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Comparative study on change of compressive strength of concrete cubes cured in normal water and saline water

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ABSTRACT

The aim of this project is to investigate the effect of sodium chloride attack on concrete cubes. For this research work M25 grade of concrete was used.To determine the property of concrete, experiments like slump test was carried out as per the mix design ,the ratio was found out to be – 1:1.24:2.09, and slump value of 60 mm where, as per IS. Code, nominal design mix ratio of M25 is 1:2:2. The Physical Properties of concrete cube, i.e. Compressive Strength after normal water curing and saline water curing were studied and results were compared. The changes were observed and are plotted respectively.

Keywords: Mix Design, Compressive Strength, Slump cone test, Sodium Chloride

I. INTRODUCTION

We have used M25 grade of concrete as it is most used grade of concrete for construction purpose. It gives the compressive strength of 25 N/mm^2, after 28 days of curing. The water – cement ratio was kept 0.45. Detoriation of concrete due to sodium attack is very common in moist weather. So, it is very important to investigate the water quality before the curing of the structure, impurities in water may interfere the setting of the cement and may adversely affect the strength properties. The ingredients present in the sodium chloride affects the setting, hardening and strength development of mixture massively. Hence, as we know that in seawater in a average we have 3.5% i.e. (35g/L) of salt is present in one litre of water. So, in this research work we have cured the concrete cubes with 3.5% of salt per litre

II. INTRODUCTION TO MATERIALS

2.1. Cement

Ordinary Portland cement of 43 grade is used for the present investigation. The cement is of uniform colour i.e. grey with a light greenish shade and is free from any hard lumps.

2.2. Fine Aggregates

The fine aggregates used for the experimental work is locally procured and conformed to grading zone III. Sieve Analysis of the fine aggregate is carried out in the laboratory as per IS 383-1870. The sand is first sieved through 4.75 mm sieve to remove any particle greater than 4.75 mm sieve and then washed to remove the dust.

2.3. Coarse Aggregates

Crushed stone aggregate (locally available) of nominal size 10 mm are used throughout the experimental study. The aggregates are washed to remove dust and dirt and are dried to surface dry condition.

2.4. Sodium chloride

The cubes were prepared using 35g of salt per 1 litre of water added.

2.5. Water

Fresh and clean tap water is used for casting the specimens in the present study. The water is relatively free from organic matter, silt, oil, sugar, chloride and acidic material as per Indian standard.

III. METHODOLOGY

To investigate the effect of salt water on compressive strength of concrete, concrete cubes were made, in which nine concrete cubes cast and cured with fresh water and nine concrete cubes were cast and cured with salt water. The amount of salt (NaCl) used in water was kept as 35g/litre).

The concrete cube size was kept 150×150×150 mm. The batching of the concrete was carried out by weight. Mixture was proportioned for the targeted cube strength of 25N/mm^2 and had a cementitious material content of 383.2kg/m3, a fine aggregate content of 800.94kg/m3, a coarse aggregate content of 1087.75kg/m3 and a water

cement ratio of 0.50. The slump cone was maintained upto 60 mm in height. When the concrete was properly mixed using the salt water and fresh water respectively, the concrete cubes mould was filled to one third of their height and compacted 25 times. The cube mould was later filled to two third of their height and finally filled completely. In each of the layer, the concrete cubes were compacted 25 times respectively. The concrete cubes were cast and cured for 7, 14 and 28 days respectively. The concrete cubes were cured for 7, 14 and 28 days respectively. After every hydration period, cubes were tested and the average compressive strength was recorded. The concrete cubes were tested in compression testing machine and the result was presented in chart and graph in the following.

