International Journal of Emerging Trends & Technology in Computer Science (IJETTCS)
Web Site: www.ijettcs.org Email: editor@ijettcs.org, editorijettcs@gmail.com
Volume 7, Issue 2, March - April 2018 ISSN 2278-6856

Experimental Study On Mechanical Behavior Of Roof Panel Using Steel Fibre With Alkaline Solution

T.Subramani[1], N.Liyamin Ahad[2], Eldhose Jolly[3], Manuel Cheriyan[4], S.Priyanka[5]

[1]Professor & Dean, Department of Civil Engineering, VMKV Engineering College, Vinayaka Mission's Research Foundation (Deemed to be University), Salem, TamilNadu, India.

[2,3,4,5]UG Students, Department of Civil Engineering, VMKV Engineering College, Vinayaka Mission's Research Foundation (Deemed to be University), Salem, TamilNadu, India.

Abstract: ***Various fibres have been used to reinforce concrete to enhance properties of cement. This review critically analyses the use of different natural and synthetic fibres, the treatments done on some of them to be used in concrete, their strength and weaknesses to be used for such applications. Accelerated and natural weathering of bagasse reinforced cement composite roof panel were studied. Since natural fibres are available in abundant quantities in many developing countries, more elaborate research should be directed toward the various problems associated with the use of these fibres. In this paper, the durability of natural fibres such as sugarcane bagasse used as roofing sheets has been reported by conducting an experimental investigation. This investigation includes determination of mechanical strength properties such as compressive, tensile, modulus of rupture and flexural properties of the roof panel. In addition, it was found that addition sugarcane bagasse fibre achieved strength and durability properties. This research therefore recommends the use of 5% fibre content with M35 grade of concrete, also test results for compression, flexural and impact test results with comparison of conventional concrete.***

Keywords: Experimental Study, Mechanical Behavior, Roof Panel, Steel Fibre, Alkaline Solution

1. INTRODUCTION

1.1 Background

India endowed with an abundant availability of natural fibre such as Jute, Coir, Sisal, Pineapple, Ramie, Bamboo, Banana etc. has focused on the development of natural fibre composites primarily to explore value-added application avenues. Such natural fibre composites are well suited as wood substitutes in the housing and construction sector. The development of natural fibre composites in India is based on two pronged strategy of preventing depletion of forest resources as well as ensuring good economic returns for the cultivation of natural fibres. The developments in composite material after meeting the challenges of aerospace sector have cascaded down for catering to domestic and industrial applications. Composites, the wonder material with light-weight; high strength-to-weight ratio and stiffness properties have come a long way in replacing the conventional materials like metals, wood etc. The material scientists all over the world focused their attention on natural composites reinforced with Jute, Sisal, Coir, Pineapple, bagasse etc. primarily to cut down the cost of raw materials.

1.2 Natural Fibre Reinforced Concrete (NFRC)

The use of natural fibres in making concrete is recommended since several types of these fibres are available locally and are plentiful. The idea of using such fibres to improve the strength and durability of brittle materials is not new; for example, straw and horse hair are used to make bricks and plaster. Natural fibres that are suitable for reinforcing concrete and are easily available in developing countries can be broadly classified as shown in Figure 1.

Wood fibres have been attempted as reinforcement in cement concrete productions. Hast fibres include hemp, flax, and ramie. These fibres are reported to be stronger than other vegetable fibres and possess a higher modulus of elasticity. Among the leaf fibres, sisal is one of the most important and widely used and is plentiful in many tropical countries. Among the seed and fruit fibres, coconut or coir is reported to be the most suitable for concrete. Previous studies have been concerned with the use of sisal and coconut fibres in making corrugated roofing sheets and ribbed or folded plates. Fibres derived from palm trees are considered to be stronger than coconut fibres, and a detailed investigation of their use is worth pursuing. The use of bamboo fibres also needs to be investigated. Many types of bamboos are available in tropical countries, and their fibres may be suitable as reinforcement in concrete products. It is reported that the mechanism for metallic fibre reinforcements are also valid for natural fibres.
Figure 1 shows the natural types.

