International Journal of Application or Innovation in Engineering & Management (IJAIEM)
Web Site: www.ijaiem.org Email: editor@ijaiem.org
Volume 6, Issue 3, March 2017 **ISSN 2319 - 4847**

Stabilization Of M30 Concrete Pavement By Partially Replacing Cement By 20% Of Flyash And Sodium Silicate

T.Subramani[1], A.Anbuchezian[2]

[1]Professor & Dean, Department of Civil Engineering, VMKV Engineering College, Vinayaka Missions University, Salem, India

[2] Professor & Head, Department of Civil Engineering, Annapoorana Engineering College, Salem, India.

ABSTRACT

Cement is the most well known material utilized as a part of development, late pattern is in solid concrete is supplanted by admixtures, for example, GGBS, fly cinder, slag, silica smoke and sodium silicate to enhance the attributes of superior of cement keeping in mind the end goal to decrease the crawl and shrinkage and to enhance elasticity, fibers are added. In our venture portrays the ideal level of swap for quality and workability of cement for asphalt by supplanting diverse rate of fly powder and sodium acetic acid derivation by weight of bond and fine total for a blend of M30 review concrete. Subsequently the review is made on effect of fly blazing remains and sodium silicate on the execution of various parameters of cement. Keeping in mind the end goal to make a temperate cement for unbending asphalts. The principle target of the venture is to discover elective materials for street asphalts to meet the requests of bitumen for the up and coming years, to give sufficient serviceability at least cost, to make the eco well disposed streets with wellbeing, and speed for the stream of activity. The tests are led to discover the split elasticity and compressive quality of the solid example.

Keywords: Stabilization, Concrete Pavement, Replacing, Cement, Flyash, Sodium Silicate

1.INTRODUCTION

1.1 General

Concrete is now the most broadly utilized development material as it can be cast to any form and shape at site very easily. Cement concrete has set up itself as the most favored material. Fly fiery remains is the fine powder delivered as an item from the burning of pounded coal. The transfer is one of the primary reasons of fly fiery debris. As dumping of fly fiery remains as a waste material may bring about extreme natural issues. The amount of fly ash delivered from the warm power stations in India is roughly 80 million tons for each year. In any case, its rate of use is under 10%. For the most part more measure of fly fly delivered is class F type. Fly ash is by and large utilized as a substitution of bond, as an admixture in cement and assembling concrete. By utilizing fly fiery debris as an admixture in cement as opposed to dumping it as a waste material can be incredible helpful for the bringing down the water request of cement for comparable workability which additionally lessens draining and brings down the advancement of warmth. The concrete containing fly ash as partial replacement of cement possesses problems on delayed early strength. But concrete containing fly ash as partial replacement of fine aggregate will possess no delayed early strength. The focus on this investigation is to enhance the concepts that by use of steel fiber in fly ash concrete. By this to build the pliability, quality and also to enhance the toughness of general cement. The filaments which are utilized steel fiber are arbitrarily scattered all through the solid. The strands stops the interior enlarging of splits and fly powder helps as an admixture for the change in the solid properties. The impact of every coconut filaments on the mechanical properties of fly cinder is concentrated under this examination. Asphalt is the layered structure on which vehicles travel. It fills two needs, to be specific, to give an agreeable and strong surface for vehicles, and to decrease weights on basic soils. In India, the customary arrangement of bituminous asphalts is generally utilized. Since Concrete has a few lacks as low rigidity, low post breaking limit, weakness and low pliability, restricted exhaustion life, not fit for obliging substantial misshapenness, low effect quality. Bond cement is described by fragile disappointment, the almost entire loss of stacking limit, once disappointment is started. Inside a few decades the bituminous asphalt would be a history and required periodical support. Presently it is extremely basic to reconsider of another material which fulfils required offices. Concrete flops abruptly under strain and breaks too much when unreinforced. Steel rebar is routinely used to

fortify cement. However, it is extremely costly. In tropical areas, regular strands are plentifully accessible which when used will diminish the cost of strengthened cement and enhance its execution. Presently a-days concrete paver pieces are utilized as a part of different applications like road street, little and medium market streets, low volume streets and other development places. Solid piece asphalt will retain stress, for example, little quakes, stops and defrosts, and slight ground disintegration by flexing.

