

Experimental Study on Hybrid Fiber Concrete With Banana And Sugarcane Fiber

T.Subramani¹, V. Karthick², A. Mohammed Asif³, Mohammed Salman⁴, S.Priyanka⁵

¹Professor & Dean, Department of Civil Engineering, VMKV Engineering College, Vinayaka Missions Research Foundation (Deemed to be University), Salem, India

^{2,3,4,5}UG Student, , Department of Civil Engineering, VMKV Engineering College, Vinayaka Missions Research Foundation (Deemed to be University), Salem, India

Abstract

The use of two or more types of fibers in a suitable combination may potentially improve the overall properties of concrete and also result in performance concrete. The present work investigates the effect of hybridization of sugarcane bagasse and banana fibers as reinforcements in the polymer matrix. Composites made from natural fibers possess favorable properties like low cost, light weight, high strength and eco-friendly nature compared to synthetic fibers. Structural applications such as aerospace and automobile industries moving towards the use of these natural composites. In this research work two lightweight composite materials have developed, one with a linear pattern and other with chopped pattern of sugarcane bagasse and banana fiber reinforcements. The developed composites were subjected to different tests to investigate their mechanical behavior. Both the developed specimens were examined for their tensile strength, hardness, and water absorption capacity and compared their behavior. It is observed from the test results, the composite with the chopped fiber reinforcement possess better mechanical properties compared to the linear reinforcement.

Keywords: Fibers, Bagasse, Banana Fibers and Reinforcements

1. INTRODUCTION

Concrete is characterized by quasi-brittle failure, the nearly complete loss of loading capacity, once failure is initiated. This characteristic, which limits the application of the material, can be overcome by the inclusion of a small amount of short randomly distributed fibers (steel, glass, synthetic and natural) and can be practiced among others that remedy weaknesses of concrete, such as low growth resistance, high shrinkage cracking, low durability, etc. Fiber reinforced concrete (FRC) is a fiber reinforcing cementations concrete composite, and by adding discrete short fibers randomly in concrete it exhibits many substantially improved engineering properties in compressive strength, tensile strength, flexural strength etc. The fibers are able to prevent surface cracking through bridging action leading to an increased impact resistance of the concrete. The combination of two or more different types of fibers (different fiber types and/or geometries) is becoming more common, with the aim of optimizing overall system behavior. The intent is that the performance of these hybrid systems

2. METHODOLOGY

Figure 1 shows the Methodology of the study.

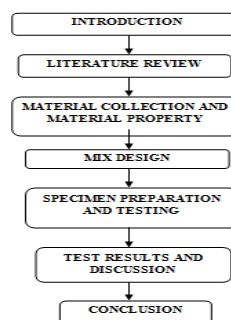


Figure 1 Methodology

3. HYBRID FIBER CONCRETE

The usefulness of hybrid fiber reinforced concrete in various Civil Engineering applications is thus indisputable. Hence this study explores the feasibility of hybrid fiber reinforcement with a given grade of concrete. Hybrid Fiber Reinforced Concrete (HFRC) is formed from a combination of different types of fibers, which differ in material properties, remain bonded together when added in concrete and retain their identities and properties. The hybridization of fibers provides improved specific or synergistic characteristics not obtainable by any of the original fiber acting alone. Hybrid fiber reinforced concrete is use of two or more than two fibers in a single concrete matrix to improve overall properties of concrete.

4. MATERIAL COLLECTION

4.1 Cement

It is mixture of calcareous, siliceous, aluminous substances and crushing the clinkers of a fine powder. The ordinary Portland cement of 43 grade is used. The specific gravity of cement is 3.15. For ordinary Portland cement, the initial setting time is 45 minutes and the final setting time is 600 minutes. The oxide contents are as follows: 60-67% cao, 17-25% sio₂, 3-8% al₂o₃, 0.5-0.6% fe₂o₃ and 0.1-0.4% mgo. Table 1 shows the Properties of Cement.

