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Experimental Investigation Of Concrete Using Peengan Waste

T.Subramani[1], S.Gunalan[2], Hari Prasath[3], K.Vasantha Sethupathi [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: ***In our project is an experimental investigation to check the suitability of using peengan waste as a substitute for coarse aggregate in the construction of concrete. Concrete mixes with different percentage (0%, 5%, 10% and 15%) of peengan waste were prepared mixes with different percentage of peengan waste was studied. Test on fresh and hardened concrete were conducted on each mix. Compare the strength of ordinary concrete with concrete incorporating tile waste as coarse aggregate and peengan waste concrete. Test on concrete were conducted on maximum strength obtained in concrete mix of particular percentage of peengan waste.***

Keywords: Experimental, Investigation, Concrete, Peengan Waste

1. INTRODUCTION

Concrete is a most versatile construction material because it is designed to withstand the harsh environments, with adequate strength and durability. Due to over usage of the concrete materials it become scared, and also the production at larger rate create many hazardous to the environment. On other side the waste exposed to our environment is an impact to ecology cycle, among all industrial waste is the major source of waste which will affect the environment. Industrial waste contains many in organic and toxic substances beyond the acceptable limit cause impact to living life. To overcome these issues these industrial waste can be recycled and reused for any useful purpose with acceptance levels. In this experimental investigation work major source of industrial waste which creates pollution to environment and left at industrial site as non-useable materials such as Peengan tile are used as concreting materials. Copper tile is industry waste obtained from smelting and refining process of copper at larger rate. Nearly 4-5 tons of copper is obtain as waste tile which contain pozzolonic property and have high density can be used as replacement for all concrete materials like sand, cement and coarse aggregate. Peengan tile industry waste is the leading industrial waste obtained in various forms like Peengan tile powder, broken tiles, slurry waste etc., which is disposed to landfill create pollution at larger rate. In this project work Peengan tile waste tiles are collected and broken into 20mm tiles for partial replacement with coarse aggregate. These replacements will reduce the cost of the project at greater percentage because aggregates are more costly than cement for concrete production.

In this experimental work the waste materials are used as partial replacements for concreting materials in varying percentages. First of all Normal concrete is designed for M40 grade and their strength were tested, then in the normal mix the copper tile is partially replaced for fine aggregate at different proportions from 25%,50%,by weight of sand. The optimum percentage of replacement is found by various testing of concrete. Then Peengan tile tiles are broken for partial replacement of 20mmaggregates and their strength were tested. The replacement of tiles alone will not promote any increment in concrete strength so the optimum percentage found in tile content is kept as constant percentage replacement for sand and the aggregate is replaced in range of 0%, 5%, 10% and 15%by weight of coarse aggregate. Finally all the strength factors are tested and compared with conventional concrete strength which should satisfy the increased concrete strength requirements.

1.1 General

Generally in design of concrete mix, cement, fine aggregates and coarse aggregates are using from a long years back. These three materials only play a crucial role in designing of a particular grade of concrete. But now a days there is a scarcity in aggregates. So, some new materials which are very near to our surroundings and some type of materials have to be introduce for replacing the fine aggregates, coarse aggregates and as well as cement to get the same strength as that these basic materials can give.

In the present study we have to replace the Waste tiles and peengan tile powder were collected from the surroundings. Crushed tiles are replaced in place of coarse aggregate and peengan tile powder in place of fine aggregate by the percentage of 25%,50%.The fine aggregates were replaced individually by these crushed tiles and peengan tile powder and also in combinations that is replacement of coarse and fine aggregates at a time in single mix.

