AN EXPERIMENTAL STUDY ON COMPRESSION STRENGTH OF CONCRETE BY MIXING AND CURING WITH SEA WATER

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Abstract - In this research work, the comparative study of effect of sea water and normal water on concrete was investigated. This paper presents the result and findings of an experimental research on the effect of sea water and normal water on compressive strength of concrete. For this concrete cubes were cast using normal water and sea water for a mix of M30 (1:3.5:2.36) by weight of concrete and 0.40 water-cement ratio. These concrete cubes were casted and cured using normal water and sea water. The reference concrete was prepared using normal water and sea water both for mixing and curing. This study examines the possibility of using seawater as an alternative to normal water in concrete mixing and curing in areas prone to sea water. The study was as a result of shortage and scarcity of normal water in some parts of the world, mostly in the coastal areas where sea water is the only source of water.

***Key Words*:** Sea water, Normal Water, Mix Design, Concrete Cube, Compressive Strength.

1. INTRODUCTION

Cocrete is the most versatlie and widely used material of construction of diverse structures for several purpose. Now a days it is basically obtained from the mixture of cement, Fine aggregate, Coarse aggregate and water in specified proportion. Consequently tests have to be carried out for quality control and compliance with specifications. Due to economical challenges and lack of natural resources involved in construction network, we have been alternated the involvement of normal water in cube casting with sea water to determine the strength of concrete at different ages in comparision with the strength at 14days after casting.

2. LITERATURE REVIEW

Swati Maniyal, Ashutosh Patil in 2015 suggested that, there is an increase in the of compressive strength of concrete cubes at early ages which were cast and cured with sea water as compared with the concrete cubes cast and cured with potable water.

P.R.Kalyana Chakravarthy in 2020 stated that there is no decrease in the strengths and durability of concrete which was mixed and cured a role as plain cement concrete utilizing ocean water. This idea can be utilized for locals having increasingly salty water and in the coastal regions having salty bore water. This concept can also be used in offshore constructions, this will be more economical and feasible.

Arunya in 2018 concluded that in the early stage There Is a increase In the Strength of the Specimen Of About (4-7)% and later on observed that there is decrease in the tensile strength of the cylinders and an increase in the compression strength of the cube after the completion of 28 days testing results.

Prof. Sagar Gawande in 2017 suggested that, there is higher in the strength of concrete specimen cast & cured with sea water as compared to those of cast & cured in normal water. The rate of the strength gain in normal water cubes is slow as compared with sea water.

3. OBJECTIVES OF THE STUDY

- To study the effect of Compressive strength of concrete.
- To study the variation of M30 grade of concrete by plotting graph compressive strength versus curing time.

To suggest that possibility of salty water in mixing and curing of concrete cube

- By providing alternate method of curing, the usage of normal water can be reduced.
- To provide a better solution to the society by saving renewable resources such as water.
- To compare the performance between concrete cube casted with normal water and cube casted with sea water.

4. CEMENT CONCRETE

Cement concrete is a hardened mass obtained from a mixture of cement, sand, gravel, and water in definite proportions. These ingredients are mixed together in a definite proportion to form a plastic mass which is poured into desired shape moulds called as forms. This plastic mass hardens on setting and we get PCC. The hardening of this mixture is caused by a chemical reaction between the cement and water.

5. MATERIALS TESTS

a) CEMENT

Cement is the chemically active ingredient of concrete. It shows binding properties after reacting with water. It consists of silicates and aluminates of calcium which form a hardened mass after mixing with water. Portland pozzolana cement is generally used for plain cement concrete.

IS (Brand – Nagarjuna cement) was used for all concrete mixes. The cement used was normal and without any lumps.

Table -1: Properties of Cement

S.No	Properties	Test Result
1	Specific gravity	3.06
2	Fineness of cement	8.5%
3	Normal Consistency	27.5%
4	Initial Setting time	30min

5	Finial Setting time	600min

FINE AGGREGATE

Aggregate size less than 4.75mm are known as fine aggregate. The sand used for the experimental programmed was locally procured and conformed to grading zone III as per IS: 383-1970.

Table -2: Properties of Fine Aggregate

S.No	Properties	Test Result
1	Specific gravity	2.6
2	Fineness modulus	3.35
3	Water absorption	2.6%

COARSE AGGREGATE

Aggregate of size more than 4.75 mm size are called coarse aggregate. locally available coarse aggregates having the maximum size of 20 mm aggregate. Testing of coarse aggregate was done as per IS: 383-1970.

Table -3: Properties of Coarse Aggregate

S. No	Properties	Test Result
1	Specific gravity	2.7
2	Fineness modulus	2.67
3	Water absorption	0.55 %

WATER

Water is the most important ingredient for the production of concrete and least expensive one also. Purpose of using water is to cause hydration of the cement. Water is also used for washing aggregates and curing. Normal Water obtained from Civil Engineering Laboratory at NSRIT College, Sontyam. Sea Water was obtained from RamaKrishna Beach, Visakhapatnam.

Table -4: Properties of Water

S. No	Properties	Test Result
1	pH (Sea Water)	7.9
2	pH (Normal Water)	6.5

6. MIX DESIGN

Concrete mix proportioning based on the guidelines of Indian Standard IS 10262:2000.
Cement = 476.25 kg/m3
Water = 190.50 kg/m3
Fine aggregates = 646.152 kg/m3
Coarse aggregate = 1127.23 kg/m3 (for 20mm)
Water Cement Ratio = 0.4
Final Mix Proportions
Cement : Fine Aggregate : Coarse Aggregate

1 : 1.35 : 2.36

7. COMPRESSIVE STRENGTH TEST

Compressive strength test is the maximum stress a material can sustain under pushing, crushing forces. The compressive strength of a material is determined by shattering fracture of the material under those forces. The compression test on a concrete cube is used to ensure the grade of concrete used for construction. Compressive strength was determined by using Compression Testing Machine.