Table 1: Properties of cement

| Description of test | Test results obtained | Requirements of IS: 8112 1989 |
|---|---------------------------|-------------------------------|
| Initial setting time | 65 minutes | Min. 30minutes |
| Final setting time | 270 minutes | Max. 600minutes |
| Fineness (specific surface by Blaine's air permeability test) | 412.92 m ² /kg | Min. 225 m ² /kg |

4.2 Fine Aggregate

The sand used for the experimental programmer was locally procured and confirmed to grading zone The sand was sieved first through 4.75mm sieve to remove any particles greater than 4.75mm. Specific gravity – 2.65 and fineness modulus – 3.35. Table 2 shows the Properties of Fine Aggregate.

Table 2: Properties of Fine Aggregate

| S.no. | Description of materials | Properties |
|-------|--|------------|
| 1 | Specific gravity | 2.8 |
| 2 | Fineness modulus | 4.44 |
| 3 | Loose bulk density kg/m ³ | 2500 |
| 4 | Compacted bulk density kg/m ³ | 2890 |
| 5 | Water absorption % | 0.46 |

4.3 Course Aggregate

The fractions from 20mm to 4.75mm are used as coarse aggregate. The coarse aggregates from crushed Basalt rock, conforming to IS: 383 is being used. The flakiness and elongation Index were maintained well below 15%.The material whose particles are of size as are retained on I.S. Sieve No. 480 (4.75 mm) is termed as Coarse Aggregate. The size of coarse aggregate depends upon the nature of work. The coarse aggregate used in this experimental investigation are of 20mm (60%), 16mm (20%) and 12mm (20%) sizes, crushed angular in shape. The aggregates are made free from dust before being used in the concrete. Its specific gravity is 2.74. Table 3 shows the Properties of Coarse Aggregate.

Table 3: Properties of Coarse aggregate

| S.no | Description of materials | Properties |
|------|--------------------------|------------|
|------|--------------------------|------------|

| | | |
|---|--|-------|
| 1 | Specific gravity | 2.69 |
| 2 | Fineness modulus | 7.950 |
| 3 | Loose bulk density kg/m ³ | 1290 |
| 4 | Compacted bulk density kg/m ³ | 1584 |
| 5 | Water absorption % | 1.343 |

4.4 Water

Water is an important ingredient of concrete as it actually participates in the chemical reaction with cement. Since it helps to form the strength giving cement gel, the quantity and quality of water are required to be looked into very carefully. Water used in the experimental work is conformed to IS: 456-2000 for mixing as well as curing of concrete specimens. Plasticizer: Sulphonated naphthalene formaldehyde is used as a plasticizer.

4.5 Banana Fiber

Banana plant or plantain plant not only gives the delicious fruit but it also provides textile fibre, the banana fibre. Banana fibre is natural fibre. Natural fibers present important advantages such as low density, appropriate stiffness and mechanical properties and high disposability and renewability. Figure 2 shows the Banana Fibre.



Figure 2 Banana Fibre

Table 4 shows the Properties of Banana Fibers.

Table 4: Properties of Banana Fibers

| | |
|----------------------|----------------|
| Tenacity | 29.98 g/denier |
| Fineness | 17.15 |
| Moisture Regain | 13.00% |
| Elongation | 6.54 |
| Alco-ben Extractives | 1.70% |
| Total Cellulose | 81.80% |
| Alpha Cellulose | 61.50% |
| Residual Gum | 41.90% |
| Lignin | 15.00% |

4.6 Sugercane Fibre

Bagasse (Sugercane Fibre) is the dry pulpy fibrous residue that remains after sugarcane or sorghum stalks are crushed to extract their juice. It is used as a bio fuel for the production of heat, energy, and electricity, and in the manufacture of pulp and building materials. Agave bagasse is a similar material that consists of the tissue of the blue agave after extraction of the sap. For every 10 tonnes of sugarcane crushed, a sugar factory produces nearly three tonnes of wet

bagasse The high moisture content of bagasse, typically 40–50 percent, is detrimental to its use as a fuel. Table 5 shows the Properties of the Sugarcane Fiber.

