A PPC CONCRETE STUDY AND REPETITION WITH A PARTIAL REPLENISHMENT OF LOCALLY AVAILABLE ASHES

M.KRISHNA REDDY[1], SHAIK MOHAMMAD ABRARTAHA[2], Dr.K.RAJASEKHAR[3]

[1]PG STUDENT, CIVIL ENGINEERING DEPARTMENT, SIDDARTHA EDUCATIONAL ACADEMY GROUP OF INSTITUTIONS, TIRUPATI.
[2]ASST PROF, CIVIL ENGINEERING DEPARTMENT, SIDDARTHA EDUCATIONAL ACADEMY GROUP OF INSTITUTIONS, TIRUPATI.
[3]PROFESSOR , CIVIL ENGINEERING DEPARTMENT, SIDDARTHA EDUCATIONAL ACADEMY GROUP OF INSTITUTIONS, TIRUPATI.

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Abstract - This study investigates the improved qualities of concrete that result from partially substituting locally accessible ashes for some of the traditional cement and adding Portland Pozzolana Cement (PPC). The study looks into how this unique blend affects the mechanical and structural properties of concrete with the goal of advancing economical and environmentally friendly building techniques. The study assesses the effects of different amounts of locally obtained ashes on the workability, durability, and compressive strength of the concrete by thoroughly examining the mix design. It is expected that the use of PPC will augment the pozzolanic reactivity, thus improving the concrete mixture's overall performance. To promote information sharing among researchers, engineers, and industry experts, recitation sessions will be held to share the ideas and findings from this study. This study intends to optimise concrete compositions for improved structural integrity and decreased environmental effect, in line with sustainable construction practises, in addition to addressing the environmental consequences of using locally accessible ashes.

***Key Words*:** Concrete, Locally Accessible Ashes, Portland Pozzolana Cement, Workability, Durability, and Compressive strength.

1.INTRODUCTION

The utmost contest earlier the edifice trade is to serve the two pressing desires of human refinement namely the protection of the environment and meeting the subedifice requirement of our growing population and consequentially desires of tradition and sprawl in the past. The concrete trade has met these desires very well. However, for a variety of reasons, the situation has changed now.

The cement and concrete industries due to their large size are unquestionably feasible scope for economic and safe benign of millions of tones of trade by products such as fly ash, silica fume, slag, rice husk ash. Due to their possessions, by¬products can be used in certain amount such as cement replenishment material than in the practice today. In fact, these mixes replenishd by 15% of by-products have shown high forte and sturdiness at relatively early ages. This development has aloof one of the strong objections to the use of high volume of by products in mortar cubes.

Therefore, it should be obvious that certain scale cement replenishment with trade by products is highly advantageous from the stand point of cost, economy, vigor efficiency, sturdiness and overall ecological and environmental benefits.

The advantageous in concrete technology method of edifice and type of edifice have paved the way to make the best use of locally available materials by judicious mix proportioning and proper workmanship so as to result in a edifice trade satisfying the recital requirements. Proper design of mixes is intended to obtain such proportioning of fixings that will produce of high sturdiness during the designed life of a edifice.

High recital does not necessarily require high forte, it is proportioning of mixes, which has low-slung, as possible for particular use that governs the long-term high forte recital recitation of a edifice.

1.2. ADMIXTURES

This periodical provides affords on the types and functions of admixtures that have been, or are being, normalized in Europe for enactment in national normals in CEN member countries. It also provides guidance on the circumstances when it may be necessary to specify an admixture to a concrete producer.

Admixtures are materials other than cement, aggregate and water that are added to concrete either earlier or during its mixing to alter its possessions, such as workability, curing temperature range, set time or color. Some admixtures have been in use for a very long time, such as calcium chloride to provide a cold-weather setting concrete. Others are more recent and represent an area of expanding possibilities for increased recital. Not all admixtures are economical to employ on a particular project. Also, some characteristics of concrete, such as low absorption, can be achieved simply by consistently adhering to high quality concreting practices.