Aggregate is one of the most important materials in use for concrete production as it profoundly influences concrete properties and performance. And not much research has been done on incorporating normal Peengan tile wall tiles waste as partial substitute of fine aggregates or cement, in the production of structural concrete. The current research is a bid towards exploring the possibility of incorporating wastes from Peengan tile wall tiles as partial substitute of fine aggregates or cement in the making of concrete. From economic point of view, cement and fine aggregates contribute a bigger portion of costs in the production of concrete, thus to have them replaced by waste material of similar characteristics is a major economic, while being more environment friendly. Peengan tile wastes are found to be suitable for usage as substitution for fine and coarse aggregates and partial substitution in cement production. Researchers have indicated their potential for usage in both structural and non-structural concrete and even for mortars. They were found to be performing better than normal concrete, compressive strength.

The usage of waste tiles partially as a replacement for coarse or fine aggregates will clear the wastes from construction and production site, also environmental pollution is reduced as impact of mining is reduced, natural resources are conserved and power consumption required for quarrying is minimized. Compressive strength of concrete gradually increased with the increase of quantity of coarse waste Peengan tile aggregate up to certain limits i.e. 20% for water-cement ratio of 0.4, 30% for water-cement ratio of 0.5 and 40% for water-cement ratio of 0.6. The greatest compressive strength was observed for C5-10 concrete. It was noticed that the flexural strength of Optimal Waste Peengan tile Concrete was32.2% higher than flexural strength of Reference Concrete. Therefore, it can be concluded that the use of coarse waste Peengan tile content in the concrete enhanced the flexural strength considerably. Also, it can be seen that using waste Peengan tile tiles in concrete production causes no remarkable negative effect in the properties of concrete. The optimal case of using waste Peengan tile tiles as coarse aggregates is found to vary from 10 to 30 percent. In these measures, not only an increase happens in compressive strength, but also a decrease in unit weight occurs. Finally, using waste Peengan tile tiles in concrete is an effective measure regarding to reducing the costs of concrete and is environmentally cleaner clean along with wastage management and decreasing the use of natural raw materials. In it is affirmed that the increase in tiles powder leads to the increase in workability of concrete.

1.2 Concrete

Concrete is a composite material consist of mainly water, aggregate, and cement. The physical properties desired for the finished material can be attained by adding additives and reinforcements to the concrete mixture. A solid mass that can be easily moulded into desired shape can be formed by mixing these ingredients in certain proportions. Over the time, a hard matrix formed by cement binds the rest of the ingredients together into a single hard (rigid) durable material with many uses such as buildings, pavements etc.,

1.3 Environmental and Economic Benefits of Peengan tile Aggregate Concrete:

The usage of tile aggregate as replacement to coarse aggregate in concrete has the benefits in the aspects of cost and reduction of pollution from construction industry. The cost of concrete manufacturing will reduce considerably over conventional concrete by including tile aggregate and granite powder since it is readily available at very low cost and there-by reducing the construction pollution or effective usage of construction waste.

1.4 Need for Peengan Tile Materials in Concrete

Indian peengan tile production is 100 Million ton per year. In the ceramic industry, about 15%-30% waste material generated from the total production. This waste is not recycled in any form at present. However, the peengan tile waste is durable, hard and highly resistant to biological, chemical, and physical degradation forces. The Ceramic industries are dumping the powder in any nearby pit or vacant spaces, near their unit although notified areas have been marked for dumping utilization of peengan tile waste and its application are used for the development of the construction industry, Material sciences. It is the possible alternative solution of safe disposal of peengan tile waste. Use of ceramic materials brings positive effect to the environment. Waste tiles can be used to replace some of the aggregates in a concrete mixture. This contributes to reducing the unit weight of the concrete. This is useful in applications requiring non-bearing light weight concrete, such as concrete panels used in facades, foot bath.