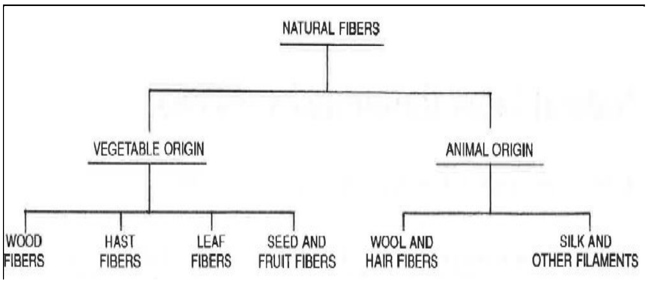

Figure 1 Natural fibre type

1.4 Current development in FRC

The latest developments and research presented the new fibre matrix like:

- High fibre volume micro-fibre system.
- Compact reinforced composites.
- Polymer concrete

1.4.1 High fibre volume micro-fibre system

It can replace asbestos fibre. It improves toughness and impact strength. These properties make it attractive for thin precast products such as roofing sheets, cladding panels. Cement composites are useful for repair & rehabilitation works.

1.4.2 Compact reinforced composites (CRC)

It consists of an extremely strong, dense cement matrix and extremely expensive. It exhibits flexural strength up to 260Mpa and compressive strength of about 200Mpa. It is as strong as structural steel and can be moulded and fabricated at the site.

1.4.3 Polymer concrete

Polymer concrete is porous due to air voids, water voids. Impregnation of monomer & subsequent polymerization is the latest technique adapted to reduce porosity and improves strength.

Types of polymer concrete are:

- Polymer-impregnated concrete (PIC).
- Polymer cement concrete (PCC).
- Polymer concrete (PC).
- Polymer impregnated & surface coated polymer concrete.

1.4.3.1 Polymer-impregnated concrete (PIC).

PIC is precast conventional concrete, cured & dried in an oven.Polymerization carried out by using radiation, application of heat or by chemical initiation. Monomers used are methyl methacrylate, styrene, acrylonitrile, T-butyl styrene. The amount of monomer loading depends on the quantity of water and air that has occupied the total void space. A monomer loading time can be reduced by application of pressure.

1.4.3.2 Polymer cement concrete (PCC)

PCC is made by mixing cement, aggregates, water & monomer. Monomers used in PCC are polyester-styrene, epoxy-styrene, furans, and vinylidene chloride. A superior PCC made by furfuryl alcohol aniline hydrochloride in the wet mix is claimed to be especially dense, non-shrinking, high corrosion resistance, low permeability & high resistance to vibrations and axial extension.

1.4.3.3 Polymer concrete (PC)

The aggregate bound with a polymer binder. It minimises void volume in the aggregate mass. Strength obtained is 140 MPa with a short curing period. The graded aggregates are prepacked& vibrated in the mould. It tends to be brittle & it is reported that dispersion of fibre reinforcement would improve the toughness & tensile strength of material.

1.4.3.4 Partially impregnated and surface coated concrete

It significantly increases the strength of original concrete. Polymerization can be done by the thermal catalytic method. The depth of the monomer penetration depends upon pore structure of hardened & dry concrete, duration of soaking & viscosity of monomer. Excellent penetration can be achieved by pounding the monomer on a concrete surface.

1.5 Applications of FRC

It is used on account of the advantage of increased static and dynamic tensile strength and better fatigue strength. FRC is used for:

- Runway, Aircraft parking and Pavements
- Industrial flooring
- Tunnel and canal lining
- Slope stabilization
- Thin shells
- Curtain Walls
- Pipes
- Manholes
- Dams and Hydraulic structures
- Roof tiles
- Composite decks
- Impact resisting structures

1.6 Primary Importance

The roof is a system that separates the building's top floor from the outdoor environment. It consists of functional parts, which have to work together:

- supporting structure
- air barrier
- vapour barrier
- Insulation
- ventilated space if appropriate
- decking for roofing
- Actual roofing
- Water drainage
- Penetrations
- Other auxiliary roof structures

1.7 Roof System Regulations and Guidelines

Structural design and the use of products in construction are regulated by EU building product directives, harmonised product standards, national building codes, e.g. The National Building Code of Finland and voluntary guidelines such as the Roof Systems Manual, the RT construction file, water and moisture-proofing code of practice (RIL 107), RYL 2000 on the quality requirements in the construction industry as well as the product and contracting certificates given by VTT Technical Research Centre of Finland, all of which illustrate good building practices to be adhered to in Finland.