Admixtures are now widely accepted as materials that contribute to the production of durable and cost-effective concrete edifices. The contributions include improving the handling possessions of fresh concrete making placing and compaction easier, reducing the permeability of hardened concrete, and providing freeze/thaw resistance.

TYPES OF ADMIXTURES

Admixtures vary widely in chemical composition, and many perform more than one function. Two basic types of admixtures are available:

1) Mineral admixtures.

2) Chemical admixtures.

All admixtures to be used in concrete edifice should meet stipulations; tests should be made to evaluate how the admixture will affect the possessions of the concrete to be made with the specified job materials, under the anticipated ambient conditions, and by the anticipated edifice procedures.

1) MINERAL ADMIXTURES

Mineral admixtures (fly ash, silica fume [SF], and slag) are usually added to concrete in larger amounts to enhance the workability of fresh concrete; to improve resistance of concrete to thermal cracking, alkali-aggregate enlargement, and sulfate attack; and to enable a reduction in cement content.

(a) Fly Ash

(b) Silica Fume

(c) Ground Granulated Blast Furnace Slag

(d) Rice husk ash

2) CHEMICAL ADMIXTURES

Chemical admixtures are added to concrete in very small amounts mainly for the entrainment of air, reduction of water or cement content, plasticization of fresh concrete mixtures, or control of setting time.

Seven types of chemical admixtures are specified in ASTM C 494, and AASHTO M 194 [06], depending on their purpose or purposes in PCC. Air entraining admixtures are specified in ASTM C 260 and AASHTO M 154[05]. General and physical requirements for each type of admixture are included in the stipulations.

(a) Air-Entrainment agents.

(b) Water-Reduecers.

(c) Set-Retarders.

(d) Accelerators.

(e) Superplasticizers.

FUNCTIONS

In ACI 212-3R [01], the reasons for the use of admixtures are outlined by the following functions that they perform:

i. Increase workability without increasing water content or decrease the water content at the same workability

ii. Retard or accelerate time of initial setting.

iii. Reduce or prevent shrinkage or create slight enlargement

iv. Modify the rate or capacity for bleeding

v. Reduce segregation

vi. Improve pumpability

vii. Reduce rate of slump loss

viii. Retard or reduce heat evolution during early hardening

ix. Accelerate the rate of forte development at early ages

x. Increase forte (compressive, tensile, or flexural)

xi. Increase sturdiness or resistance to severe conditions of exposure, including application of deicing salts and other chemicals

xii. Decrease permeability of concrete

xiii. Control enlargement caused by the retortion of alkalies with potentially retortive aggregate residents

xiv. Increase bond of concrete to steel reinforcement

xv. Increase bond between existing and new concrete

xvi. Improve impact and abrasion resistance

xvii. Inhibit corrosion of embedded metal and Produce colored concrete or mortar

The edifice trade is now slowly becoming aware of the environmental issues and other sustainable development issues for cement and concrete industries. It is looking for the ways and means to develop building products, which will increase the life span and quality, it is in this regard that merit of using silica fume, ground granulated blast furnace slag, fly ash and rice husk ash have been well recognized by the edifice trade.

Count of these materials was found to have enhanced the basic possessions including forte and sturdiness both in fresh and hardened state.

There have been subtle changes in the way aggregates are used. Proportioning between different sizes is now much more flexible is designed for specific purpose in response to intended specific recital criteria. There has also been development in the optimum use of locally available materials with the consideration of economy. Finally, count of admixtures with PSC is more than that of the OPC in the similar way..

2. SCOPE AND OBJECTIVES

The present scrutiny is aimed at using of waste material like fly ash, Silica fume, slag, rice husk ash, which is otherwise hazardous to environment. This may be used as partial replenishment of cement. This leads to economy, utilization of trade waste in useful way and environmental reduction of pollution to great extent.

