PERFORMANCE EVALUATION OF AERATED AUTOCLAVED CONCRETE BLOCKS USING SILICA FUME

Sandip M. Rathod[1], Prof. Yogesh V. Akbari[2]

[1]PG student, Master of Structural Engineering, DIET-Rajkot, Gujarat, India

[2]Assistant Professor, Civil Department, DIET-Rajkot, Gujarat, India.

ABSTRACT: At present in India, around 960 million metric tonne of huge amounts of strong waste is being created every year as repercussions amid modern, mining, civil, farming and other forms. Propels in strong waste administration brought about option development materials as a substitute to customary materials such as blocks, squares, tiles, totals, pottery, concrete, lime, soil, timber and paint. To protect the earth, endeavors are being made for reusing diverse squanders and to use them in worth included applications. In the previous two decades, different examinations have been directed on mechanical squanders such as fly ash, Ground granulated blast furnace slag, Silica smolder, rice husks, cooper tailing, natural zeolite, silica fume and other modern waste materials to go about as concrete substitutions. In This paper cover study of the using the silica fume in AAC blocks by replacing cement in various amounts 0%, 2.5%, 5%, 7.5%, 10%, 12.5%, 15%, 17.5%, 20%, 22.5%, 25%.

Key words: Silica fume, Compressive Strength, Flexural Strength, Water absorption, Moisture Content, Durability Tests

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1.1 INTRODUCTION

The development of country has shown the recent advances of infrastructure. Furthermore time, use of AAC block has grown vast compare to clay brick. AAC block is light weight concrete which is made by use of Aluminium powder, fly ash, and lime. The chemical reaction of Aluminium paste makes it a porous structure having light weight and enhanced insulation properties making it different from other light weight concrete. Powdered zinc may also be added in place of aluminium powder. Hydrogen peroxide and bleaching powder have also been used instead of metal powder. But this practice is not widely followed at present. Autoclaving is the high temperature and high pressure steam curing process. The Silica Fume is a waste of industrial materials, which is essentially consisting pozzolanic material. Silica fume is a very fine pozzolanic, amorphous material, a by-product of the production of elemental silicon or ferrosilicon alloys in electric arc furnaces. Silica fume is a byproduct in the carbothermic reduction of high-purity quartz with carbonaceous materials like coal, coke, wood-chips, in electric arc furnaces in the production of silicon and ferrosilicon alloys. The Silica Fume is used as additive material in concrete, mortar and cement. Silica fume is added to Portland cement concrete to improve its properties, in particular its compressive strength, bond strength, and abrasion resistance.

1.2 OBJECTIVES

- To evaluate the compressive strength of AAC blocks having replacement of cement by silica fume from 0%, 2.5%, 5%, 7.5%, 10%, 12.5%, 15%, 17.5%, 20%, 22.5%, 25%.
- To evaluate the flexural strength of AAC blocks having replacement of cement by silica fume from 0%, 2.5%, 5%, 7.5%, 10%, 12.5%, 15%, 17.5%, 20%, 22.5%, 25%.
- To evaluate the durability of AAC blocks having replacement of cement by silica fume from 0%, 2.5%, 5%, 7.5%, 10%, 12.5%, 15%, 17.5%, 20%, 22.5%, 25%.
- To evaluate the bulk density and moisture content of AAC blocks having replacement of cement by silica fume from 0%, 2.5%, 5%, 7.5%, 10%, 12.5%, 15%, 17.5%, 20%, 22.5%, 25%.

1.3 MATERIALS

CEMENT

Cement use in production of AAC block is Ordinary Portland cement with 53 grade purchasing from the High bond cement company.

FLY ASH

Fly ash provide from the wanakbori thermal power station in kheda district Gujarat. The class of fly ash is F class.

ALUMINUM POWDER

In production of AAC block aluminum powder is necessary ingredient. For each cubic meter production of AAC block, 0.5 kg Aluminum powder consume. 65% Purity of Aluminum powder is required for production of AAC block.

LIME

In production process of AAC block lime powder or lime fine aggregate were used.

GYPSUM

Gypsum use for production of AAC block is in powder form.

SILICA FUME

For production of AAC block the SILICA FUME is provide from the **Stallion Energy Pvt. Ltd. Company.**

WATER

Water provide for the manufacturing of AAC block is portable water.