1.8 Ce Marking of Construction Products

By CE marking of construction products the manufacturer attests that the product complies with all the applicable EU directives. However, CE marking alone does not guarantee that the product is suitable for use in Finland.

1.8.1 Concrete tile roofing

Today most tiled roofs in Finland are made with concrete tiles. Thanks tothe method of manufacture they are dimensionally more accurate than claytiles. Concrete tiles must comply with the quality requirements of EuropeanStandards EN 490 and EN 491. Concrete tiles are usually of interlockingtype.

1.8.2 Roof pitch

Concrete tile roofing is suitable for all roof shapes up to a minimum slope of 1:5. With clay tiles the minimum pitch is approx. 1:3 depending on type. Theminimum pitch of interlocking type clay tiles is 1:4. Product-specific pitchlimits given by the manufacturer should be followed.

1.8.3 Supporting structure

The actual ventilation channel of the roof structure is between the insulation and the underlay. An underlay should always be installed under roof tiling independent of its pitch, as in changing weather conditions water and snow will enter through connections and joints underneath the roofing.

1.9 Properties of FRC

Fibre impart the following properties when introduced with concrete:-

- Increases the tensile strength of the concrete
- Reduces the air voids and water voids.
- Increases the durability of the concrete
- Reducing bleeding in fresh concrete
- Giving more flexural strength as compare to strength given by rebar.
- Restricting the growth of cracks under loads.
- Some fibres produce greater impact, abrasion in concrete.

2. METHODOLOGY

Figure 2 Shows the methodology adopted in this study

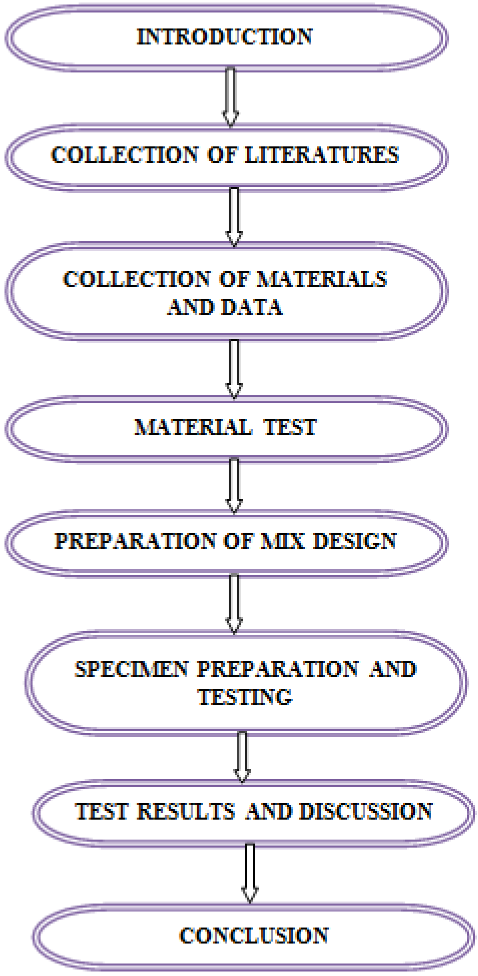

Figure 2 Methodology

3. MATERIAL COLLECTION

3.1 Cement

Ordinary Portland Cement (53 Grade) was used for casting all the specimens. To produce high performance concrete, the utilization of high strength cements is necessary. Different types of cement have different water requirements to produce pastes of standard consistence. Different types of cement also will produce concrete have a different rates of strength development. The choice of brand and type of cement is the most important to produce a good quality of concrete. The type of cement affects the rate of hydration, so that the strengths at early ages can be considerably influenced by the particular cement used. It is also important to ensure compatibility of the chemical and mineral admixtures with cement.