Initial and final setting times, compressive forte of cement mortars 1:3 (made from Portland Slag Cement and Ordinary Portland Cement) and soundness of cement were the factors considered which are likely to be influenced by the partial replenishment of cement by admixtures.

In order to facilitate the analysis, interpretation of results is carried out at each phase of the experimental work. In this scrutiny, the replenishment of cement by admixtures will effect the forte development of cube.

This interpretation of results obtained is based on the current knowledge as available in the literature as well as on the normals specified by codes (Normals specified by IS 456-2000[22] are considered).

1. The averages of both setting times of at least three cement samples prepared with mineral and chemical admixtures are compared with those of the cement specimens prepared with ordinary cements. If the difference is less than 30 minutes, the change is considered to be negligible or insignificant and if the

difference is more than 30 minutes, the change is considered to be significant.

2. The average soundness test results of three samples prepared with different admixtures under consideration are compared with that of samples made with ordinary cements. The unsoundness of the specific sample, made with mixing mineral admixtures of particular percent, is significant if the result of the Le- chatelier's test is more than 10 mm.

3. Average compressive forte of at least three cubes prepared with mineral and chemical admixtures under consideration is compared with that of three similar cubes prepared with ordinary cements. If the variation in the forte is less than 10%, it is considered to be insignificant and if it is greater than 10%, it is considered to be significant.

The principal objectives of the present scrutinys are:

1. To study the effect of replenishment of cement by various admixtures like fly ash, ground granulated blast furnace slag, silica fume, rice husk ash when they are mixed with superplasticizer and without superplasticizer on initial and final setting times of cements both the Portland Slag Cement and the Ordinary Portland Cement.

2. To examine the effects of these substances with 10 percent replenishment of cement mortar cubes on short term and long term forte development.

3. To find the fortes of cement mortar cubes after conducting various sturdiness tests like acid, alkaline and sulphate test.

2. EXPERIMENTATION

In the present chapter, the physico-chemical possessions of cement, sand and water used in the scrutiny were analyzed based on and also the normal experimental procedure laid down in the normal codes, like IS, ASTM and BS codes. These normal experimental procedures were adopted for the fortitude of normal consistency, initial and final setting times, and soundness of cement and compressive forte of cement mortar cubes. In establishing these requirements, careful consideration of possessions of locally available materials has to be accounted for.

4.2. MATERIALS

The materials used in the experimental scrutiny include:

- Portland Slag Cement (PSC)
- Ordinary Portland Cement (OPC)
- Fly Ash
- Ground Granulated Blast Furnace Slag (GGBS)
- Silica fume
- Rice Husk Ash (RHA)
- Superplasticizers
- Fine aggregate
- Water

The possessions of these materials are given in the following sub-sections

4.2.1. CEMENT

There are many types of cement in the market to suit every need. Out of them some are included in the initial experiments like initial setting time, final setting time, compressive forte and soundness test on mortar cubes were conducted on various grades of cement.

4.2.1.1- Ordinary Portland Cement

Even nevertheless only Ordinary Portland Cement is graded according to forte, the other cements too have to gain a particular forte. 33, 43 and 53 grade in OPC indicates the compressive forte of cement after 28 days when tried as per IS: 4031-1988[25], eg, 33 Grade means that 28 days of compressive forte is not less than 33 N/mm2 (MPa) . Similarly for 43 grade and 53 grade the 28 days compressive forte should not be less than 43 and 53 MPa respectively. 43 and 53 grade are also being introduced in PPC and PSC shortly by the Bureau of Indian Normals (BIS). The compressive forte of cement when tried as per IS code shall be minimum 43 MPa. Cement used in the present scrutiny is Zuari 43 Grade. The physical and chemical possessions of this cement are given in the table no.4.2 (a) below.