| S.NO | Properties of fiber | Sugarcane |
|------|------------------------------|-------------|
| 1 | Diameter | 1.50 mm |
| 2 | Aspect Ratio | 30, 60 % 90 |
| 3 | Specific gravity | 0.52 |
| 4 | Water Absorption | 286.6 |
| 5 | Density in kg/m ³ | 260 |

Table 5: Properties of the sugarcane fiber

5. MIX DESIGN

TABLE 6 SHOWS THE MIX DESIGN.

TABLE 6: MIX DESIGN

| Cement (kg)/m ³ | FA (kg)/m ³ | CA (kg)/m ³ | Water (liter)/m ³ |
|----------------------------|------------------------|------------------------|------------------------------|
| 531.43 | 639.048 | 1068.09 | 186 |

6. TESTING PROCEDURE

6.1 Compressive Strength Test

When a specimen of material is loaded in such a way that it extends it is said to be in tension. On the other hand if the material compresses and shortens it is said to be in compression. Figure 3 shows the Compression test.



Figure 3 Compression Test

Table 7 shows the Compressive strength test results.

| MIX DESIGN | % OF REPLACE MENT | COMPRESSIVE STRENGTH(N/mm ²) | | |
|-----------------|-------------------|--|---------|--------|
| | | 7DAYS | 14 DAYS | 28DAYS |
| M ₃₀ | 0 | 19.6 | 25.6 | 33.56 |
| | 1 | 23.3 | 28.96 | 42.35 |
| | 2 | 22.3 | 26.6 | 34.89 |
| | 3 | 15.6 | 22.6 | 33.44 |

Table 7: Compressive Strength Test Result

Figure 4 shows the Compression test graph result.

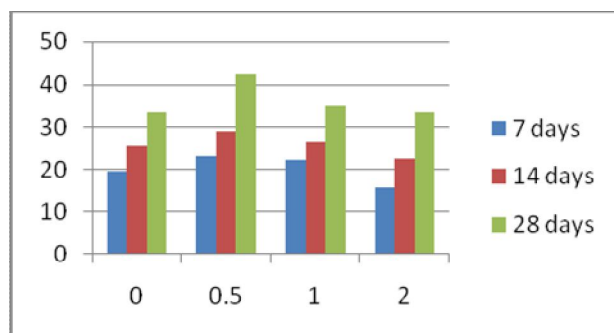


Figure 4 Compression Test Graph Result

6.2 Flexural Strength Test

Flexural strength, also known as modulus of rupture, bend strength, or fracture strength,^[1] a mechanical parameter for brittle material, is defined as a material's ability to resist deformation under load. Figure 5 shows the Flexural strength test.



Figure 5 Flexural Strength Test

Table 8 shows the Flexural strength test results.

Table 8: Flexural strength test result

| MIX DESIGN | % OF REPLACEMENT | FLEXURAL STRENGTH TEST (N/mm ²) | | |
|-----------------|------------------|---|---------|---------|
| | | 7 DAYS | 14 DAYS | 28 DAYS |
| M ₃₀ | 0 | 2.3 | 4.3 | 5.25 |
| | 1 | 2.5 | 4.6 | 6.54 |
| | 2 | 2.1 | 4.1 | 5.12 |
| | 3 | 1.96 | 3.78 | 4.96 |

Figure 6 shows the Flexural strength graph results.