1.4 MIX PROPORTION FOR AAC BLOCKS.

AAC Block Mixes	Cement (kg)	Fly Ash (Class-F) (kg)	Lime (kg)	Gypsum (kg)	Silica Fume (kg)	Aluminum Powder (kg)
	STANDARD BLOCKS					
SF 0 %	250	1390	160	20	0	1.34
	SILICA FUME BASED BLOCKS					
SF 2.5 %	243.75	1390	160	20	6.25	1.34
SF 5 %	237.5	1390	160	20	12.5	1.34
SF 7.5 %	231.25	1390	160	20	18.75	1.34
SF 10 %	225	1390	160	20	25	1.34
SF 12.5 %	218.75	1390	160	20	31.25	1.34
SF 15 %	212.5	1390	160	20	37.5	1.34
SF 17.5 %	206.25	1390	160	20	43.75	1.34
SF 20 %	200	1390	160	20	50	1.34
SF 22.5 %	193.75	1390	160	20	56.25	1.34
SF 25 %	187.50	1390	160	20	62.5	1.34

1.5 TEST RESULTS FOR PROPERTIES OF AAC BLOCK

A. Compressive Strength of AAC blocks

Sr . No.	Type Of Mixes	Compressive strength of AAC blocks	
		7 days	28 days
1	SF 0%	2.19	3.27
2	SF 2.5%	2.41	3.74
3	SF 5%	2.73	4.12
4	SF 7.5 %	2.94	4.58
5	SF 10%	3.27	4.97
6	SF 12.5%	3.63	5.39
7	SF 15%	4.02	5.89
8	SF 17.5%	3.68	5.39
9	SF 20%	3.26	4.95
10	SF 22.5%	3.01	4.48
11	SF 25%	2.15	3.24