Table -1: The Physical and Chemical possessions of OPC

	Fineness	Soundness by		Setting Time		Compressive Forte in MPa			
IS CODE	(Sq.m/ Kg) Min	Lechatlier (mm)	Auto clave	Initial	Final	3Day	7Day	28 Day	90
			Max (%)	(min)	(min)	MPa	MPa	MPa	M
(IS 8112-1989)	225	0.77	0.8	123	218	28.33	37.00	44.00	4

CHEMICAL CHARACTERISTICS OF 53 GRADE OPC

IS CODE	Lime Saturation Factor	Alumina Ratio Min.	Insoluble Residue (%) Max	MgO (%)	Suiphuric anhydride	Loss on Ignan (%
(IS 12269-1987)	0.8 Min 1.02 Max	0.65	3	6	2.5% Max when C3A is 5 or less 3% Max when C3A is greater than 5	5

Portland Slag Cement

PSC is obtained by mixing blast furnace slag, cement clinker and gypsum and grinding them together to get intimately mixed cement. The quantity of slag varies from 30-70%. The gain of forte of PSC is somewhat slower than OPC. Roth PPC and PSC will give more forte than that of OPC at the end of 12 months. PPC and PSC can be used in all situations where OPC is used, but are preferred in mass edifice where lower heat of hydration is advantageous or in marine situations and edifices near seacoast or in general for any edifice where extra sturdiness is desired. Cement used in the present scrutiny is ultratech (PSC).The physical and chemical possessions of this cement are given in the table below.

S. No.	Physical Possessions	Result	IS: 455-1989
1	Specific gravity	3.02	3.16
2	Normal consistency	36%	Not specified
	Setting times (minutes)		
3	a) Initial	133	Not less than 30
	b) Final	257	Not more than 600
	Compressive forte (MPa)		
A	a) 3 days	24.30	Not less than 16
t	b) 7 days	33.32	Not less than 22
	c) 28 days	44.50	Not less than 33

S. No.	Chemical Possessions	Test results	Requirements of IS: 455 1989
1	Magnesia (% by mass)	3.52	8.0 max
2	Sulphur trioxide(%by mass)	2.23	3.0
3	Sulphide sulphur	0.25	1.5
4	Total loss on ignition	1.02	5.0
5	Insoluble residue	0.94	4.0
6	Chloride	0.005	0.1

Fly Ash

Table 2: The Physical and Chemical possessions of fly ash

S. No.	Physical Characteristics	Percentage
1	Silica SiO_2	49-67
2	Alumina AI2O3	16-28
3	Iron oxide Fe_2O3	4-10
4	Lime CaO	0.7-3.6
5	Magnesia MgO	0.3-2.6
6	Sulphur trioxide SO3	0.1-2.1
7	Loss on ignition	0.4-0.9
8	2/I Surface area m /kg	230-600

S.No.	Chemical Characteristics	Requirement	Composition of fly ash u
1	Silica + alumina + iron oxide % by mass	70 (min)	94.2
2	Silicon dioxide % by mass	35 (min)	53.0
3	Magnesium oxide % by	5 (max)	1.19
4	Sulphur trioxide % by mass	2.75 (max)	0.04
5	Available alkalies as sodium oxide % by mass	1.5 (max)	0.46
6	Loss on ignition	12 (max)	0.34

Ground Granulated Blast Furnace Slag (GGBS)

Table 4: The Physical and Chemical possessions of GGBS

Sl. No.	Physical Characteristics	Possessions of Slag used
1	Specific gravity	2.90
2	Fineness m^2/kg	330
3	Glass content percent	93
4	Bulk density Kg/m^3	1100
5	Color	Dull white

S. No.	**Compound**	**Chemical Requirement (BS:6699)**	**Possessions of Slag used**
1	**SiO_2**	**32-42**	**33.2**
2	**$A1_2O_3$**	**7.15**	**18.2**
3	**CaO**	**32-45**	**41.0**
4	**Fe_2O_3**	**0.1-1.5**	**1.3**
5	**MgO**	**14 max**	**11.60**
6	**SO_3**	**2.5 max**	**1.0**
7	**CaO/ SiO_2**	**1.4 max**	**1.23**
8	**Loss on ignition**	**3 max**	**0.5**