1.2 Objective

The target of the present work is to create concrete with great quality, decrease small scale splits, less permeable, less capillarity so solidness will be come to. For this reason it requires the utilization of various pozzolanic materials like fly fiery debris, lime, alongside fiber. So the experimental works to be undertaken:

1. To study the compressive strength, tensile strength and flexural strength of Concrete.
2. To study the durability characteristics of concrete.

2.LITERATURE REVIEW

Naaman A.E, Al-khairi F.M, and Hammoud H. Demonstrated that utilization of steel filaments in lower quality cements builds their compressive quality essentially contrasted with plain unreinforced grids and is straightforwardly identified with volume portion of steel fiber utilized. This expansion is more for snared filaments in correlation with quality polypropylene fiber, steel fiber or glass fiber. Siva kumar.A and Manu Santhanam. Considered on high quality cement fortified with half and half filaments (blend of snared steel and a non metallic fiber) up to a volume portion of 0.5% and found the flexural strength of steel polypropylene cross breed fiber cement was ideal to steel fiber concrete. Scott R and Singh S.P. The high performance concrete is concrete which secures/makes sure of long-time ability of last in structures exposed to aggressive surrounding conditions. Capacity to last of cement is its capacity to oppose weathering activity, synthetic assault, rub/harm and all other compounding/rusting, disintegrating, and so forth forms. Weathering incorporates identified with encompassing conditions impacts, for example, presentation to cycles of wetting and drying, warming and cooling, as likewise solidifying and defrosting. Substance declining/rusting, disintegrating, and so on process incorporates corrosive assault, enormous and wide synthetic assault because of dampness and chloride entrance.

3.MATERIAL COLLECTION

3.1 Cement

Cement is one of the binding materials in this project. Cement is the important building material in today's construction world. 53 grade Ordinary Portland Cement (OPC) conforming to IS: 8112-1989.

3.2 Fine Aggregate

Concrete delivered from a blend of fine total (sand), a cover (bond), and water. Fine-total cement is like building mortars in its arrangement and certain properties. It is utilized principally to make thin-walled and customary rein-constrained cement auxiliary segments and items. Fine-aggregate is utilized as a part of parkway and runway development on account of the high rigidity that outcomes from its fine-grained structure. The nonappearance of coarse total (pulverized stone or rock) generously encourages the readiness, transport, and putting of the solid, especially when solid pumps are utilized. A weakness of fine-total cement is the expanded utilization of cover contrasted with different sorts of cement and the related more prominent shrinkage and crawl. The amount of cover in the solid can be diminished by pummeling a portion of the sand, by the utilization of plasticizers, or via autoclaving of items. The sand which was locally accessible and going through 4.75mm IS strainer is utilized. The particular gravity of fine total was 2.60.

3.3 Coarse Aggregate

Locally accessible pounded blue rock stones fitting in with evaluated total of ostensible size 12.5 mm according to Seems to be: 383 – 1970. Squashed rock total with particular gravity of 2.77 and going through 4.75 mm sifter and will be utilized for throwing all examples. A few examinations inferred that most extreme size of coarse total ought to be confined in quality of the composite. Notwithstanding cement glue – aggregate proportion, aggregate sort impacts concrete dimensional stability.

3.4 Fly Ash

Fly Ash is a by-result of the ignition of pounded coal in electric power era plants. At the point when the pummeled coal is touched off in the ignition chamber, the carbon and unpredictable materials are scorched off. In any case, a portion of the mineral contaminations of mud, shale, feldspars, and so forth., are combined in suspension and completed of the burning chamber in the fumes gasses. As the fumes gasses cool, the intertwined materials cement into circular shiny particles called Fly Ash. Because of the combination in-suspension these Fly Ash particles are generally minute strong

circles and empty ecospheres with a few particles notwithstanding being plerospheres, which are circles containing littler circles.