1.5 Problem Statement

The demand of construction materials for project is increasing. Therefore, there is a need to explore alternative building materials from industrial waste materials that can be recycled. Peengan tiles are often discarded as waste after defined as useless. But it can be recycled and can be used as a construction material in present world which is seeking for alternative construction materials which are economical, environment friendly as well as provides same quality as that of a normal aggregate made of regular aggregates. Tile wastes can be used safely with no need for dramatic change in production and application pro

1.6 Scope of Study

Peengan tile waste use in this research was taken from old site factory the scope of concrete use is in Malaysia construction industry. The experiment is only limit to five lab tests, Slump test, compression test, test and water absorption test. Slump test is used to determine the correct hydration of a batch of concrete. The slump is the distance the wet concrete settles after the slump cone is lifted off. It is essential test to test the workability of fresh concrete, this test very useful in detecting variations in the uniformity of a mix of given nominal proportions. All of the specimens were subjected to immerse in water tank for curing process for being test. Compressive test is to determine the strength of the concrete cube at the 7rd, 14th and 28th day of the casting period. The value obtained from the test must be higher than the standard specified strength for the concrete cube to pass.

1.7 Significance of Study

There are many inquiry and study that had carried carry out to improvise the quality of concrete production and to create various types of concrete that will be used for different purposes according to its suitability. Many researches had been conducted to intensify the quality or properties of the regular concrete by mixing or adding other materials into the natural conventional concrete. For this study, ceramic tile waste is used as partial coarse aggregates replacement to natural coarse aggregates. The study is essential because the proposed material to replace coarse aggregates is waste product from construction. If ceramic waste is suitable, it can be used in concrete production. This will reduce the waste material from construction as ceramic tile waste can be recycled for concrete production purposes. Besides, we can cut down the uses of natural aggregates that are produced from quarrying process which is non-environmental process and harmful to environment. The concrete's production cost can be reduced because the alternative material is waste material that is very low in cost

1.8 Other Applications of Ceramic Waste Substitution

Peengan tile are made from natural substantial which have a high proportion of clay minerals. So, the manufacturing process involved in Peengan tile materials needs high firing temperatures which may effective the clay minerals, enhance them with pozzolanic properties and forming hydrated outputs related to those obtained with other active materials.

1.9 Application of Raw Materials Production of Civil Industrial

You can see the peengan tile industry waste under the microscope, microscopic morphology of the peengan tile waste is an irregular scaly which determines grind ability of tile particles. After full, moderately coarse broken and surface cleaning with a surfactant impurities, the peengan tile waste can get raw materials suiting cement, concrete and other construction materials production and processing. Putting the ceramic waste after reprocessing into cement and concrete production will bring great social and economic benefits and achieve effective integration of ceramic waste disposal with construction materials production. Application are mainly in the production of peengan tile and wall insulation board by peengan tile waste and preparation of concrete and padded liner insulation aspects.

1.10 Objectives

The objective of this work is to develop concrete with good strength, less porous, less capillarity so that durability will be reached. For this purpose it requires the use of different pozzolanic materials like Tiles waste

1. To study the properties of M40grade of peengan tile concrete.
2. To save the natural aggregate by using Peengan tile waste.
3. To investigate the increase in the strength of concrete and better bonding between the aggregate and cement paste.
4. To minimize the environment hazards by utilizing wastages.
5. To study the partial replacement of coarse aggregate with peengan tiles
6. To compare the strength of replaced concrete with the conventional concrete.