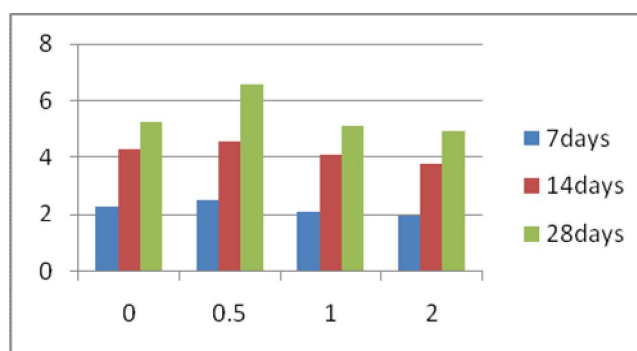


Figure 6 Flexural Strength Graph Result

6.3 Split Tensile Test

The tensile strength is one of the basic and important properties of the concrete. The concrete is not usually expected to resist the direct tension because of its low tensile strength and brittle nature. Figure 7 shows the Split tensile test.



Figure 7 Split tensile test

Table 9 shows the Split tensile test results.

Table 9: Split tensile test results

| MIX DESIGN | % OF REPLACEMENT | SPLIT TENSILE TEST (N/mm ²) | | |
|-----------------|------------------|---|---------|---------|
| | | 7 DAYS | 14 DAYS | 28 DAYS |
| M ₃₀ | 0 | 2.5 | 3.1 | 3.9 |
| | 1 | 2.8 | 3.5 | 4.3 |
| | 2 | 2.4 | 3.06 | 4.09 |

| | | | | |
|--|---|------|------|-----|
| | 3 | 1.92 | 2.85 | 3.3 |
|--|---|------|------|-----|

Figure 8 shows the Split tensile graph results.

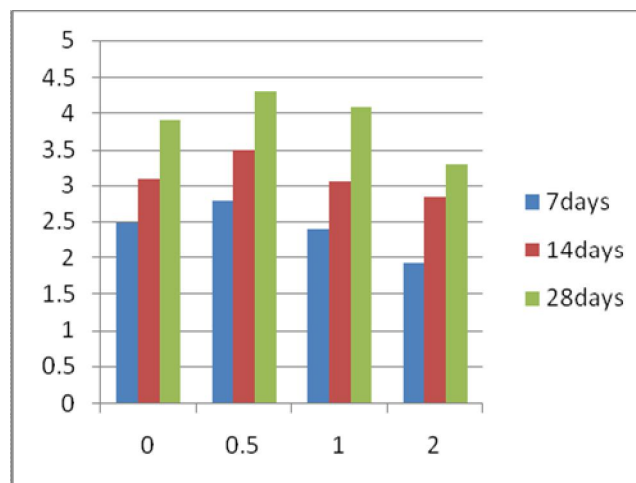


Figure 8 Split Tensile Graph Result

7. CONCLUSION

The shear behaviour of concrete beams reinforced with GFRP layer with Basalt fibre and banana fiber shear reinforcement has been presented in our project.

- The compressive strength at 1 percentages Basalt fibre was 42.35N/mm^2 . The increase percentage of strength at 3 percentage Basalt fibre and banana fiber controlled concrete cube strength 33.44N/mm^2 at 28 days.
- Both split tensile & Flexural strength at 1 percentage was increased as 4.3 N/mm^2 , 6.54 N/mm^2 compared to conventional and increasing percentage of basalt fibre.