3.2 Aggregate

Aggregate are the most important constituents in concrete and the aggregate occupy nearly 70-80% of concrete volume. They give body to the concrete, reduce shrinkage and stiffened the concrete. One of the most important factors for producing workable concrete is a good gradation of aggregates. Good grading implies that a sample fraction of aggregates in required proportion contains minimum voids requirements to use as concreting materials.

3.2.1 Coarse Aggregate

Aggregates fractions larger than 4.75mm are termed as coarse aggregates. The fraction of aggregates used in the experimental work passed in 20mm sieve and retained on 10mm IS sieve comes under Zone II aggregates conforming to IS: 383-1970.

3.2.2 Fine Aggregate

Fine aggregates are termed as "filler" which fills the voids in concrete. The aggregates less than 4.75mm are known as fine aggregates. The river sand is used as fine aggregate conforming to requirements of IS: 383-1970 comes under zone II.

3.3 Water

Water is an important ingredient of concrete as it actually participates in the chemical reaction with cement. Since it helps to from the strength giving cement gel, the quantity and quality of water are required to be looked into very carefully.

4. MATERIAL PROPERITIES

4.1 Materials

The raw materials used in this research are Ordinary Portland cement, fine aggregate and coarse aggregate (OPC), Rivers and, Bagasse fibre and water. They were all obtained in India.

4.2 Cement

Ordinary Portland cement of 53 grade of cement is used according to IS: 12269-1987 and conducting test on cement to find out the physical properties and results

4.3 Fine Aggregate

Aggregate fillers River sand passing through a 4.75-mm IS sieve was obtained from a locally available source; it conforms to grading zone-III of IS 383 (1970).

4.4 Coarse Aggregates

Crushed aggregates of less than 12.5mm size produced from local crushingplants were used. The aggregate exclusively passing through 12.5mm sieve size and retained on 10mm sieve is selected. The aggregates were tested for their physical requirements such as gradation, fineness modulus, specific gravity and bulk density in accordance with IS: 2386-1963. The individual aggregates were mixed to induce the required combined grading. The particular specific gravity and water absorption of the mixture are given in Table1

Table 1: Physical properties of Coarse aggregate

Properties	Coarse aggregate
Particle shape	Angular
Particle size	20mm
Specific gravity	2.75
Bulk density	1340 kg / m^3
Fineness modulus	4.18

4.5 Water

Water plays a vital role in achieving the strength of concrete. For complete hydration it requires about 3/10th of its weight of water. It is practically proved that minimum water-cement ratio 0.35 is required for conventional concrete. Water participates in chemical reaction with cement and cement paste is formed and binds with coarse aggregate and fine aggregates. If more water is used, segregation and bleeding takes place, so that the concrete becomes weak, but most of the water will absorb. Hence it may avoid bleeding. If water content exceeds permissible limits it may cause bleeding. If less water is used, the required workability is not achieved. Potable water fit for drinking is required to be used in the concrete and it should have pH value ranges between 6 to 9.

4.6 Fibres

First the sugarcane was dried directly in sun light till it becomes dry, then it's were chopped off to size of Aspect ratio 5%. Place the chopped Bagasse in oven at a constant temperature of 50 to 60ºC for an hour (this makes the Bagasse brittle).Finally the Bagasse used for the study. Table 2 shows the properties of fibre.