Rice Husk Ash

Table 3: The Physical and Chemical possessions of Rice Husk Ash

S. No.	Physical Possessions	Result
1	Variety	Mixed
2	Calorific value	3350 Kcal/kg
3	Specific gravity	2
4	Loss on ignition	3.6%
5	Burning	Open
6	Fineness Blains	16000 cm^2/gm
S. No.	Chemical Constituent	Percentage
1	Si02	93.2
2	A1203	0.9
3	Fe203	0.45
4	MgO	0.40
5	CaO	3.15
6	KO	1.6

Superplasticizer

Table 5: The Possessions of Super plasticizer

S. No.	Possessions	Result
1	Specific gravity	1.22 to 1.225 at 30° C
2	Chloride content	Nil as per IS:456-2000
3	Air entrainment	Approximately 1 % countal air is entrained
4	Compatibility	Can be used with all types of cements except high alumina cement
5	Workability	Can be used to produce following concrete that requires no compaction
6	Cohesion	Interconnectionis improved due to dispersion of cement particles thus minimizing the segregation & improving surface finish
7	Compressive forte	Early forte is increased up to 20% if water reduction is taken advantage
8	Sturdiness	Reduction in water cement ratio enable increasing density & impermeability thus enhancing sturdiness of concrete

3.TEST PROGRAMME

The details of the mineral and chemical admixtures used in the experimental work are presented in Table 4.3(a) & (b). A total of 60 samples of normal mould used in Vicat's gadget were cast and tried for initial and final setting times experiments. The same number of samples of normal mould was used in Le-chatelier s equipment to test for soundness. A total of 420 mortar cubes of 50 sq-cm cross-sectional area were tried at different ages (3, 7, 28 and 90 days) for compressive forte. For entire experimental programme altogether 540 samples were casted and tried.

Table 6 Details of Test Programme

Sl. No.	Constituent	No. of specimens for setting time test	No. of specimens for soundness test	No. of specimens for compression test
1	PSC	3	3	3x4
2	PSC + 10% Fly Ash Rep.	3	3	3x4
3	PSC+10% GGBS Rep.	3	3	3x4
4	PSC +10% Mierosilica Rep.	3	3	3x4
5	PSC +10% Rice Husk Ash Rep.	3	3	3x4
6	PSC + SP	3	3	3x4
7	PSC+10% Fly Ash Rep. + SP	3	3	3x4
8	PSC +10% GGBS Rep. + SP	3	3	3x4
9	PSC +10% Silica fume Rep.+ SP	3	3	3x4
10	PSC +10% Rice Husk Ash Rep.+ SP	3	3	3x4
11	OPC	3	3	3x4
12	OPC + 10% Fly Ash Rep.	3	3	3x4
13	OPC +10% GGBS Rep.	3	3	3x4
14	OPC +10% Silica fume Rep.	3	3	3x4
15	OPC +10% Rice Husk Ash Rep.	3	3	3x4
16	OPC+SP	3	3	3x4
17	OPC+10% Fly Ash Rep. + SP	3	3	3x4
18	OPC +10% GGBS Rep. + SP	3	3	3x4
19	OPC +10% Silica fume Rep.+ SP	3	3	3x4
20	OPC +10% Rice Husk Ash Rep.+ SP	3	3	3x4

4.TEST RESULTS AND DISCUSSIONS

Table 7: Initial and final setting times, soundness of cement, compressive forte and percent change in compressive forte of cement mortar cubes at different ages made with 10% replenishment of mineral admixtures with and without superplasticizer in Portland Slag Cement.