3.5 Sodium Silicate

Sodium silicate is the regular name for mixes with the recipe Na2(SiO2)nO. A notable individual from this arrangement is sodium metasilicate, Na2SiO3. Otherwise called water glass or fluid glass, these materials are accessible in watery arrangement and in strong shape. The immaculate arrangements are shading less or white, yet business tests are frequently greenish or blue attributable to the nearness of iron-containing polluting influences.Figure.1 shows sodium silicate.

Figure.1 Sodium Silicate

3.5.1 Properties Of Sodium Silicate

- **Sodium silicate is a white powder that is promptly solvent in water, creating an antacid arrangement.**
- **It is one of various related mixes like, sodium orthosilicate, sodium pyrosilicate, and so on. All are polished, dreary and break up in water.**
- **Sodium silicate** is stable in neutral and alkaline. In acidic solutions, the silicate ion reacts with hydrogen ions to form silic acid, which when heated and roasted forms silica gel, a hard, glassy substance.

4.PAVEMENT DESIGN

The base coarse of Dry Lean Concrete (DLC) serves as working platform for supporting PFRC slabs which by slab action distributes the wheel load to larger area. The DLC base layer rests on granular sub-base which rest on sub grade. Figure.2. shows Cross Section Of A Typical PFRC Pavement

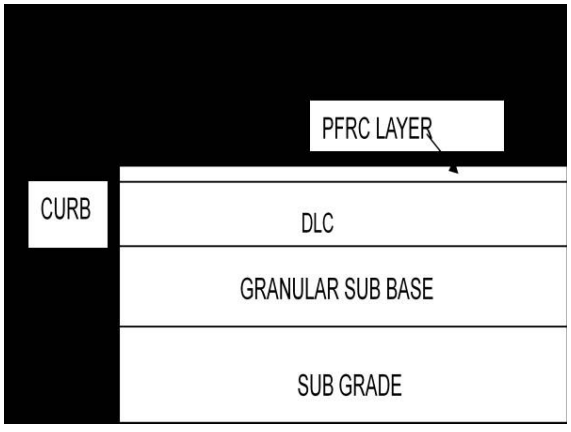

Figure.2 Cross Section Of A Typical PFRC Pavement

Over the well compacted sub grade Granular Sub base is constructed using big stone boulders and mud. Over that the Dry Lean Concrete of mix 1:4:8 is made, which is compacted, leveled and floated. Surface of DLC is also corrected for road camber.An antifriction separation membrane of 125 micron thickness is spread over the DLC surface so as to impart free movement of the upper slab caused due to temperature warping stresses. The separation membrane may be stuck to the lower layer with patches of adhesives or appropriate tape or concrete nails with washer so that polythene

sheet does not move during placement of concrete. Many of the thickness design methods for cement concrete pavement adopted internationally derive their origin from the method evolved by Portland Cement Association (PCA). In this technology thickness of the pavement is assumed on trial basis. When dewatered concrete is provided on lean concrete, it has no issue of water being turning out on surface amid compaction handle yet when it is done over WBM, a lot of water is drenched by WBM and therefore the solid loses the water to WMB and the water which turns out amid dewatering/compaction process is not in same amount as in the event of incline cement.

5.TESTING PROCEDURE

5.1 Introduction

The following test done by the concrete compressive strength of cube, flexural strength of beam & split tensile strength for cylinder

5.2 Compressive Strength Test

Compressive quality is measured on materials, parts, and structures. By definition, a definitive compressive quality of a material is that estimation of uniaxial compressive anxiety achieved when the material bombs totally. The compressive quality is typically gotten tentatively by method for a compressive test. The contraption utilized for this investigation is the same as that utilized as a part of a malleable test. In any case, as opposed to applying a uniaxial pliable load, a uniaxial compressive load is connected. As can be envisioned, the example (generally round and hollow) is abbreviated and in addition spread along the side. At the season of testing, every example must keep in compressive testing machine. The most extreme load at the breakage of Solid Square will be noted. From the prominent qualities, the compressive quality may ascertained by utilizing beneath recipe.Compressive Strength = Load / Area (Figure.3)