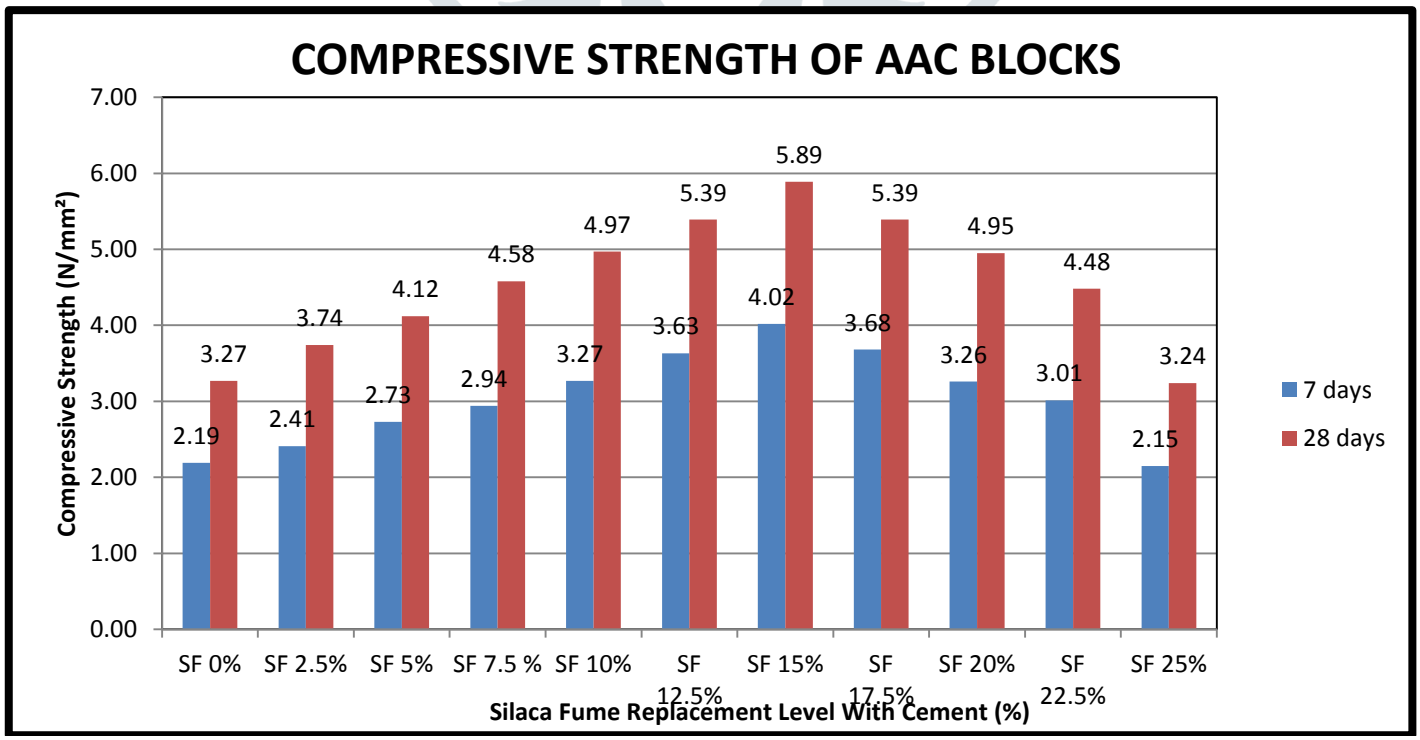

Fig. 1..5(a) Compressive Strength of AAC blocks

B. Flexural Strength of AAC blocks

Sr.No.	Type Of Mixes	Flexural Strength of AAC block
1	SF 0%	0.47
2	SF 2.5%	0.54
3	SF 5%	0.58
4	SF 7.5 %	0.61
5	SF 10%	0.63
6	SF 12.5%	0.64
7	SF 15%	0.68
8	SF 17.5%	0.62
9	SF 20%	0.57
10	SF 22.5%	0.51
11	SF 25%	0.49

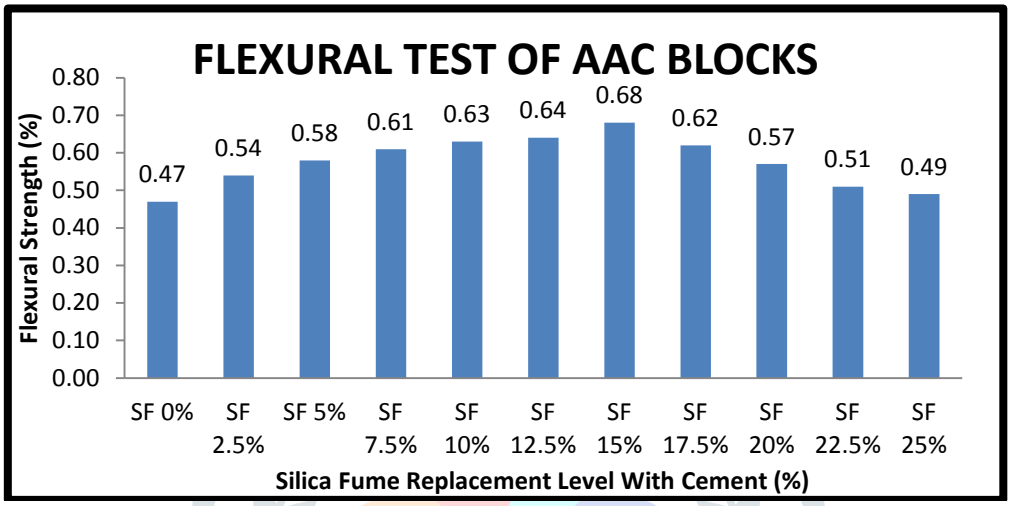

Fig. 1..5(b) Flexural Strength of AAC blocks

C. Water Absorption test of AAC blocks

Sr.No.	Type Of Mixes	Water Absorption of AAC block
1	SF 0%	63.60
2	SF 2.5%	61.42
3	SF 5%	59.47
4	SF 7.5 %	56.86
5	SF 10%	54.11
6	SF 12.5%	52.18
7	SF 15%	51.48
8	SF 17.5%	50.18
9	SF 20%	49.06
10	SF 22.5%	47.65
11	SF 25%	46.38

