



## ROLE OF HIGH STRENGTH CONCRETE M 90° DEGREE DESIGN IN WATER RESEARVUR: EMERGING NEEDS AND CHALLENGES

### Engineering

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### ABSTRACT

At present scenario, everywhere found water scarcity, People needs pure water for drinking and needs sufficient water for Industry, agriculture and domestic purpose all around the globe. Henceforth , we need to use more surface water as reservation project, where, civil engineers plays an important role for construction of water reserved and it's well utilization. In this research article , the researcher has focused the following objectives of proportioning concrete mixes is to arrives at the most economical combinations of different ingredients to produce concrete that will satisfy the performance requirements under specified conditions of use. The necessity of high performance concrete is increasing because of increasing demand of construction material in construction industry. The compressive strength of concrete is its most important and useful properties. Research paper includes the mix design of high strength concrete with characteristic compressive strength of 99.4 N/mm<sup>2</sup> according to IS 456:2000 and IS 10262:2009. The present experiment is based on the principle that fine aggregate should fill all the voids in the coarse aggregate and the cement should fill all the voids in the fine aggregate. Besides that, the aggregate having less voids gives stronger concrete. Such a combination of fine and coarse aggregate will require minimum amount of cement and will be most economical for a given water-cement ratio and slump. The proportion of fine to coarse aggregate which gives maximum weight of Combined aggregate can be obtained by trial. Super plasticizer is used to decrease the water cement ratio while increasing density and bond strength. We use master gelenium as super plasticizer in this research. High strength concrete can be made by using low water to cement ratio. This research is carried out to study the mix design of high strength concrete of grade M90 how strengthen and construction of water reserved in India.

### KEYWORDS

Water Reservoir (WR) Silica fume, (SF) Super Plasticizer (SP), compressive strength, Slump (CSS), High strength Concrete Design (HSCD) -M90° Degree Concrete Design

### 1. INTRODUCTION:

Today, water is treated as the white blood vessels of Human body and their life line. Without pure and sufficient water, the life of industries, agriculture and human life are not possible to exist and survive. Thus, we should have utilize the water resources properly and preserve it for our future generation. That's why, we construct Dam, reserved, canals etc. by the assistance of civil engineers. Where they have taken vital role in construction of the above said works. A High strength concrete is made carefully by selecting high quality ingredients and optimized mixture designs. These are batched, mixed, placed, compacted and cured to the highest industry standards. Typically, such concrete have low water -binder ratio due to very low w/b ratio of about 0.25 - 0.3, super plasticizer are required to achieve adequate workability.

The use of mineral admixture is also strongly recommended. The coarse aggregates must be round or cubic in shape. HSC is a High strength concrete is made carefully by selecting high concrete which possess high durability and high strength when compared to conventional concrete. This concrete contains one or more cementitious materials such as fly ash silica fumes or ground granulated blast furnace slag and usually a super plasticizer. Many trials are carried out which acts as accurate guide to select the best combinations of ingredients so as to achieve the desired properties. Design of concrete mix requires complete knowledge of the various properties of these constituent materials. PC (polycarboxylate ether) or naphthalene based super plasticizers are used because they will reduce more than 30% of mixing water than the normal super plasticizers. For high strength concrete (M 60 and above) mixes, generally OPC 53-grade, a PC based super plasticizer (which can reduce 30% of the mixing water) and 5-10% silica fume will be required. In this research, the concrete having grade M90 is mix designed.

### 3. Why are water storage reservoirs necessary?

There are numerous reasons why water storage reservoirs are a necessary element of water resource systems in Serbia. The most important ones are stated below:

a) Temporal distribution of water flow in rivers is irregular. Lots of rivers have torrent type flow. Very often 60–70% of summery annual water discharge runs in a short flood period, succeeded with long dry periods. The average annual flow of all domestic waterways in India is around 525 m<sup>3</sup>/s. In a low flow period it decreases ten times and stands

at around 50 m<sup>3</sup>/s. This is insufficient even for ecological needs of the water ecosystem.

b) The relation between the minimum monthly discharge with the occurrence probability of 95% and the maximum annual discharges with the occurrence probability of 1% are often greater than 1:1000. Variation coefficients of annual discharges are also high (CV > 0.5 for many rivers in India), indicating a variation of mean annual discharges, which are usually higher than 3:1.

c) An analysis of the coefficient of autocorrelation of annual discharges and phenon: accumulation of dry years creating one long dry period, when discharges are very low on all rivers (catchments) and all water users are endangered, as well as the rivers as ecosystems. These extremely dry periods affect a broader region and without water storage reservoirs it would be impossible to provide water for normal human activities (settlements and economy).

### 2. Literature Review:

In the section of literature review, the researcher has taken both the data of primary and secondary Resources from India .some where it based on the empirical study and some where it focused on the original research work as related with the research problem.

Here, the researcher has trying to their level best to justified the taken hypothesis as related with the research title /problem "**Role of High Strength Concrete M90° Degree Design in Water Reservation: Emerging Needs And Challenges**".