Table 2: Properties of the Fibre

Properties of fiber	Sugarcane
Diameter	1.50 mm
Aspect Ratio	30, 60 % 90
Specific gravity	0.52
Water Absorption	286.6
Density in kg/m³	260
Young's Modulus (GPa)	27.1
Tensile strength (MPa)	222
Elongation (%) Sugar cane bagasse fibre	1.1

Figure 3 shows the sugarfibre used in this study

Figure 3 Sugarcane fibre

5. MIX DESIGN

Design Stipulations

Grade Designation - M-35
Type of cement - O.P.C-53grade
Fine Aggregate - Zone-I
Sp. Gravity Cement - 3.12
Sp. Gravity Fine Aggregate - 2.4
Sp. Gravity Coarse Aggregate - 2.75

Mix Proportion

Table 3 shows the mix proportion

Table 3: Mix proportion

Cement (kg)/m^3	FA (kg)/m^3	CA (kg)/m^3	Water (liter)/m^3
563.34	527.59	1051.71	197.17

6. TEST PROCEDURE

6.1 Compressive Strength

Compression tests are used to determine how a product or material reacts when it is compressed, squashed, crushed or flattened by measuring fundamental parameters that determine the specimen behaviour under a compressive load. Compression test are conducted at the end of 7th and 28th day of casting the specimens. The load was applied without any shock and continuously until the failure of the specimens. The maximum load is applied to the specimens until failure is recorded.

6.2 Flexural Strength Test

During the testing, the beam specimens of size7000mmx150mmx150mm were used. Specimens were dried in open air after 7 days of curing and subjected to flexural strength test under flexural testing assembly.Apply the load at a rate that constantly increases the maximum stress until rupture occurs. The fracture indicates in the tension surface within the middle third of span length.

6.3 Impact Test

An impact test is a technique for determining the behavior of material subjected to shock loading in:

- Bending
- Tension
- Torsion

This test is designed to determine how a specimen of a known material will respond to a suddenly applied stress. The test ascertains whether the material is tough or brittle.

6.3.1 Types of Impact Tests

For a single impact test the three most popular types of test are the Chirpy V-notch test, the Izod test and the Tensile Impact test. These three tests all essentially determine the same characteristics of the material but differ in the orientation of the test sample which causes the sample to be stressed in different directions and involve a known weight released from a known height colliding with the specimen in its test fixture. All of these tests are useful in determining the impact mechanics of the test specimen.

7. TEST RESULT

7.1 Ratios for Special Concrete (Extra Ingredients)

Ratio –I

Sugarcane fibre addingof 5 %

7.2 Compressive Strength of Cube

Table 4 shows the compressive strength test results.

Table 4: Compressive Strength Test Result

MIX DESIGN	% OF REPLACEMENT	COMPRESSIVE STRENGTH(N/mm²)		
		7DAYS	14 DAYS	28DAYS
M_{35}	0	25.6	30.85	38.54
	5 %	27.5	37.9	43.16

Figure 4 shows the compression test graph results of cube

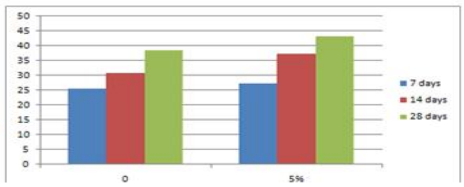

Figure4 Compression Test Graph Result

7.3 Flexural strength test:

Table 5 shows the Flexural strength test results.

Table 5: Flexural strength test result

MIX DESIGN	% OF REPLACEMENT	FLEXURAL STRENGTH TEST (N/mm²)		
		7 DAYS	14 DAYS	28 DAYS
M_{35}	0	3.1	4.85	5.99
	5 %	3.68	5.25	6.89

Figure 5 shows the Flexural strength graph result of prism

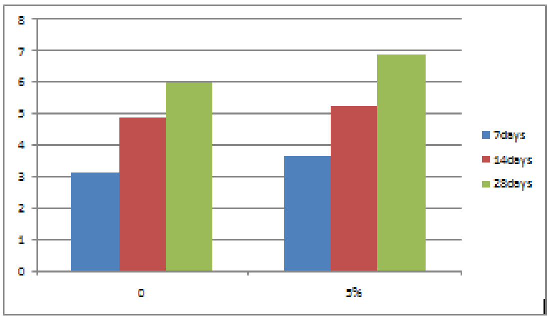

Figure5 Flexural strength graph result

7.4 Impact Test Result

Table 6 shows the impact test results.