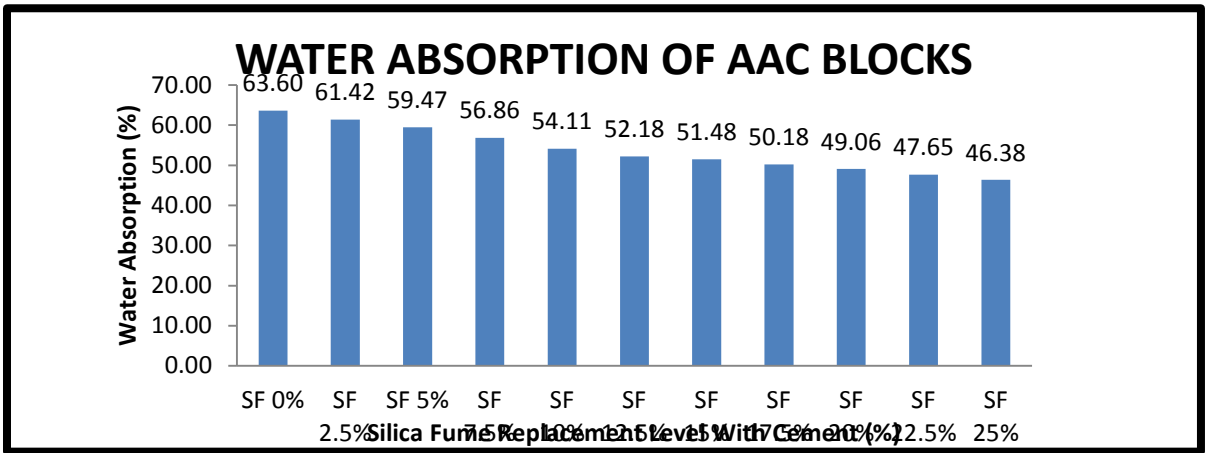

Fig. 1.5(c) Water Absorption of AAC blocks

D. Bulk Density and Moisture content of AAC blocks

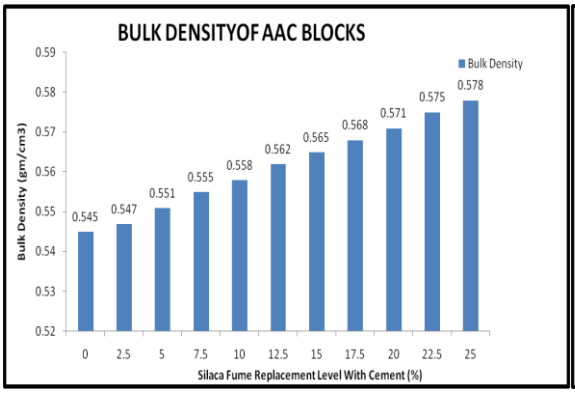

Fig. 1.5(d_1) Bulk Density of AAC blocks

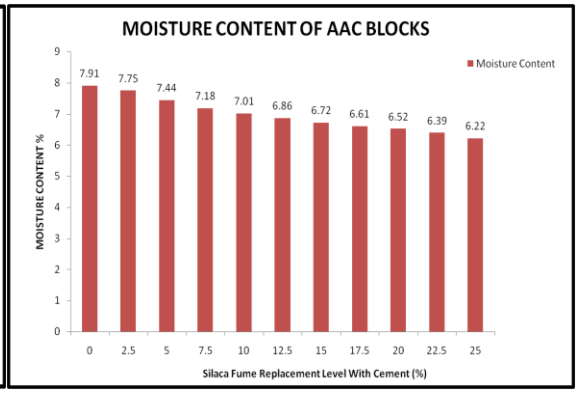

Fig. 1.5(d_2) Moisture Content of AAC blocks

E. Sorptivity of AAC blocks

Sr.No.	Type Of Mixes	Sorptivity of AAC block
1	SF 0%	0.73
2	SF 2.5%	0.67
3	SF 5%	0.63
4	SF 7.5 %	0.60
5	SF 10%	0.58
6	SF 12.5%	0.55
7	SF 15%	0.54
8	SF 17.5%	0.53
9	SF 20%	0.50
10	SF 22.5%	0.48
11	SF 25%	0.46