Size of the test specimen=150mm x 150mm x 150mm

Figure.3 Compression Test

5.3 Split Tensile Test

The size of cylinders 300 mm length and 150 mm diameter are placed in the machine such that load is applied on the opposite side of the cubes are casted. Align carefully and load is applied, till the specimen breaks. The formula used for calculation.(Figure.4)

Split tensile strength = 2P/ μdl

Figure.4 Split Tensile Test Setup

5.4 Sorptivity Test

The sorptivity can be determined by the measurement of the capillary rise absorption rate on reasonably homogeneous material. Water was used of the test fluid. The chambers subsequent to throwing were drenched in water for 90 days curing. The example measure 100mm dia x 50 mm tallness subsequent to drying in stove at temperature of 100 + 10 °C were suffocated as appeared in figure 4with water level not more than 5 mm over the base of example and the spill out of the fringe surface is forestalled via fixing it appropriately with non-permeable covering. The amount of water consumed in day and age of a hour was measured by weighting the example on a top dish adjust weighing up to 0.1 mg. Sorptivity (S) is a material property which describes the inclination of a permeable material to retain and transmit water by capillarity. The cumulative water absorption (per unit area of the inflow surface) increases as the square root of elapsed time (t) $I=S.t^{½}$

Therefore $S=I/ t^{½}$
Where; S= sorptivity in mm,
t= elapsed time in mint.
$I=\Delta w/Ad$
Δw= change in weight = W2-W1
W1 = Oven dry weight of cylinder in grams
W2 = Weight of cylinder after 60 minutes capillary suction of water in grams.
A = surface area of the specimen through which water penetrated.
D = density of water

6.TEST RESULTS

6.1 Compressive Strength Of Concrete
The Table.1 shows the strength gain at various percentages of fly ash various percentage replacement at 7, 14 & 28th day. It can be seen clearly shown in Figure.5.

Table 1 Compressive Strength of Concrete Test Results

Grade of concrete	**SAMPLES**	Compressive strength (MPa)		
		7days	14days	28days
M30	**CC**	17.2	20.4	24.7
	PC Fly ash (20%) + Sodium Silicate	18.60	25.4	29.5

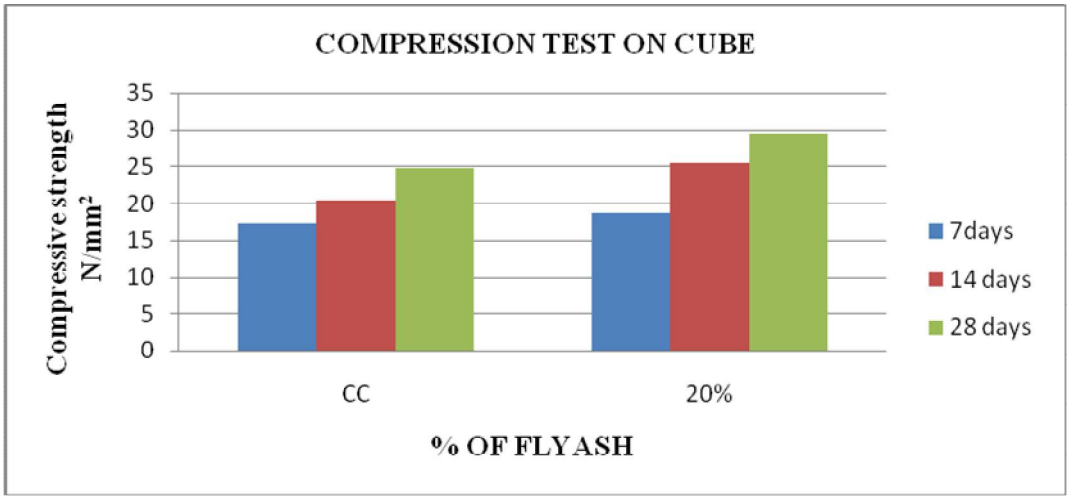

Figure 5 Compressive test result on cube

6.2 SPLIT TENSILE TEST FOR CYLINDER

The Table.2 shows the split tensile strength gain at various percentages of fly ash various percentage replacement at 7, 14 & 28th day. It can be seen clearly shown in Figure.6.