CALCULATION OF COMPRESSIVE STRENGTH
Size of the cube = 150mmx150mmx150mm
Area of the specimen = 22500 mm^2
Compressive strength = (load / area) in N/mm^2

Compressive Strength of Cube Casted and cured with Normal Water

Compressive strength for 7 days
Maximum load applied = 460 KN = $460x10^3$ N
Compressive strength =load ÷ Area
= $(460x10^3) \div (150x150) = 20.44$ N/mm^2

Compressive strength for 14 days
Maximum load applied = 565 KN = $565x10^3$ N
Compressive strength =load ÷ Area
= $(565x10^3) \div (150x150) = 25.6$ N/mm^2

Compressive Strength of Cube Casted and cured with Sea Water:

Compressive strength for 7 days
Maximum load applied = 425 KN = $425x10^3$ N
Compressive strength = load ÷ Area
= $(425x10^3) \div (150x150) = 18.88$ N/mm^2

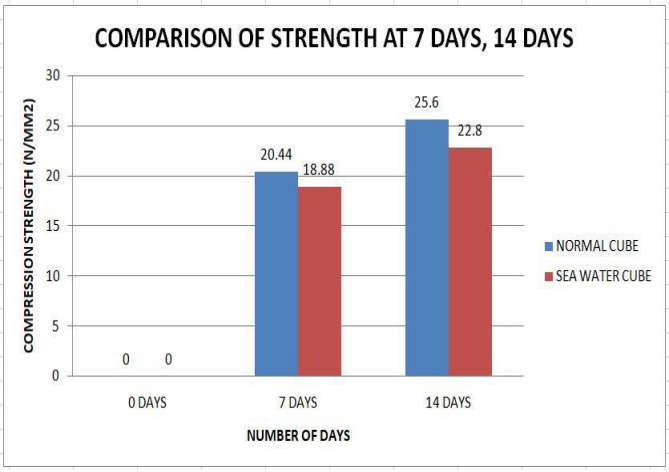
Compressive strength for 14 days
Maximum load applied = 515 KN = $515x10^3$ N
Compressive strength =load ÷ Area
= $(515x10^3) \div (150x150) = 22.8$ N/mm^2

8. RESULTS

S. No	Age of Concrete	Load applied (N)		Compressive Strength (N/mm^2)	
		Normal water	Sea water	Normal Water	Sea Water
1	7 Days	460 x 10^3	425 x 10^3	20.44	18.88
2	14 Days	565 x 10^3	515 x 10^3	25.6	22.8

9. GRAPHS

Graph 1: Comparision of Compression Strength of cubes at the age of 7 Days, 14 Days.



10. CONCLUSION

- Sea water cannot be used to produce M30 concrete keeping water cement ratio in the range of 0.40.
- Fine aggregate having high fineness modulus is also fit for producing standard concrete.
- This study has found that sea water cannot be used as for the purpose of curing and casting the concrete specimen.
- The rate of strength gain in sea water is slow when compared to normal water.
- The strength is decreased by 6% in 7 days using sea water when compared to normal water.
- The strength is decreased by 7% in 14 days using sea water when compared to normal water.

11. REFERENCE

- Prof. Sagar Gawande, Prof. Yogesh Desh mukh, Mr. Milind Bhagwat, Mr. Suhas More, Mr. Namdev Nirwal, Mr. Akshay Phadatare, "Comparative Study of Effect of Sea Water and Normal Water on Concrete", International Research Journal of Engineering and Technology (IRJET), Volume:04 (Issue:04), April-2017.
- Preeti Tiwari, Rajiv Chandak, R.K.Yadav, "Effect of sea water in the compressive strength of Concrete", Int. Journal of Engineering Research and Applications, Volume:04 (Issue:04), April2014.
- Swati Maniyal and Ashutosh Patil, "An Experimental Study on Compressive Strength of Various Cement Concrete Under Sea Water", International Journal of Scientific & Engineering Research, April-2015.
- Olutoge, F.Adeyemi and Amusan, G.Modupeola "The Effect of Sea Water on Compressive Strength of Concrete", international journal of engineering science invention, Volume: 03 (Issue:07), July-2014.
- Kalyana Chakravarthy P.R, S. Aishwarya "Suggestions for introducing treated sea water in construction industry", Materials Today: Proceedings· October 2020.
- Akinsola Olufemi Emmanuel, Fatokun Ajibola Oladipo & Ogunsanmi Olabode E "Investigation of Salinity Effect on Compressive Strength of Reinforced Concrete", Journal of Sustainable DevEmmanuel, Volume: 05 (Issue:06), May-2012.
- P. Balakrishna, P. Chamanthi "Investigation on the Use of Sea Water on Strength Properties on Different Blended Cement Concretes", International Journal of Advanced Technology and Innovative Research, Volume: 09 (Issue:01), January-2017.
- E.M. Mbadikea, A.U. Elinwa "Effect of Sea Water in the Production of Concrete", Nigerian Journal of Technology, Volume: 30 (Issue:02), July-2011.
- Akshat Dimri, Jay Kr. Varshney, V. K. Verma, Sandeep Gupta "A Review on Strength of Concrete in Seawater", International Journal of Engineering Research & Technology (IJERT), Volume: 04 (Issue:03), March-2015.
- A.Arunya, S.Rajesh "Investigational Study on Effect of Sea Water on Concrete", International Journal of Pure and Applied Mathematics, Volume: 119, (Issue:12), 2018.