Comparative Study of Effect of Accelerated and Normal Curing on Compressive Strength of Concrete

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Abstract: As we all know, concrete is the most extensively used building material in the world today, and compressive strength is the most desirable quality for its endurance in all weather situations. The question is, how can we know its compressive strength as soon as possible, since we need to know is the compressive strength of concrete in a short period of time, because if the required strength is not acquired, the entire project will be delayed. According to Indian standard regulations, the concrete shall be accepted or refused based on its 28-day normal cured strength. Normal concrete curing for 28 days is highly hard and time demanding for outcomes. There are no satisfactory outcomes for quantity durability. To reduce time consumption and resultant delays, rapid curing strength might be incredibly beneficial. According to IS-9013, only the 28-day strength of standard concrete from fast curing strength was predicted. This document discusses some of the efforts performed with fly ash concrete to get strength from the accelerated curing test.

INTRODUCTION

Concrete's strength is an essential aspect in its durability and overall function. Curing is an important step that contributes to the required strength and durability of concrete. Normal curing is the usual way of curing concrete, whereas accelerated curing is a technique intended to speed up the curing process. The purpose of this research is to examine the compressive strength of concrete after accelerated and conventional curing. Casting concrete sample and exposing them to both curing procedures will be part of the research. The compressive strength of the cured specimens will be measured and compared to determine the efficacy of each curing procedure. The findings of this study may be useful in determining the best curing procedures for reaching the necessary strength and durability of concrete.

ACCELERATED CURING OF CONCRETE

Concrete accelerated curing is designed to increase the rate at which the concrete gains strength. The rate of strength increase is influenced not only by curing length but also by curing temperatures. The optimal temperature for curing may be proven to be between 15 and 38 degrees Celsius. Concrete strength may be shown to be a function of the sum of curing time and temperature. This is referred to as "concrete maturity." Temperature measurement begins at -13 degrees Celsius, and time scales linearly with concrete maturity. Because of the accelerated hydration chemical processes, the strength increased with increasing curing temperature. This increase only affects the concrete's early strengths, with no detrimental consequences on final strength or breaking due by heat stress. As a consequence, concrete curing and strength growth may be hastened by increasing the curing temperature and decreasing the curing period. This is referred to as fast curing. Accelerated curing has several advantages in the manufacture of precast concrete products, including:

a) the ability to reuse the mould in less time.
b) The product may be supplied to the consumer as rapidly as feasible, boosting turnover and lowering expenses.
c) Reducing the storage space required in the factory.

I. Need for Accelerated Concrete Curing

The resulting quick strength growth of concrete offers various benefits in the concrete manufacturing business, such as greater output and faster product turnover in precast facilities. There are numerous methods for curing in the field. Accelerated curing is one method of curing that has gained popularity in precast pre-stressed concrete factories. This method of curing is useful when early strength increase in concrete is needed or when more heat is required to

achieve hydration, such as in cold weather. Accelerated curing saves curing costs and time in the manufacturing of precast parts. For many years, the use of rapid curing in the manufacturing of precast members has been standard industry practice. Early research concentrated on establishing curing cycles that maximized concrete strength while also offering economy and efficiency in plant production. However, with the increased usage of high-strength concrete in precast/pre-stressed concrete beams, several old rapid curing procedures must be reconsidered.

II. Accelerated Curing Procedures

The accelerated curing processes followed the Indian Standard technique of producing, curing, and measuring the compressive strength of accelerated curing concrete test specimens. The following are the two approaches of such rapid techniques:

Method A: Warm Water.

Method B: Boiling Water.

The current study used the boiling water technique, which conforms to IS: 9013 - 1978.

III. Experimental Investigation

The following materials are used in the present investigation. A brief description is given below regarding the materials used:

1. Cement (OPC 43 Grade)
2. Fine Aggregate
3. coarse aggregate
4. silica fume
5. water

Table 1 Physical properties of Cement OPC 43grade

1	SPECIFIC GRAVITY	3.14
2	FINAL SETTING TIME	255 microns
3	INITIAL SETTING TIME	75 microns
4	COLOUR	greyish
5	NORMAL CONSISTENCY	32%

Table 2 sieve analysis of fine aggregate

S.N.	IS SEIVE SIZE	WT. RETAIN	CUM. WT. RETAIN	CUM % WT. RETAIN	CUM% PASSING
1	10 mm	0	0	0	100
2	20 mm	0	0	0	100
3	4.75 mm	25	25	2.5	97.5
4	2.36 mm	70	95	9.5	90.5
5	1.18 mm	205	300	30	70
6	600 microns	400	700	70	30
7	300 microns	250	950	95	5
8	150 microns	50	1000	100	0