2. METHODOLOGY

Figure 1. Shows the methodology adopted in this study

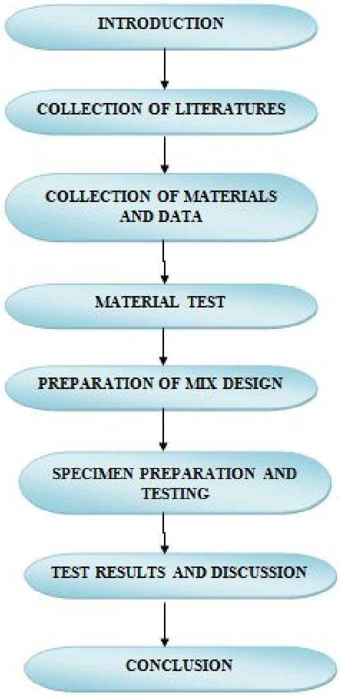

Figure 1 Methodology

3. MATERIAL COLLECTION

3.1 Cement

Ordinary Portland cement is the most common type of cement in general use around the world as a basic ingredient of concrete, mortar, stucco, and most non-specialty grout. It developed from other types of hydraulic lime in England in mid-19th century and usually originates from limestone. It is a fine powder produced by heating materials to form clinker. After grinding the clinker we will add small amounts of remaining ingredients. Many types of cements are available in market. When it comes to different grades of cement, the 53 Grade OPC Cement provides consistently higher strength compared to others. As per the Bureau of Indian Standards (BIS), the grade number of a cement highlights the minimum compressive strength that the cement is expected to attain within 28 days. For 53 Grade OPC Cement, the minimum compressive strength achieved by the cement at the end of the 28th day shouldn't be less than 53MPa or 530 kg/cm2. The colour of OPC is grey colour and by eliminating ferrous oxide during manufacturing process of cement we will get white 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.

3.1 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 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 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.

3.3 Fine Aggregate
Sand is a natural granular material which is mainly composed of finely divided rocky material and mineral particles. The most common constituent of sand is silica(silicon dioxide, or SiO_2), usually in the form of quartz, because of its chemical inertness and considerable hardness, is the most common weathering resistant mineral. Hence, it is used as fine aggregate in concrete Fine aggregates are termed as "filler" which fills the voids in concrete. The reactions of aggregates less then4.75mm are known as fine aggregates. The river sand is used as fine aggregate conforming to requirements of IS: 383-1970 comes under zone II.

3.4 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.

- Role of Water in Cement Concrete.
- Requirements of water used in concrete.
- The permissible limits for solids in water.
- Solids Permissible Limits (Max).
- Organic 200 mg/lit.
- Inorganic 3000 mg/lit.
- Sulphates (SO_4) 500 mg/lit.
- Chlorides (Cl) 500 mg/lit.
- Suspended matter 2000 mg/lit Water/Cement Ratio and Strength.

3.5 Peengan Tiles
Peengan tiles aggregate are hard having considerable value of specific gravity, light weight than normal aggregate and rough surface on one side and smooth surface on other side. Replacement of ceramic aggregate is not only cost effective but also environment-friendly. The waste ceramic tiles are broken into pieces in nominal size (20mm as per IS 383-1970) and mixed with concrete as partial replacement of coarse aggregate. The usage of waste tiles would lead to reduce the environmental pollution. The properties of peengan tiles are well within the range of the values of concrete making aggregate since, there are no harmful chemical on tiles

Figure 2 Peengan Tiles

4. MATERIAL PROPERTIES
4.1 Cement
Ordinary Portland cement is the most common type of cement in general use around the world as a basic ingredient of concrete, mortar, stucco, and most non specialty grout. It developed from other types of hydraulic lime in England in mid 19thcentury and usually originates from limestone. It is a fine powder produced by heating materials to form clinker. After grinding the clinker we will add small amounts of remaining ingredients. Many types of cements are available in market. When it comes to different grades of cement, the 53 Grade OPC Cement provides consistently higher strength compared to others. As per the Bureau of Indian Standards (BIS), the grade number of a cement highlights the minimum compressive strength that the cement is expected to attain within 28 days. For 53 Grade OPC Cement, the minimum compressive strength achieved by the cement at the end of the 28^{th} day shouldn't be less than 53Mpa or 530 kg/cm2. The color of OPC is

grey color and by eliminating ferrous oxide during manufacturing process of cement we will get white cement also. Ordinary Portland Cement of 53 Grade of brand name Ultra Tech Company, available in the local market was used for the investigation. Care has been taken to see that the procurement was made from single batching in air tight containers to prevent it from being effected by atmospheric conditions. The cement thus procured was tested for physical requirements in accordance with IS: 169-1989 and for chemical requirement in accordance IS: 4032-1988.