Table. 2: Split Tensile Test Results

Grade of concrete	SAMPLES	Split Tensile Strength		
		7days	14days	28days
M30	**CC**	1.78	1.98	2.65
	PC **Fly ash (20%) + Sodium Silicate**	1.95	2.05	3.12

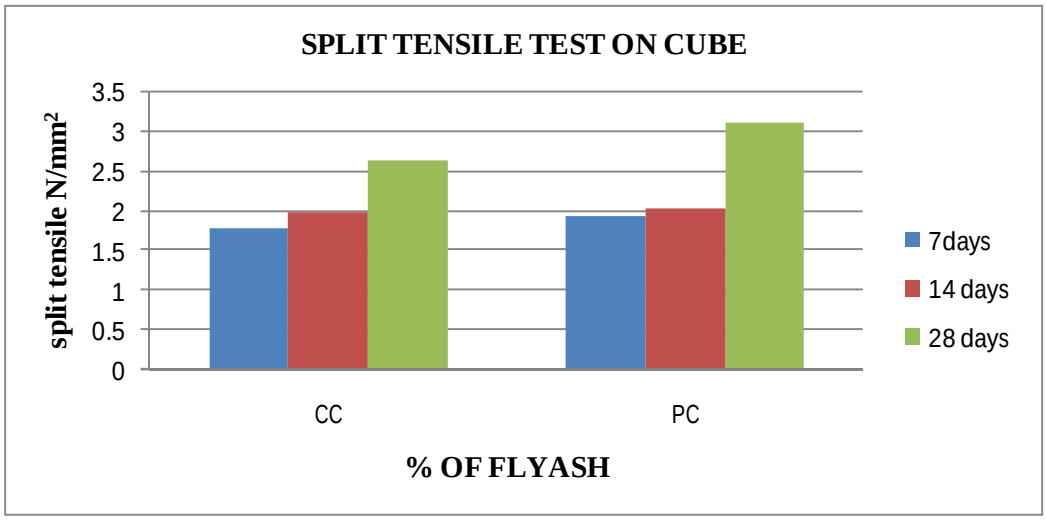

Figure 6 Split Tensile Test on cylinder

6.3 Sorptivity Test

The Table.3 shows the Sorptivity Test Results at various percentages of fly ash various percentage replacement at 7, 14 & 28th day. It can be seen clearly shown in Figure.7.

Table. 3: Sorptivity Test Results

GRADE OF CONCRETE	SAMPLES	Dry Wt In Grams	Wet Wt In Grams	Sorptivity Value in 10^{-5} m/min$^{0.5}$
M30	**CC**	874	875.4	3.25
	PC **Fly ash(20%) + Sodium Silicate**	892	894	4.64