SI. No.	Cement + Admixture	Initial setting time (min)	Final setting time (min)	Soundness (mm)	Compressive forte MPa				Percent change in compressive forte			
					3 day	7 day	28 day	90 day	3 day	7 day	28 day	90 day
1	PSC	133	257	0.25	24.30	33.32	44.580	50.80	0	0 *	0	.<0
2	PSC+10% MS	127	265	0.80	23.20	30.21	40.60	49.20	-4.53	-9.33	-8.76	-3.15
3	PSC + 10% FA	155	190	1.10	24.33	32.24	42.20	51.33	0.12	-3.24	-5.17	1.04
4	PSC+10% RHA	150	211	0.30	23.00	30.10	42.20	47.20	-5.35	-9.66	-5.17	-7.09
5	PSC + 10% GGBS	170	282	1.50	24.33	31.40	39.40	48.60	0.12	-5.76	-11.46	-4.33

Table 8: Initial and final setting times, soundness of cement, compressive forte and percent change in compressive forte of cement mortar cubes at different ages made with 10% replenishment of mineral admixtures with and without superplasticizer in Ordinary Portland Cement.

SI. No.	Cement + admixture	Initial setting time (min)	Final setting time (min)	Soundness (mm)	Compressive forte MPa				Percent change in compressive forte			
					3 day	7 day	28 day	90 day	3 day	7 day	28 day	90 day
1	OPC	123	218	0.77	28.33	37.00	44.00	49.40	0	0"	0	0
2	OPC +10%MS	113	188	1.20	16.82	29.00	38.00	44.00	-40.61	-21.31	-12.64	-10.93
3	OPC +10% FA	139	224	0.29	23.02	28.60	42.50	47.33	-18.74	-22.58	-3.41	-4.19
4	OPC +10% RHA	85	200	0.50	21.16	26.00	31.90	42.67	-25.31	-29.64	-27.36	-13.62
5	OPC+ 10% GGBS	90	210	1.30	24.56	30.00	41.80	44.33	-13.3	-18.69	-4.95	-10.26
6	OPC + SP	120	240	0.58	21.66	30.00	38.70	47.80	-23.54	-18.53	-11.	-3.24

Note: SP=Superplasticizer, GGBS =Ground Granulated Blast Furnace Slag, OPC=Ordinary Portland Cement, RHA= Rice Husk Ash

Table 9 Sturdiness Tests of the Portland Slag Cement made with 10% replenishment of mineral admixtures with and without superplasticizer on the compressive forte

SI. No.	Cement + Admixture	Compressive Forte (Mpa)	Acid Test(Mpa)	Alkaline Test (Mpa)	Sulphate Test (Mpa)	% Loss in Compressive Forte in Acid Test	% Loss in Compressive Forte in Alkaline Test	% Loss in Compressive Forte in Sulphate Test
1	PSC	50.80	18.66	15.00	14.06	63.25	59.82	62.34
2	PSC +10% MS	49.20	9.50	12.16	8.00	71.50	63.52	76.00
3	PSC +10% FA	51.33	12.03	19.05	16.33	69.84	52.24	59.06
4	PSC +10% RHA	47.20	14.23	17.13	17.00	63.95	56.60	56.93
5	PSC +10%GGBS	48.60	13.11	16.88	17.67	64.44	54.22	52.07
6	PSC+ SP	54.30	19.17	22.33	22.50	61.14	54.73	54.39

Table 10 Sturdiness Tests of the Ordinary Portland cement made with 10% replenishment of mineral admixtures with and without superplasticizer on the compressive forte

SI No.	Cement + Admixture	Compressive Forte (Mpa)	Acid Test MPa	Alkaline Test (Mpa)	Sulphate Test (Mpa)	% Loss in Compressive Forte in Acid Test	% Loss in Compressive Forte in Alkaline Test	% Loss in Compressive Forte in Sulphate Test
1	OPC	49.40	19.73	20.00	19.00	60.06	59.51	61.54
2	OPC +10% MS	44.00	18.00	19.77	17.87	59.09	55.07	59.39
3	OPC +10% FA	47.33	17.33	18.67	18.25	63.38	60.55	61.44
4	OPC +10% RHA	42.67	16.17	18.33	17.60	62.10	57.04	58.75
5	OPC +10% GGBS	44.33	18.57	22.53	20.73	58.11	49.18	53.24