Table 3 physical properties fine aggregate

S NO	PROPERTIES	TEST RESULTS
1	Fineness Modulus	3.07
2	Specific Gravity	2.58
3	Bulk Density	
	Loose State	1603 Kg/ cum
	Compacted State	1711 Kg/cum

Table 4 sieve analysis of 20mm coarse aggregate

S NO	IS SIEVE SIZE	WT RETAINED (GM)	CUM %WT. RETAINED (GM)	CUM %WT. RETAINED (GM)	CUMULATIVE % PASSING
1	40 mm	0	0	0	0
2	0 mm	2050	41	41	59
3	10 mm	2950	59	100	0
4	4.75 mm	-	-	100	0
5	2.36 mm	-	-	100	0
6	1.18 mm	-	-	100	0
7	600 mm	-	-	100	0
8	300 mm	-	-	100	0
9	150 mm	-	-	100	0

Table 5 physical properties of coarse aggregate

S no	Properties	Test result
1	Fineness modulus	7.41
2	Specific gravity	2.62
3	Bulk density In loose state In compacted state	 1359kg/m^3 1528 kg/m^3
4	Flakiness index	12%
5	Elongation index	24%

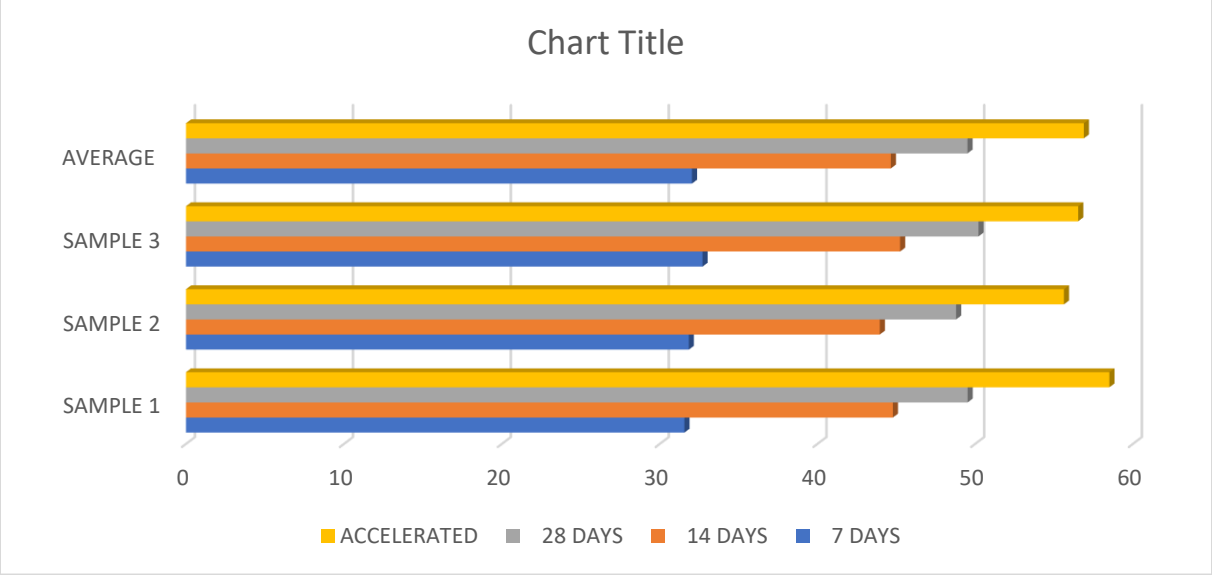
NEED OF THE PROJECT

As concrete binds every new construction, and since its discovery, concrete has changed the world's construction system and speed up to the mark, so to experiment the new way of concrete construction and in its properties in such aspect by definite mode, thus the concrete strength and durability can be enhanced and compared to use particular concrete in particular project with more perfection and efficiency.

METHODOLOGY

Sampling of concrete with or without additive (super plasticizer) is developed for mix percentage as per 10262:2019, and for each category 10 samples were made, and comparative research on each parameter was performed, which led to this study.

Casting molding is done in accordance with IS:516-1959, and 10 cubes will be cast for each category at the same time.



	SAMPLE 1	SAMPLE 2	SAMPLE 3	AVERAGE
7 DAYS	31.56	31.84	32.71	32.04
14 DAYS	44.78	43.95	45.24	44.65
28 DAYS	49.52	48.79	50.21	49.51
ACCELERATED	58.51	55.63	56.53	56.89

RESULT

It was found that accelerated curing gives 15.00 % higher side compressive strength than normal curing sample in 28 days, instead these accelerated results can prove the compressive strength of any concrete