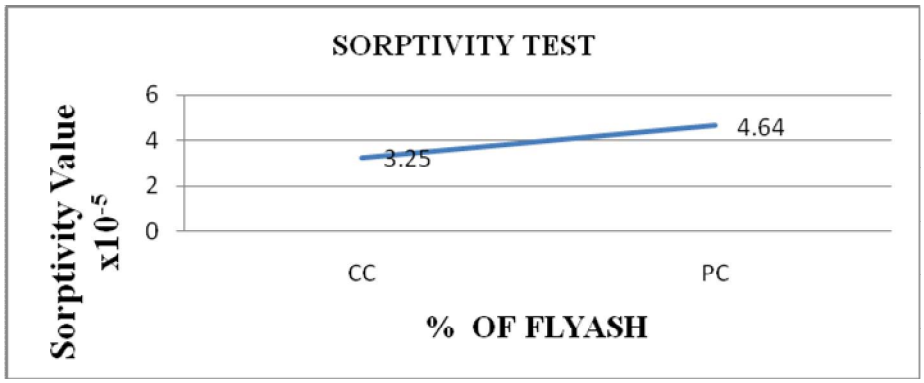

Figure.7 Sorptivity Test Result on Cylinder

7.CONCLUSION

Based on limited experimental investigation concerning the compressive strength and sorptivity of concrete, the following observations are made regarding the resistance of different percentage replaced fly ash for M30 grade concrete:

- The compressive strength of fly ash concrete shows lower strength at 20% replacement with fly ash for M30 There after the compressive strength value shows an increasing trend to increase the flyash content up to 20 % in concrete.
- For 30 days strength, where percentage decreases in sorptivity is found to be 4.64 mm/min$^{0.5}$ for M30 grade of concrete.
- The sorptivity of fly ash concrete shows lower sorptivity at a replacement level of 20% with fly ash for M30 grade concrete.
- The sorptivity of fly ash concrete shows higher sorptivity than traditional concrete.
- The fly ash can be innovative supplementary cementitious Construction Material but judicious decisions are to be taken by engineers.

References

[1] Sadam Hade Hussein, Kamal Nasharuddin Bin Mustapha, Zakaria Che Muda,Salmia Beddu, Verification For Modeling of Ultimate Load For Lightweight Palm Oil Clinker Reinforced Concrete Beams with Web Openings Using Response Surface Methodology. International Journal of Civil Engineering and Technology, 3(2), 2012, pp.229–240.