IV. RESULT AND ANALYSIS

4.1.Compressive strength of concrete cube cured in fresh water

TABLE - 1

DIMENSION OF THE CUBE	AGE OF CUBE	NO. OF SPECIMEN	TEST LOADS (tonnes)	AVERAGE TEST LOADS (tonnes)	COMPRESSIVE STRENGTH (N/mm2)	AVERAGE COMPRESSIVE STRENGTH (N/mm2)
150*150*150 mm	7	1	50	50.3	16.4	16.73
		2	51.2		16.8	
		3	49.8		17	
150*150*150 mm	14	1	56	56.6	23.1	23.73
		2	56.8		23.8	
		3	57.2		24.3	
150*150*150 mm	28	1	61	61	24.8	25.06
		2	61.2		25.1	
		3	60.8		25.3	

4.2. Compressive strength of concrete cube cured in salt water

TABLE - 2

DIMENSION OF THE CUBE	AGE OF CUBE	NO. OF SPECIMEN	TEST LOADS (tonnes)	AVERAGE TEST LOADS	COMPRESSIVE STRENGTH (N/mm2)	AVERAGE COMPRESSIVE STRENGTH

				(tonnes)		(N/mm2)
150*150*150 mm	7	1	49	49.5	15.8	16.30
		2	49.5		16.5	
		3	50		16.6	
150*150*150 mm	14	1	53	53.8	22.3	23.36
		2	53.4		24.2	
		3	55		23.6	
150*150*150 mm	28	1	58	60	24.5	25.7
		2	62		24.8	
		3	63.2		25.5	

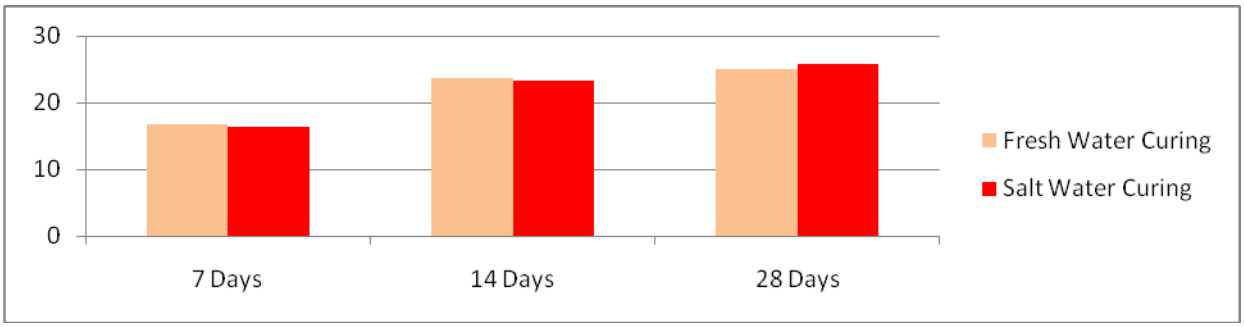

Chart – 1 Graphical representation of average compressive strength of fresh water cured cubes and saline water cured cubes

V. CONCLUSION

Series of experiments were conducted on M25 grade (1:1.24:2.09) of concrete. Cubes were cast and cured in fresh water and in salt water as per the relevant IS code of practice. The cubes were tested at different ages i.e. 7.14 and 28 days. Based on the result following conclusion can be drawn:-

1. The average compressive strength of concrete cubes cast and cured in fresh water at 7,14 and 28 days were found as 16.73 N/mm^2, 23.73 N/mm^2 and 25.06 N/mm^2 respectively.

2. The average compressive strength of concrete cubes cast and cured in salt water at 7, 14 and 28 days were found as 16.30 N/mm^2, 23.36 N/mm^2 and 25.7N /mm^2 respectively.

3. There is marginal increase in the strength of cubes cast and cured in salt water as compared to those of cast and cured in fresh water at 28 days of curing.

4. From the above finding we can conclude that there is no reduction in the strength if we use salt water casting and curing the concrete. There is some increase in the strength if salt water is used for casting and curing.

5. Thus, concrete casted in salt water can also be used for mass concreting without any decrease in strength properties**.**

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