4.2 Fine Aggregates

Sand is a natural granular material which is mainly composed of finely divided rocky material and mineral particles. The most common constituent of sand is silica (silicon dioxide, or SiO2), usually in the form of quartz, because of its chemical inertness and considerable hardness, is the most common weathering resistant mineral. Hence, it is used as fine aggregate in concrete. River sand locally available in the market was used in the investigation. The aggregate was tested for its physical requirements such as gradation, fineness modulus, specific gravity in accordance with IS: 2386-1963.The sand was surface dried before use.

4.3 Coarse Aggregates

Crushed aggregates of less than 12.5mm size produced from local crushing plants 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 table.

4.4 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.

4.5 Peengan Tile Coarse Aggregate

Broken peengan tiles were collected from the solid waste of ceramic manufacturing unit. Crushed them into small pieces by manually and by using crusher. And separated the coarse material to use them as partial replacement to the natural course aggregate. Separated the tile waste which is lesser than 4.75 mm. Crushed tiles were partially replaced in place of coarse aggregate by the percentages of 5%, 10% and 15% individually and along with replacement of fine aggregate with granite powder also.

Table 4 shows the Physical properties of ceramic aggregate

Table 1: Physical properties of ceramic aggregate

S.NO	PROPERTIES	WASTE PEENGAN TILES
1	Particle shape	Irregular
2	Impact value	12.5 %
3	Water absorption	0.13%
4	Aggregate crushing value	0.19%
5	Specific gravity	2.9

5. MIX DESIGN

5.1 Mix Proportion

Table 2 shows the Physical properties of ceramic aggregate

Table 2: Physical properties of ceramic aggregate

Cement (kg)/m^3	FA (kg)/m^3	CA (kg)/m^3	Water (liter)/m^3
547.37	580.53	1072.35	191.58

6. TEST PROCEDURE

6.1 Compressive Strength Test

Compressive strength is often measured on a universal testing machine; these range from very small table-top systems to ones with over 53 MN capacity. Measurements of compressive strength are affected by the specific test method and conditions of measurement. Compressive strengths are usually reported in relationship to a specific technical standard.

6.2 Splitting Tensile Strength

Tensile strength is one of the basic and important properties of concrete. Knowledge of its value is required for the design of concrete structural elements subject to transverse shear, torsion, shrinkage and temperature effects. Its value is also used in the design of prestressed concrete structures, liquid retaining structures etc. The cylindrical specimen shall have diameter not less than four times the maximum size of the coarse aggregate and not less than 150 mm. The length of the specimens shall not be less than the diameter and not more than twice the diameter.

6.3 Flexural Test

The flexural test is carried out on the beam moulds of size 500mmx100mmx100mm.

7. TEST RESULT

7.1 Compressive Strength of Cube

Table 3 shows the Compressive Strength of Cube.

Table 3: Compressive Strength of Cube

MIX DESIGN	% OF REPLACEMENT	COMPRESSIVE STRENGTH(N/mm^2)		
		7 DAYS	14 DAYS	28 DAYS
M40	0	22.87	29.17	42.5
	5	28.26	36.7	45.2
	10	23.4	32.3	41.6
	15	21.7	28.5	39.8

Figure 3 shows the compressive Strength of Cube graph results.

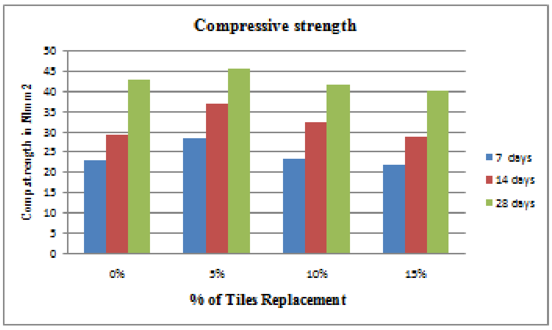

Figure 3 Compressive Strength of Cube graph results

7.2 Split Tensile Test for Cylinder

Table 4 shows the Split tensile test results.