[2] T.Subramani, P.Ramasamy , " Thermal Conductivity Of Fibre Filled With Ferrocement Sandwich Panels" , International Journal of Application or Innovation in Engineering & Management (IJAIEM) , Volume 5, Issue 5, pp. 204-215 , 2016 .
[3] T.Subramani, P.Sakthivel , " Experimental Investigation On Flyash Based Geopolymer Bricks" , International Journal of Application or Innovation in Engineering & Management (IJAIEM) , Volume 5, Issue 5, pp. 216-227 , 2016 .
[4] T.Subramani, S.R.Rajiv , " Improving Construction Efficiency And Productivity Of Industry Using SPSS" , International Journal of Application or Innovation in Engineering & Management (IJAIEM) , Volume 5, Issue 5, pp. 239-250 , 2016 .
[5] T.Subramani, R.Siva, "Experimental Study On Flexural And Impact Behavior Of Ferrocement Slabs" International Journal of Application or Innovation in Engineering & Management (IJAIEM), Volume 5, Issue 5, pp. 228-238 , 2016 .
[6] T.Subramani, A.Anbuvel , " Experimental Behaviour Of Reinforced Concrete Beams With Coconut Shell As Coarse Aggregate" International Journal of Application or Innovation in Engineering & Management (IJAIEM) , Volume 5, Issue 5, pp. 067-075 , 2016 .
[7] T.Subramani, K.S.Ramesh , " Experimental Study On Partial Replacement Of Cement With Fly Ash And Complete Replacement Of Sand With M sand" , International Journal of Application or Innovation in Engineering & Management (IJAIEM) , Volume 4, Issue 5 , pp. 313-322 , 2015
[8] T.Subramani, G.Shanmugam , " Experimental Investigation Of Using Papercrete And Recycled Aggregate As A Coarse Aggregate " , International Journal of Application or Innovation in Engineering & Management (IJAIEM) , Volume 4, Issue 5, pp. 323-332 , May 2015
[9] T.Subramani, S.Kumaran , " Experimental Investigation Of Using Concrete Waste And Brick Waste As A Coarse Aggregate " , International Journal of Application or Innovation in Engineering & Management (IJAIEM) , Volume 4, Issue 5, pp. 294-303 , 2015
[10] T.Subramani, G.Ravi, **"Experimental Investigation Of Coarse Aggregate With Steel Slag In Concrete", IOSR Journal of Engineering,** Volume 5,Issue 5, Version 3, pp64-73, 2015
[11] T.Subramani, A.Mumtaj , " Experimental Investigation Of Partial Replacement Of Sand With Glass Fibre" , International Journal of Application or Innovation in Engineering & Management (IJAIEM) , Volume 4, Issue 5, pp. 254-263 , 2015
[12] T.Subramani, S.B.Sankar Ram **Experimental Study on Concrete Using Cement With Glass Powder, IOSR Journal of Engineering,**Volume 5 , Issue 5, Version 3, pp43-53, 2015
[13] T.Subramani, C.Sumathi , " Experimental Investigation Of Partial Replacement Of Cement With Fly Ash And Sand With Bottom Ash And Glass Used In Concrete" , International Journal of Application or Innovation in Engineering & Management (IJAIEM) , Volume 4, Issue 5, pp. 245-253 , 2015
[14] T.Subramani, B.Suresh , " Experimental Investigation Of Using Ceramic Waste As A Coarse Aggregate Making A Light Weight Concrete " , International Journal of Application or Innovation in Engineering & Management (IJAIEM) , Volume 4, Issue 5, pp. 153-162 , 2015
[15] T.Subramani, M.Prabhakaran , " Experimental Study On Bagasse Ash In Concrete" , International Journal of Application or Innovation in Engineering & Management (IJAIEM) , Volume 4, Issue 5, pp. 163-172 , 2015
[16] T.Subramani, V.K.Pugal , " Experimental Study On Plastic Waste As A Coarse Aggregate For Structural Concrete" , International Journal of Application or Innovation in Engineering & Management (IJAIEM) , Volume 4, Issue 5, pp.144-152 2015
[17] T.Subramani, V.Angappan , " Experimental Investigation Of Papercrete Concrete" , International Journal of Application or Innovation in Engineering & Management (IJAIEM) , Volume 4, Issue 5, pp. 134-143 , 2015
[18] T.Subramani, D.Latha , " Experimental Study On Recycled Industrial Waste Used In Concrete" , International Journal of Application or Innovation in Engineering & Management (IJAIEM) , Volume 4, Issue 5, pp. 113-122 , 2015
[19] Subramani.T, Senthilkumar.T, Jayalakshmi.J, "Analysis Of Admixtures And Their Effects Of Silica Fumes, Metakaolin And Pfa On The Air Content",International Journal of Modern Engineering Research, Volume 4, Issue 6 (Version 4), pp 28-36, 2014.

AUTHOR

Prof. Dr.T.Subramani Working as a Professor and Dean of Civil Engineering in VMKV Engineering College, Vinayaka Missions University, Salem, TamilNadu, India. Having more than 27 years of Teaching experience in Various Engineering Colleges. He is a Chartered Civil Engineer and Approved Valuer for many banks. Chairman and Member in Board of Studies of Civil Engineering branch. Question paper setter and Valuer for UG and PG Courses of Civil Engineering in number of Universities. Life Fellow in Institution of Engineers (India) and Institution of Valuers. Life member in number of Technical Societies and Educational bodies. Guided more than 400 students in UG projects and 250 students in PG projects. He is a reviewer for number of International Journals and published 164 International Journal Publications and presented more than 25 papers in International Conferences.

Dr.A.Anbuchezian completed his B.E. Degree in the branch of Civil Engineering in IRTT, Erode, Bharathiyar University and M.E-Structural Engineering, GCE, Periyar University. He also completed his Ph.D. in of Civil Engineering in Vinayaka Missions University. Having more than 20 years of Teaching experience in Various Engineering Colleges. Currently he is working as a Professor and Head of the Department of Civil Engineering in Annapoorana Engineering College, Salem, TamilNadu. He is also holding the additional responsibility of Dean – Academic (Non Circuit branches) in Annapoorana Engineering College, Salem, TamilNadu. He published 14 International Journal Publications and presented more than 5 papers in International Conferences