In connection with the above said, the researcher has taken two hypotheses as related with two variables. In hypothesis one H<sub>0</sub> (Observed Hypothesis), the role of high strength concrete M90° /degree design plays an important role for strengthen of construction of water Reserve (Variable I). In hypothesis II , treated as expected hypothesis (H<sub>e</sub>) as related to variable II refers that A good design of construction work or layout would be enhance the strengthen the construction work Therefore, the researcher has found various research reports available on the various properties of concrete and finally got the conclusion as the taken hypothesis has justified due to its highly significance. Here few of reports are presented for reader's kind perusal and its approval. i.e



Date	Value
Degree of workability Desired	Good
Standard Deviation	6
Statistic, depending upon the accepted proportion of low	1.65
Target mean strength Maximum size of aggregate used	99.4
Minimum size of coarse aggregate MPa	20mm 4mm

**6.2. Water content**

According to IS-10262:2009, for 20 mm size aggregate, water content and sand as percent of total aggregate by absolute volume is taken as 186 kg per cubic meter of concrete. We have used 150 liters water and with super plasticizer 1 % and expected that super plasticizer, silica fume will have high workability of 135 mm slump



[Nagarjun Sagar Dam inside Nagarjunsagar Srisailam Tiger Reserve in India figure; 02]



[Niagara Bio-sphere Reserve in India figure: 03]

**6.3. Air content Estimation:**

According to IS-10262:1982, approximate amount of entrapped air to be expected in normal concrete is taken as 2% according to the nominal size of aggregate used.

**6.4. Casting of samples for mix Design:**

The size of the cube Specimen is (150x150x150) mm. A total of 4 trials for mix design were casted. In each trial 6 cubes are casted. A total of 30 cubes are casted for the

**6.5. Curing of Samples;**

In the next day of casting, cube samples were de-moulded from the moulds and placed in curing tanks until they are taken out from it for further tests. 3 and 3cubes - from each trial are taken out in 7 day and 28 day respectively for compression test. Accelerated steam curing also done on the trial no 5 in which predicted 28 days compressive strength =  $R_{28} = (8.09 + 1.64 R_a)$ , where  $R_a$  is accelerated compressive strength and  $R_{28}$  is predicted compressive strength at 28 days.

**6.6. Mix proportions mix design of high strength concrete.**

**Table Mix Properties**

Trial mix number	Water to binder ratio	Cement Fine Aggregate Coarse Aggregate	super plasticizer
1	0.34	1:1.3:2.54	1.3 of cement
2	0.32	1:1.45:2.58	1.1% of cement
3	0.30	1:1.24:2.32	1% of cement
4	0.28	1:1.47:2.3	1% of binder
5	0.26	1:1.39:2.25	1% of binder

**RESULTS**

**1. Trial 1(compressive test results)**

The 7-day and 28-day compressive test result of Trial-1 are given in the following table.

**Table B: Trial 1(compressive test results)**

Age in days		7	28
No of Cubes		3	3
<b>Cube Strength In Mpa</b>	<b>Cube- 1</b>	42	63
	<b>Cube -2</b>	39	60
	<b>Cube -3</b>	36	58
<b>Average Compressive Strength</b>		39	60.35

**2. Trial 2(compressive test results)**

The 7-day and 28-day compressive test result of Trial2 are given in the following table

**Table C: Trial 2(compressive test results)**

Age in days		7	28
No of Cubes		3	3
<b>Cube Strength In Mpa</b>	<b>Cube- 1</b>	33.4	64.26
	<b>Cube -2</b>	37.5	63.25
	<b>Cube -3</b>	34	61.32
<b>Average Compressive Strength in MPa</b>		35	63

**3. Trial 3(compressive test results)**

Thus, the 7-day and 28-day compressive test result of Trial-3 are given in the following table.

**Table D: Trial 3(compressive test results)**

Age in days (Duration)		7	28
No of Cubes		3	3
<b>Cube Strength In Mpa</b>	<b>Cube- 1</b>	35.4	64
	<b>Cube -2</b>	39.34	68
	<b>Cube -3</b>	35	67
<b>Average Compressive Strength in MPa</b>		36.58	67

**4. Trial 4(compressive test results)**

The 7-day and 28-day compressive test result of Trial-4 are given in the following table.

Age in days		7	28
No of Cubes		3	3
<b>Cube Strength In Mpa</b>	<b>Cube- 1</b>	47.69	76.20
	<b>Cube -2</b>	51.12	81
	<b>Cube -3</b>	49.36	79.65
<b>Average Compressive Strength in MPa</b>		50	79

**5 Trial 5(Compressive test results)**

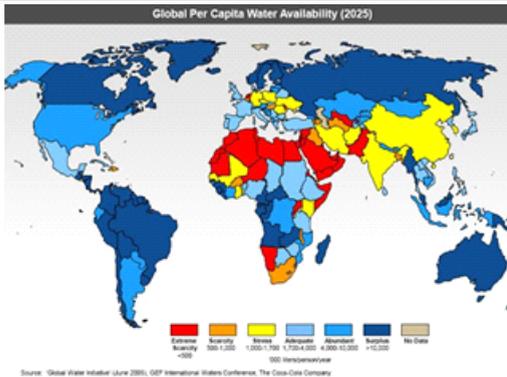
As per IS 9013-1978-Method of making, curing and determining compressive strength of accelerated cured concrete test specimens, the specimens are cured in accelerated steam curing. Accelerated Curing Method is used to get early high compressive strength in concrete.  $R_{28}(\text{Strength at 28 days}) = 8.09 + 1.64 R_a$