References

- [1] 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 (IJAEM), Volume 6, Issue 5, May 2017 , pp. 312-319 , ISSN 2319 - 4847.
- [2] T.Subramani, M.Senthilkumar, V.Ashok Kumar, Pawan Kumar Singh, R.Silambarasan , " Experimental Study On M-Sand With Addition Of Sugar As Admixture In Concrete " , International Journal of Emerging Trends & Technology in Computer Science (IJETTCS), Volume 7, Issue 2, March - April 2018 , pp. 100-107 , ISSN 2278-6856.
- [3] T.Subramani, A.Fizoor Rahman, K.M.Mohamed Irfan, G.Ramajayam, Shubram Mohan , " Experimental Study Of Applying Translucent Concrete In Green House Building Concrete Using M-Sand " , International Journal of Emerging Trends & Technology in Computer Science (IJETTCS), Volume 7, Issue 2, March - April 2018 , pp. 116-125 , ISSN 2278-6856.
- [4] T.Subramani, M.Senthilkumar, G.Gopinathan, A.S.Kabil, R.Naveen Kumar , " Experimental Study On Pervious Concrete Using Different Size Of Coarse Aggregate " , International Journal of Emerging Trends & Technology in Computer Science (IJETTCS), Volume 7, Issue 2, March - April 2018 , pp. 126-133 , ISSN 2278-6856.
- [5] T.Subramani, S.Sekar, Kuriakose saji, Syam gopalakrishnan, A.Arul prakash , " Experimental Study On Pollution Control Concrete " , International Journal of Emerging Trends & Technology in Computer Science (IJETTCS), Volume 7, Issue 2, March - April 2018 , pp. 149-157 , ISSN 2278-6856.
- [6] T.Subramani, N.Liyamin Ahad, Eldhose Jolly, Manuel Cheriyan, S.Priyanka , " Experimental Study On Mechanical Behavior Of Roof Panel Using Steel Fibre With Alkaline Solution " , International Journal of Emerging Trends & Technology in Computer Science (IJETTCS), Volume 7, Issue 2, March - April 2018 , pp. 169-176 , ISSN 2278-6856.

- [7] T.Subramani, S.Gunalan, Hari Prasath, K.Vasantha Sethupathi , S.Priyanka , " Experimental Investigation Of Concrete Using Peengan Waste " , International Journal of Emerging Trends & Technology in Computer Science (IJETTCS), Volume 7, Issue 2, March - April 2018 , pp. 208-215 , ISSN 2278-6856.
- [8] T.Subramani, and S.Sindhu, "Batch Study Experiments and Column Analysis For Finding out a Suitable Biosorbant For the Removal of Heavy Metals From Electroplating Industry Effluent" International Journal of Engineering Research and Applications, Vol.2, Issue.4, pp 172-184, 2012.
- [9] T.Subramani and R.Elangovan.R, " Experimental and Analytical Approaches to a Steel Bridge Identification", International Journal of Computer Applications in Engineering,Technology and Sciences(IJ-CA-ETS),Vol.4, No.2, pp 81 - 87, 2012
- [10] T.Subramani, D.Latha , " Experimental Study On Recycled Industrial Waste Used In Concrete" , International Journal of Application or Innovation in Engineering & Management (IJAEM) , Volume 4, Issue 5, pp. 113-122 , 2015
- [11] T.Subramani, V.Angappan , " Experimental Investigation Of Papercrete Concrete" , International Journal of Application or Innovation in Engineering & Management (IJAEM) , Volume 4, Issue 5, pp. 134-143 , 2015
- [12] 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 (IJAEM) , Volume 4, Issue 5, pp.144-152 2015
- [13] 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 (IJAEM) , Volume 4, Issue 5, pp. 153-162 , 2015
- [14] T.Subramani, M.Prabhakaran , " Experimental Study On Bagasse Ash In Concrete" , International Journal of Application or Innovation in Engineering & Management (IJAEM) , Volume 4, Issue 5, pp. 163-172 , 2015
- [15] 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 (IJAEM) , Volume 4, Issue 5, pp. 245-253 , 2015
- [16] T.Subramani, A.Mumtaj , " Experimental Investigation Of Partial Replacement Of Sand With Glass Fibre" , International Journal of Application or Innovation in Engineering & Management (IJAEM) , Volume 4, Issue 5, pp. 254-263 , 2015
- [17] *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*
- [18] 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 (IJAEM) , Volume 4, Issue 5, pp. 294-303 , 2015
- [19] *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*
- [20] 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 (IJAEM) , Volume 4, Issue 5 , pp. 313-322 , 2015
- [21] 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 (IJAEM) , Volume 4, Issue 5, pp. 323-332 , May 2015
- [22] 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 (IJAEM) , Volume 5, Issue 5, pp. 067-075 , 2016 .
- [23] 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 (IJAEM) , Volume 5, Issue 5, pp. 085-094 , 2016 .
- [24] T.Subramani, D.Udayakumar , " Experimental Study On Stabilization Of Clay Soil Using Coir Fiber" , International Journal of Application or Innovation in Engineering & Management (IJAEM) , Volume 5, Issue 5, pp. 192-203 , 2016 .
- [25] T.Subramani, P.Sakthivel , " Experimental Investigation On Flyash Based Geopolymer Bricks" , International Journal of Application or Innovation in Engineering & Management (IJAEM) , Volume 5, Issue 5, pp. 216-227 , 2016

