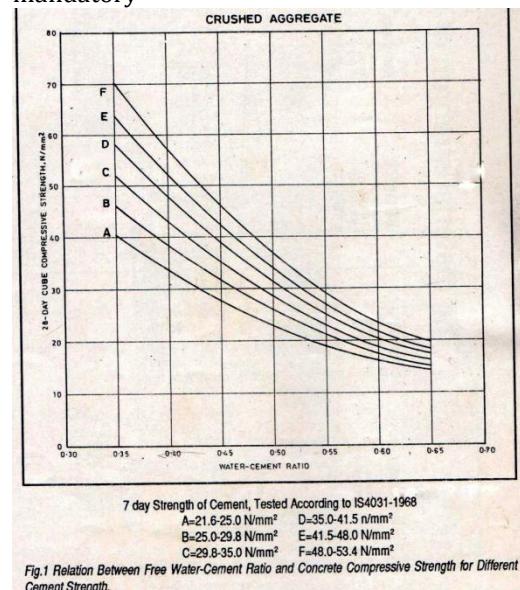
1.INTRODUCTION *(Size 11 , cambria font)*

As we know, concrete plays a major role in any construction activity. Depending up on the importance of structure, matrix has been taken from any of the 3 categories; Nominal, Standard & Design mixes.
At the time of construction in site cubes of standard size are casted with the matrix taken from the random batches of fresh concrete departed from the miller or RMC for the determination of compressive strength of concrete, either accelerated or normal 28 days, which takes such a long time. By the time, cube strength results are indicated low or to be discarded, it is too late so that curative action for the substandard concrete cannot be under-taken which has already been set in form. Nevertheless, in practice, mistakes, errors and even premeditated actions can lead to incorrect mix proportions.
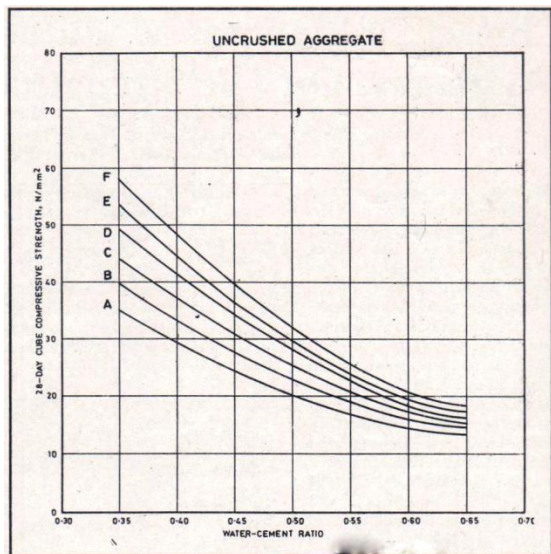 This inferior concrete may results not only slacken of the structure, but it may lead to drastic disasters & economic loss in mass concreting structures , sometimes it may cost lives of genus also . This is one of the challenging aspects that quality control might face. Therefore it is useful to determine the composition of concrete just discharged from the mixer in site of construction.

REQUIRMENTS
- Weighing machine or Ordinary balance of least count of 0.2 grams .

- Oven + pan.

- Sieve of 150μ , 4.75 mm conforming to IS:460-1965 .

- Few pans or trays.

- 7 days compressive strength of OrdinaryPortland cement tested according to the IS: 4031-1968.

- And also the following figures are mandatory

Fig.1 Relation Between Free Water-Cement Ratio and Concrete Compressive Strength for Different Cement Strength.

7 day Strength of Cement, Tested According to IS4031-1968
A=21.6-25.0 N/mm²   D=35.0-41.5 n/mm²
B=25.0-29.8 N/mm²   E=41.5-48.0 N/mm²
C=29.8-35.0 N/mm²   F=48.0-53.4 N/mm²

UNCRUSHED AGGREGATE

7 day Strength of Cement, Tested According to IS4031-1968
A=21.6-25.0 N/mm²   C=29.8-35.0 N/mm²   E=41.5-48.0 N/mm²
B=25.0-29.8 N/mm²   D=35.0-41.5 n/mm²   F=48.0-53.4 N/mm²
Fig 2 Relation Between Free Water-Cement Ratio and Concrete Compressive Strength for Different Cement Strength.

PROCEDURE:

1. Take about 300g of dry sample of sand which is going to be used in matrix sieved through 150µ sieve and percentsge of fines passing are to be found **.**

2. This step involves in following similar two methods of sieve analysis (a) Dry analysis , (b) Wet anlysis.
   (a) Sample 1. 1000g of green concrete sample is to be taken oven dried and weighed so that the difference may gives the water content in that sample .