Table 6 Impact test results

S.NO	Slab Identification	First Crack Load (kN)	Ultimate Failure Load (kN)	Deflection (mm)	
				At First Crack	At Ultimate Failure
1	Roof panel with sugarcane fiber	0.428	0.478	1.46	5.62

8. CONCLUSION

From the results obtained from the compression test, it is observed that there is an improvement in strength with the addition of sugarcane bagasse fibres whether treated or non-treated in comparison with plain cement concrete.

- There is 10.5 % increase in compressive strength for sugarcane bagasse fibres reinforced concrete than conventional concrete.
- Compressive strength was maximum obtained for sugarcane bagasse fibre reinforced concrete in 43.16N/mm^{2}at 28days compared to conventional concrete.
- Flexural strength will be increases at 5% replacement of sugarcane bagasse fibre at 6.89 N/mm^2.
- From impact test result Roof panel with 0.5% bagassefibre with 5.62 mm deflection at 0.478 kN.

References

[1]. T.Subramani., S.Krishnan. S.K.Ganesan., G.Nagarajan ”Investigation of Mechanical Properties in Polyester and Phenyl-ester Composites Reinforced With Chicken Feather Fibre” International Journal of Engineering Research and Applications Vol. 4, Issue 12(Version 4), pp.93-104, 2014.

[2]. T.Subramani, J.Jayalakshmi , " Analytical Investigation Of Bonded Glass Fibre Reinforced Polymer Sheets With Reinforced Concrete Beam Using Ansys" , International Journal of Application or Innovation in Engineering & Management (IJAIEM) , Volume 4, Issue 5, pp. 105-112 , 2015

[3]. 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

[4]. 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

[5]. 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

[6]. 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

[7]. 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

[8]. 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

[9]. 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*

[10]. 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

[11]. 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*

[12]. 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

[13]. 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

[14]. 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 .

[15]. 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

[16]. T.Subramani, A.Anbuchezian , " Experimental Study Of Palm Oil Fuel Ash As Cement Replacement Of Concrete " , International Journal of Application or Innovation in Engineering & Management (IJAIEM), Volume 6, Issue 3, March 2017 , pp. 001-005 , ISSN 2319 - 4847.

[17]. T.Subramani, A.Anbuchezian , " Experimental Study Of Mineral Admixture Of Self Compacting Concrete " , International Journal of Application or Innovation in Engineering & Management (IJAIEM), Volume 6, Issue 3, March 2017 , pp. 006-010 , ISSN 2319 - 4847.

[18]. T.Subramani, A.Anbuchezian , " Experimental Test On Bitumen With Addition Of 35% Of Plastic Fibre " , International Journal of Application or Innovation in Engineering & Management (IJAIEM), Volume 6, Issue 3, March 2017 , pp. 017-022 , ISSN 2319 - 4847.

[19]. T.Subramani, A.Anbuchezian , " Stabilization Of M30 Concrete Pavement By Partially Replacing Cement By 20% Of Flyash And Sodium Silicate " , International Journal of Application or Innovation in Engineering & Management (IJAIEM), Volume 6, Issue 3, March 2017 , pp. 023-031 , ISSN 2319 - 4847.

[20]. T.Subramani, A.Anbuchezian , " Experimental Investigation On Flexural Behavior Of Folded Ferro Cement Panels " , International Journal of Application or Innovation in Engineering & Management (IJAIEM), Volume 6, Issue 3, March 2017 , pp. 045-049 , ISSN 2319 - 4847.

[21]. T.Subramani, A.Anbuchezian , " Experimental Study On Replacement Of Concrete Material By Water Treatment Plant Waste Sewage " , International Journal of Application or Innovation in Engineering & Management (IJAIEM), Volume 6, Issue 3, March 2017 , pp. 050-057 , ISSN 2319 - 4847.