6	OPC + SP	47.80	14.33	17.67	14.33	70.02	63.03	70.02
7	OPC + 10% MS + SP	40.67	14.67	15.07	. 15.93	63.93	62.95	60.83
8	OPC + 10% FA + SP	46.00	15.70	18.37	16.77	55.65	48.11	52.63
9	OPC + 10% RHA+ SP	34.33	14.00	14.50	14.67	59.22	57.76	57.27
10	OPC + 10% GGBS + SP	43.33	17.33	20.83	20.17	60.00	51.93	53.45

Table 11 Percentage loss in heft for Portland Slag Cement

Sl. No.	Cement + Admixture	Acid Test	Alkaline Test	Sulphate Test
1	OPC	1.47	0.00	0.00
2	OPC + 10% MS	1.11	3.42	0.00
3	OPC + 10% FA	0.50	0.00	0.37
4	OPC + 10% RHA	1.57	0.00	0.00
5	OPC + 10% GGBS	1.46	0.00	0.00
6	OPC + SP	0.36	0.00	0.00
7	OPC + 10% MS+ SP	0.63	0.00	0.00
8	OPC + 10% FA + SP	1.10	0.00	1.22
9	OPC + 10% RHA + SP	0.75	0.00	1.14
10	OPC+ 10%GGBS+SP	0.87	0.00	0.13

Table 12 Percentage loss in heft for Ordinary Portland Cement

Sl. No.	Cement + Admixture	Acid Test	Alkaline Test	Sulphate Te
1	PSC	1.27	2.62	0.00
2	PSC+10% MS <-	2.20	0.98	0.00
3	PSC + 10% FA	2.47	0.12	0.00
4	PSC + 10% RHA	1.49	0.00	0.00
5	PSC + 10% GGBS	1.59	0.37	0.00
6	PSC+ SP	1.94	0.00	0.00
7	PSC + 10% MS+ SP	0.98	0.00	0.00
8	PSC + 10% FA + SP	0.76	0.00	0.00
9	PSC + 10% RHA + SP	0.12	0.00	0.00
10	PSC + 10% GGBS + SP	0.36	0.00	0.00

5. CONCLUSIONS

Based on the results obtained in the present scrutiny in Chapter 5, the following conclusions can be drawn.

- PSC with 10% replenishment of inanimate admixtures like fly ash, ground granulated blast furnace slag, with superplasticizer retards the setting times destiguineshly where as in the case of rice husk ash with and without superplasticizer accelerates both the initial and final setting times destiguineshly.
- PSC with 10% replenishment of all admixtures with and without SP the percentage change in compressive forte is meagre and further it is observed that

the decrease in compressive forte is significant in the case of RHA with SP at lateral ages.

- Significant loss in compressive forte is observed in PSC and PSC with replenishment of inanimate admixtures with and without superplasticizer when the samples are tried in acid, alkali and sulphate solutions.
- OPC with 10% replenishment of mineral admixtures like fly ash, ground granulated blast furnace slag and silica fume with superplasticizer retards final setting time destiguineshly, where as in the case of rice husk ash with and without superplasticizer accelerates both the initial and final setting times distinguishely.
- OPC with 10% replenishment of fly ash, ground granulated blast furnace slag and silica fume with and without superplasticizer the percentage change in compressive forte is decreased ditinguishely and further, it is observed that this decrease in forte slightly increases at lateral days.
- OPC with 10% replenishment of mineral admixtures like fly ash, ground granulated blast furnace slag, silica fume and rice husk ash with and without superplasticizer, the loss in compressive forte in Acid Test, alkali and sulphate test is distinguished.
- From the test analysis it can be inferred that the PSC in all the cases performing better than that of the OPC. Hence it is prefarable to use PSC.

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