Table 4: Split tensile test result

MIX DESIGN	% OF REPLACEMENT	SPLIT TENSILE TEST (N/mm^2)		
		7 DAYS	14 DAYS	28 DAYS
M40	0	1.67	2.3	2.82
	5	2.32	2.68	2.98
	10	2.14	2.57	2.85
	15	1.8	2.45	2.62

Figure 4 shows the Split tensile test graph results.

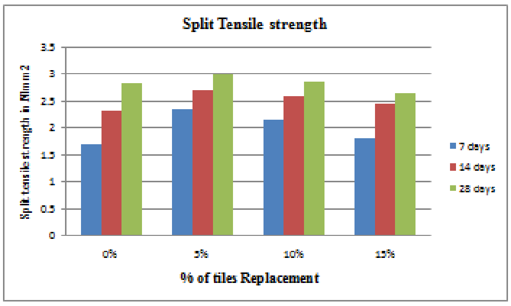

Figure 4 Split tensile test graph result

7.3 Flexural Strength Test for Beam

Table 5 shows the Flexural strength test results

Table 5 Flexural Strength Test Graph Result

MIX DESIGN	% OF REPLACEMENT	FLEXURAL STRENGTH IN N/MM^2		
		7 DAYS	14 DAYS	28 DAYS
M40	0	3.8	4.25	4.98
	5	4.2	4.86	5.72
	10	3.98	4.42	5.48
	15	4.08	4.65	5.25

Figure 5 shows the flexural strength test graph result

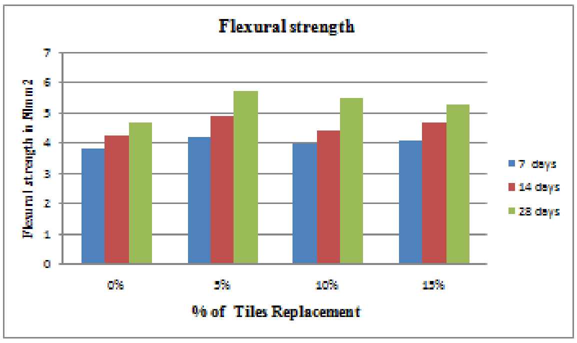

Figure 5 Flexural strength test graph result

8. CONCLUSIONS

The conclusions drawn from these experimental investigations are as follows.

- The Strength of peengan waste containing in concrete was high compared with that of the conventional mix.
- The compressive strength of M40 concrete with peengan waste as coarse aggregate was optimum with a value of 45.20 N/mm^2 at 28 days curing.
- The split tensile strength of M40 concrete with peengan waste as coarse aggregate was optimum with a value of 2.98 N/mm^2 at 28 days curing.

- The flexural strength of M40 concrete with peengan waste as coarse aggregate was optimum with a value of 5.72 N/mm^2at 28 days curing.
- Hence comparing concrete using peengan waste with conventional concrete, it can be concluded that the proposed concrete is 5% of peengan waste containing concrete is attain high strength compared with conventional concrete.

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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 more than 45 papers in National conferences and published 4 books.

Mr.S.Gunalan is pursuing B.E Under graduate in the branch of Civil Engineering at Vinayaka Missions Kirupananda Variyar Engineering College, Vinayaka Missions Research Foundation, Salem. He has well knowledge in AUTOCAD drawing and Staad pro Analysis. He is very much interested in sports.

Mr. Hari Prasath is pursuing B.E Under graduate in the branch of Civil Engineering at Vinayaka Missions Kirupananda Variyar Engineering College, Vinayaka Missions Research Foundation, Salem. He has well knowledge in AUTOCAD drawing. His hobbies are playing Volleyball, drawing, Reading books.

Mr.K.Vasantha Sethupathi is pursuing B.E Under graduate in the branch of Civil Engineering at Vinayaka Missions Kirupananda Variyar Engineering College, Vinayaka missions University , Salem. He has well knowledge in AUTOCAD drawing. His hobbies are playing Basketball, Hockey and Cricket.

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.