- [26] 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
- [27] T.Subramani, A.Anbuchejian , " 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.
- [28] T.Subramani, A.Anbuchejian , " 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.
- [29] T.Subramani, A.Anbuchejian , " 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.
- [30] T.Subramani, A.Anbuchejian , " Experimental Analysis Of Decomposed Organic Material Excreted From Vermicomposting Technology " , International Journal of Application or Innovation in Engineering & Management (IJAIEM), Volume 6, Issue 3, March 2017 , pp. 039-044 , ISSN 2319 - 4847.
- [31] T.Subramani, A.Anbuchejian , " 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.
- [32] T.Subramani, A.Anbuchejian , " 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.
- [33] T.Subramani, A. Fizzor 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.
- [34] 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.
- [35] T.Subramani, T.Anandavel, S.Priyanka , " Experimental Investigation Of Waste Plastic Fiber 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.
- [36] 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.
- [37] T.Subramani, R.Sengottaiyan, K.Roop Kumar, V.Arun Kumar , S.S.Shanjay Sundara Sood , " An Experimental Investigation On Mineral Admixture For High Performance Of Concrete " , International Journal of Application or Innovation in Engineering & Management (IJAIEM), Volume 6, Issue 5, May 2017 , pp. 320-326 , ISSN 2319 - 4847.
- [38] T.Subramani, R.Sathiyaraj, M.N.Suhail, Jestin Mathew , T.S.Sreehari , " Transparent Concrete Concept By Replacing Fine Aggregate Of Waste Glass By Using Admixture In Optical Fibre " , International Journal of Emerging Trends & Technology in Computer Science (IJETTCS), Volume 7, Issue 2, March - April 2018 , pp. 108-115 , ISSN 2278-6856.
- [39] T.Subramani, A.Anbuchejian , " Water Proofing Concrete By Using Fake Snow Powder " , International Journal of Application or Innovation in Engineering & Management (IJAIEM), Volume 6, Issue 3, March 2017 , pp. 011-016 , ISSN 2319 - 4847.
- [40] T.Subramani, A.Anbuchejian , " 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.
- [41] T.Subramani, R.K.Sridhar, S.Priyanka , " Natural Fibre As Soil Stabilizer For Construction " , International Journal of Application or Innovation in Engineering & Management (IJAIEM), Volume 6, Issue 5, May 2017 , pp. 274-284 , ISSN 2319 - 4847.
- [42] T.Subramani, C.Kathirvel , K.Dinoja Kamalendran , K.Praveen Kumar , S.Kelvin Raj , " Corrosion Inhabitation Of Iron Steel By Natural Inhibitors " , International Journal of Emerging Trends & Technology in Computer Science (IJETTCS), Volume 7, Issue 2, March - April 2018 , pp. 198-207 , ISSN 2278-6856.