[22]. T.Subramani, A. Fizoor Rahman , " An Experimental Study On The Properties Of Pet Fibre Reinforced Concrete " , International Journal of Application or Innovation in Engineering & Management (IJAIEM), Volume 6, Issue 3, March 2017 , pp. 058-066 , ISSN 2319 - 4847.

[23]. T.Subramani, M.Meganathan, S.Priyanka , " Experimental Study On Strength Properties Of Diaphanous Concrete With Vermiculite " , International Journal of Application or Innovation in Engineering & Management (IJAIEM), Volume 6, Issue 5, May 2017 , pp. 229-238 , ISSN 2319 - 4847.

[24]. T.Subramani, T.Anandavel, S.Priyanka , " Experimental Investigation Of Waste Plastic Fibre In Reinforced Cement Concrete Using Recycled Coarse Aggregate " , International Journal of Application or Innovation in Engineering & Management (IJAIEM), Volume 6, Issue 5, May 2017 , pp. 239-250 , ISSN 2319 - 4847.

[25]. T.Subramani, S.Priyanka , " Experimental Test On Carbon Nano Powder On The Properties Of Concrete " , International Journal of Application or Innovation in Engineering & Management (IJAIEM), Volume 6, Issue 5, May 2017 , pp. 294-303 , ISSN 2319 - 4847.

[26]. T.Subramani, P.Babu, S.Priyanka , " Strength Study On Fibre Reinforced Concrete Using Palmyra Palm Fibre Using Fem Software " , International Journal of Emerging Trends & Technology in Computer Science (IJETTCS), Volume 6, Issue 3, May - June 2017 , pp. 198-207 , ISSN 2278-6856.

[27]. T.Subramani, G.Unni Krishnan, R.Arumugam, A.Godwyn Michael Cornelies, H.Gopu , " Experimental Study Of Quarry Sand And Rice Husk Replacing In Concrete " , International Journal of Application or Innovation in Engineering & Management (IJAIEM), Volume 6, Issue 5, May 2017 , pp. 312-319 , ISSN 2319 - 4847.

[28]. T.Subramani, R.Sengottaiyan, K.Roop Kumar, V.Arun Kumar , S.S.ShanjaySundaraSood , " An Expremental Investigation On Mineral Admixture For High Perfomence Of Concrete " , International Journal of Application or Innovation in Engineering & Management (IJAIEM), Volume 6, Issue 5, May 2017 , pp. 320-326 , ISSN 2319 - 4847.

[29]. T.Subramani, J.Karthickrajan , " Experimental Study On Absorption Of CO2 By M30 Concrete As A Partial Replacement Of Cement By 25% Of Zeolite" , International Journal of Application or Innovation in Engineering & Management (IJAIEM) , Volume 5, Issue 5, pp. 085-094 , 2016 .

AUTHOR

Prof. Dr.T.Subramani Working as a Professor and Dean of Civil Engineering in VMKV Engineering College, Vinayaka Missions Research Foundation (Deemed to be University),Salem, TamilNadu, India. Having more than 28 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 420 students in UG projects and 300 students in PG projects. He is a reviewer for number of International Journals and published 201 International Journal Publications and presented more than 55 papers in International Conferences. Also presented morethan 45 papers in National conferences and published 4 books.

LiyaminAhad N is persuing B.E Under graduate in the branch of Civil Engineering at V.M.K.V. Engineering College, Vinayaka missions University , Salem. His hobbies are playing Cricket, drawing , Swimming and cycling.

Eldhose jolly is persuing B.E Under graduate in the branch of Civil Engineering at V.M.K.V. Engineering College, Vinayaka missions University , Salem. His hobbies are Travelling, Photography &Driviing.

Manuel Cheriyan is persuing B.E Under graduate in the branch of Civil Engineering at V.M.K.V. Engineering College, Vinayaka missions University, Salem. His hobbies is Travelling

S.Priyanka is persuing B.E. Degree in the branch of Civil Engineering in V.M.K.V. Engineering College, Vinayaka Missions University, Salem. She has illustrious career in her intermediate and matriculation exams, her hobby is cooking and surfing internet.