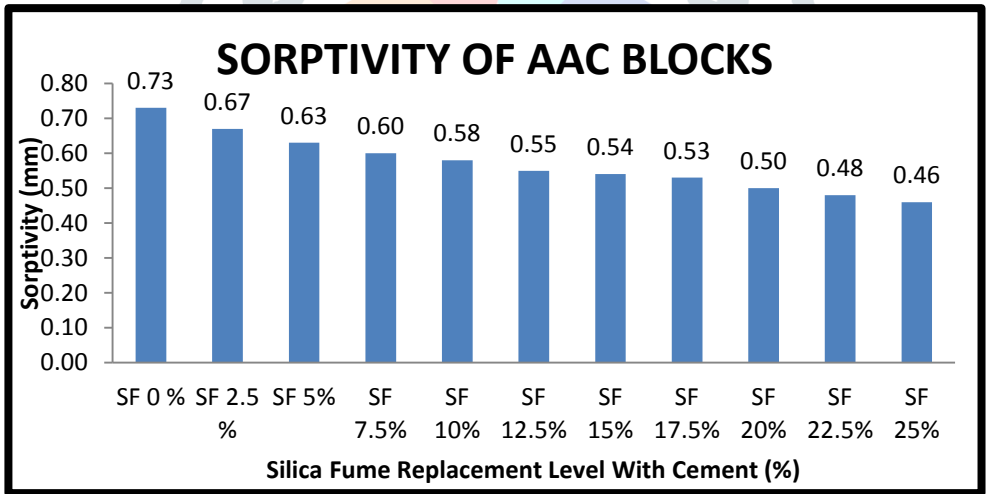

Fig. 1.5(e) Sorptivity of AAC blocks

F. RCPT of AAC blocks

Sr.No.	Type Of Mixes	Coloumbs
1	SF 0%	2174.13
2	SF 2.5%	2112.99
3	SF 5%	2042.94
4	SF 7.5 %	1888.45
5	SF 10%	1553.49
6	SF 12.5%	1196.37
7	SF 15%	827.61
8	SF 17.5%	707.01
9	SF 20%	539.01
10	SF 22.5%	367.11
11	SF 25%	261.15