Where,  $R_a$  = Accelerated Curing Strength in MPa. Table F: Trial 5(compressive test results)

<b>Age in hours</b>			28
	<b>No of Cubes</b>		3
<b>Cube Strength In Mpa</b>	<b>Cube- 1</b>	$R_a=58.48$	$R_{28}=104$
	<b>Cube -2</b>	$R_a=53.12$	$R_{28}=95.2$
	<b>Cube -3</b>	$R_a=55.34$	$R_{28}=98.83$
<b>Average Compressive Strength</b>		39	60.35
<b>in MPa</b>		99.34	



Oysters in Gurgaon: the second Appu Ghar in NCR (Water Park -figure 05)



[Global capita per water availability by 2025]



[Water Reserve at Dam in India fig.- 04]

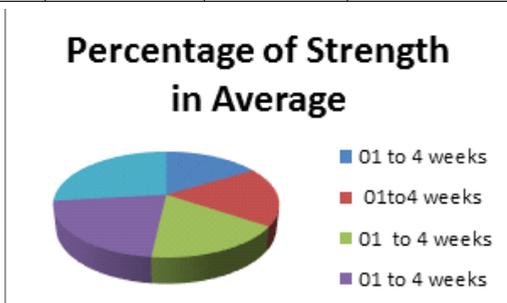


[Joint water reserve at Manada by India and Pakistan figure: 06]  
Final Result Table: (% high strength Concrete)

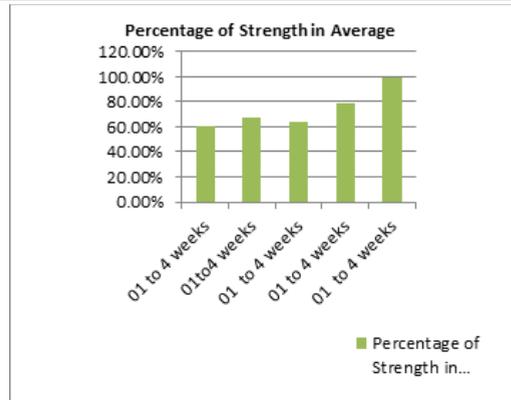
This table represents the average percentages of all five trials and their properties how strengthen the concrete process as passage of time. (Please see the tables and graphs as follows)

**7. Final result Table: 01**

Trial No	Type of Trial	No. of working Days	Percentage of Strength in Average
01	Compressive Test	01 to 4 weeks	60.35%
02	Compressive Test	01 to 4 weeks	67%
03	Compressive Test	01 to 4 weeks	64%
04	Compressive Test	01 to 4 weeks	79%
05	Compressive Test	01 to 4 weeks	99.34%
Total trial=05	Comprehensive Test of Concrete	5- 20 weeks	369.69



Percentages of high strength concrete in Pie chart ( pie chart :01)



Percentages of high strength concrete in Bar Graph (01)  
**8. Hypothesis testing:**

In this section, the researcher has trying to their level best to justify the taken hypothesis, the Observed hypothesis has accepted due to its significance level 0.1 and 0.5 level , because the role of high strength concrete M 90° /degree design plays an important role for strengthen of construction of Water Reservoir (Variable I). In hypothesis II , treated as expected hypothesis (H<sub>e</sub>) as related to variable II refers that A good design of construction work or layout would be enhance the strengthen the construction work at various projects such as water reservoir, Dam, Irrigation project, and electricity energy creation project etc.

**CONCLUSION:**

In conclusion, the above discussions are proving that water resources, the economic, social and other aspects of water storage reservoirs, it can be concluded that there is an unambiguously clear answer to the question of whether they should be built. They have to be built because economic and social progress and even the survival of the civilization depend on water storage reservoirs. water storage reservoirs into the environment. Harmonious integration of reservoirs into the environment is not a technical matter. It was pointed out that technically, the majority of negative impacts can be neutralized, mitigated or compensated, and some of the other components of ecosystem (environment), in the process of building water storage reservoirs, significantly improved. In addition to past experiences, the criteria for developing an optimum solution must be extended to include optimizations of economics, of the technical know-how, and only elements necessary for the system's functionality should be built. The present study was based on M90° degree design of concrete undertaken to develop high strength concrete and to investigate the compressive strength of concrete specimen with the addition of different percentage of silica fume and superplasticizer. Based upon the result it can be concluded that supplementary cementitious material play a significant role in strength development of concrete mixes of higher grade. It should also be noted that the supplementary cementitious material are mostly by-product which are otherwise wasted. This should be considered toward recognition of high strength concrete as an environment friendly material.

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