   NOTE: The delay of above procedure may results in loss of watercontent due to temperature or due to hydration process.

   (b.1) Sample 2. 1000g of green concrete sample shall be throughly washed through 150µ sieve & retained sample should be oven dried or heated and cooled .

   (b.2) The retained sample should be sieved through 4.75 mm sieve so that the retained sample shall be coarse aggregate & sample passed shall be sand.

   The difference in weights will give cement sample of the sample .

3. Using the obtained water content & cement content, w/c ratio is calculated and along with that based on 7 days compressive strength of cement and type of aggregate used(crushed or uncrushed) ,the 28days strength of concrete can be anticipated with the help of graphs from the requirements

EXPERIMENTAL PROOF:

Step1. Sand passing through 150 µ.

I .Weight of dry sand = 206g

II. Weight of sand retained on 150µ sieve
$$= 200g$$

III .Percentage of fines of silts
$$= [(206-200)/206] \times 100 = 2.91\%$$

Step 2.(b.1) Concrete for the determination of water content .

IV. Weight of concrete taken = 1000g

V. Weight of sample after drying = 912g

VI. Water content (w%) = [(1000-912)/1000] x 100= 9.05%

(A) Total water sample
$$=(9.05 \times 1000) / 100$$
$$= 90.5g$$

(b.2) 1000g Sample of concrete for the determination of cement content .

VII. Weight of sample retained on 150µ sieve after washed with water = 753.65g

VIII.Weight of coarse aggregate retained on 4.75mm sieve =513.6g

IX .Sand content = VII-VIII = 753.65 -513.6

$$=240.05g$$

X. Actual sand content =IX +[(2.91x 240.05)/ 100] = 240.050+6.98 =247.03g

(B) Cement content = IV-VIII-IX-(A)

$$= 1000-513.6-240.05-90.5$$

$$= 148.87g$$

Determining the mix of concrete sample :

1. Aggregate / cement ratio on the basis of dry aggregates = (X+VIII)/(B)
    =1:5.10

2. Total water / cement ratio =(A)/(B)

    = 90.5/148.87 =0.61

3. Free water sample = (A) – 1% absorption of aggregate
    = 90.5-[(513.6x0.01)+(247.03x0.01)]

    = 82.89g

4. Actual water or free water / cement content(W/C ratio) = 82.89/148.87

    W/C = 0.55

Note :

1. The maximum size of crushed aggregate used is *20mm.*

2. The type of sand is found to be ' *Zone-II(river sand).*

The mix proportions derived on the basis of SSD conditions:

Cement :   Sand   : Coarse aggregate (10mm&20mm)

148.87 : 247.03   :   513.6

 1   :   1.65   :   3.44

Specified mix proportions on the basis of SSD conditions

Cement : sand : Coarse aggregate

  1   :   2 :   4

Note : The 7days compressive strength of cement used is found to **35.5N/mm²** (D Curve from figure mentioned in requirments = 35.0 to 43.15 N/mm)

Upshot:

From graph or fig 1. For W/C ratio of 0.55 on D-curve of fig.1.

Anticipated 28 days strength of green concrete = **27.5 N/mm².**

Check : Actual 28 days strength of hardened concrete after testing   = *27.915 N/mm²*

CONCLUSION *:*

This method is very simple, economical and requirements are intensively inexpensive when compared to many other methods which gonna need huge machinery which are incompetent with economy. This method can be done on every batch of the concrete matrix helps not only in discarding the substandard concrete but also helps in maintaining   the   quality   of   construction.

Note: It should be kept in mind that the cube strength of concrete alone should not only be given unaccompanied criteria as the quality & strength of the concrete depends up on the many factors together with placing ,compacting , curing , temperature effects, carbonation etc .

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BIOGRAPHIES

B.G.S.S.Rajesh did his Diploma in Civil Engineering from "Andhra Polytechnic,Kakinada.",Presently persuing B.tech final year student ,as well as, co-ordinator for R&D in Sasi Institution of Technology &Engineering. His main research involves in "Concrete Technology".

S.Jayaram did his Diploma in Civil Engineering from "C.R.Reddy polytechnic,Eluru",Presently persuing B.tech final year student ,as well as, co-ordinator for R&D in Sasi Institution of Technology &Engineering. His main research involves in "Concrete Technology".