- [43] T.Subramani, A.Fizoor Rahman, M.S Lekshmi, T. Neeraj, Vishnu Vijayan , " Study On Replacement Of Sago Waste Water In Roofing Tiles " , International Journal of Emerging Trends & Technology in Computer Science (IJETTCS), Volume 7, Issue 2, March - April 2018 , pp. 216-223 , ISSN 2278-6856.
- [44] T.Subramani, Krishnan.S, Ganesan.S.K, Nagarajan.G "Investigation of Mechanical Properties in Polyester and Phenyl-ester Composites Reinforced With Chicken Feather Fiber" International Journal of Engineering Research and Applications Vol. 4, Issue 12(Version 4), pp.93-104, 2014.
- [45] T.Subramani, Bharathi Devi.K, Saravanan.M.S ,Sivakumar.C.T, "Cost Comparative Study On Steel Frame Folded Plate Roofing System Vs Conventional Truss Roofing System" International Journal of Engineering Research and Applications Vol. 4, Issue 12(Version 4), pp.139-144, 2014.
- [46] T.Subramani, P.Ramasamy , " Thermal Conductivity Of Fibre Filled With Ferrocement Sandwich Panels" , International Journal of Application or Innovation in Engineering & Management (IJAEM) , Volume 5, Issue 5, pp. 204-215 , 2016 .

AUTHOR



Prof. Dr. T. Subramani Working as Professor and Dean of Civil Engineering in Vinayaka Missions Kirupananda Variyar 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 serving as reviewer for many International Journals and also published 250 papers in International Journals. He has presented more than 107 papers in conferences, especially 77 in International and 30 National Level. He has authored 07 books. Guided more than 259 students in PG projects. Currently he is guiding 03 Ph.D., Research Scholars. He is serving as examiner and Valuer for B.E & M.E Degree Theory and Practical Examinations for Madras University, Periyar University, Anna University, Annamalai University and Vinayaka Missions Research Foundation [Deemed to be University]. He is Question paper setter and Valuer for UG and PG Courses of Civil Engineering in number of Universities. He is serving as Chairman of Board Of Studies (Civil Engineering), Vinayaka Missions Research Foundation [Deemed to be University], also a member of Board of studies in Periyar University. He is Life Fellow in Institution of Engineers (India) and Institution of Valuers. Life member in number of Technical Societies and Educational bodies like MISTE, MIGS, MIRC,ISRMTT, UWA, Salem District Small and Tiny Association (SADISSTIA), SPC – Salem Productivity Council. He has delivered much technical talk in various field. He is a Chartered Civil Engineer and Approved Valuer for many banks. He is a Licensed Building Surveyor in Salem City Municipal Corporation-Salem, and Licensed Civil Engineer in Salem Local Planning Authority- Salem. He is the recipient of many prestigious awards.



V.Karthick is perusing B.E Degree in the branch of Civil Engineering at V.M.K.V. Engineering College, Vinayaka Missions Research Foundation (Deemed to be University), Salem, Tamilnadu, India. He has well knowledge in AUTOCAD drawing. His hobbies are singing, drawing, cycling and cooking.



A.Mohammed Asif is perusing his B.E Degree in the branch of Civil Engineering at V.M.K.V. Engineering College, Vinayaka Missions Research Foundation (Deemed to be University), Salem, Tamilnadu, India. He has well knowledge in AUTOCAD drawing.



Mohammed Salman is perusing B.E Degree in the branch of Civil Engineering at V.M.K.V. Engineering College, Vinayaka Missions Research Foundation (Deemed to be University), Salem, Tamilnadu, India. He has well knowledge in AUTOCAD drawing.



S.Priyanka is persuing B.E. Degree in the branch of Civil Engineering in Vinayaka Missions Kirupananda Variyar Engineering College, Vinayaka Missions Research Foundation (Deemed to be University), Salem, Tamilnadu, India. She published 30 papers in International Journals. She has presented more than 13 papers in conferences, especially 8 in International and 5 National Level. She has well knowledge in AUTOCAD drawing and STAAD Pro