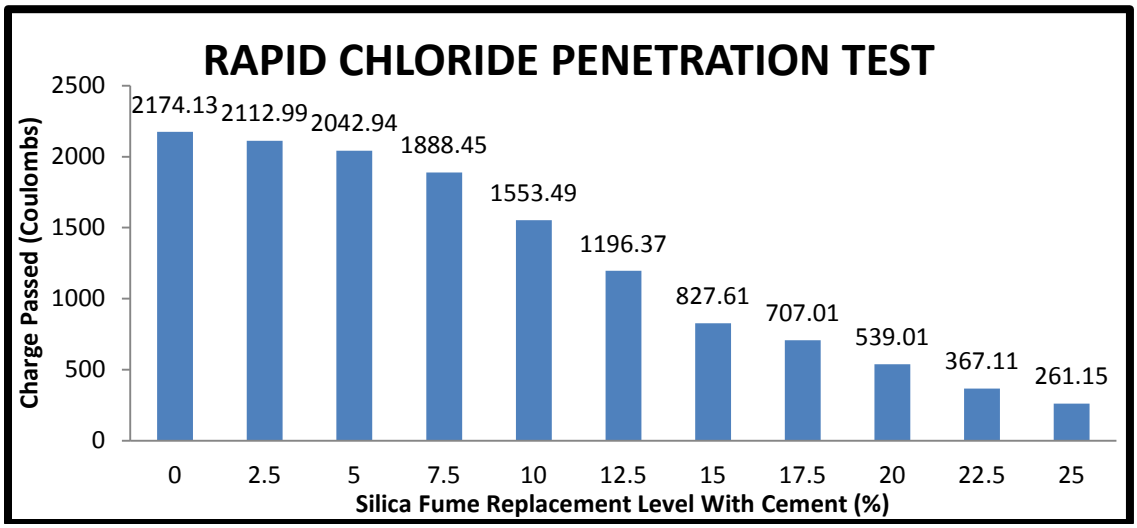

Fig. 1.5(f) RCPT of AAC blocks

G. ACID Attack of AAC blocks

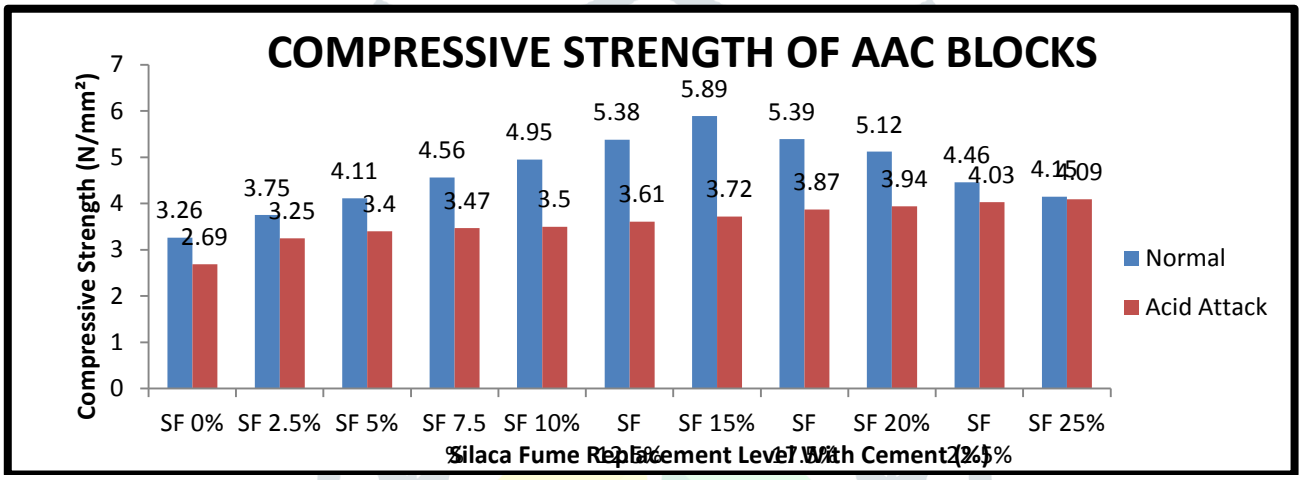

Fig. 1.5(g) Acid Attack of AAC blocks

H. Sulphate Attack of AAC blocks

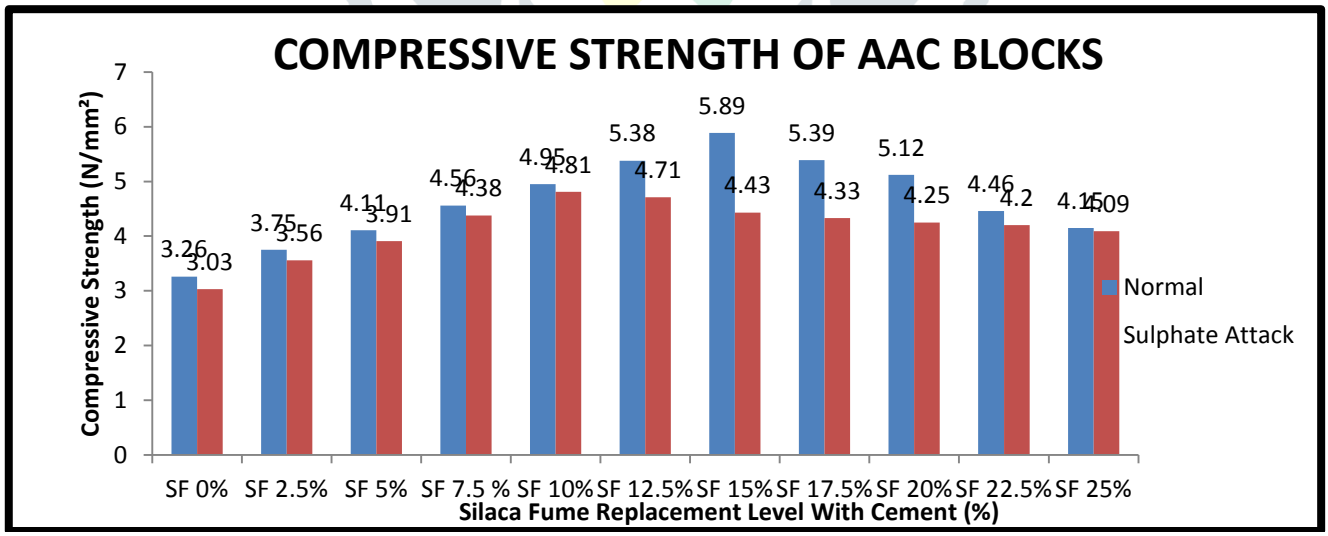

Fig. 1.5(h) Acid Attack of AAC blocks

1.6 CONCLUSION

Various tests were carried out on different mixes of blocks containing ceramic Silica fume along with control mixes in AAC blocks.. Based on experimental investigation, following observations are made on the proprty of AAC blocks :

- The Use of Silica Fume by substitution to binder has no negative effect on Properties of AAC blocks.
- The compressive strength increases upto 80% when cement is replaced by 15% of silica fume.
- The flexural Strenth increases upto 45% when cement is replaced by 15% of silica fume.
- The water absorption decreases upto 27% when cement is replaced by 25% of silica fume.
- The bulk density increses upto 6% when cement is replacefdby 25% of silica fume.
- The moisture content decreases upto 21 % when cement is replaced by 25% of silica fume.

- The Sorptivity decreases upto 37 % when cement is replaced by 25% of silica fume.
- Penetration of chloride ion continuous dereases with increase in percentage of silica fume.
- Acid resistance and sulphate resistance improves upto 15% replacement of cement by silica fume.
- From mechanical and durability properties of AAC blocks optimum dosage of silica fume is 15%.

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