

**“Comparative Study on Partial Replacement of Fine
Aggregates with Wood powder and Quarry Fines in Cement
Blocks”**

Submitted in partial fulfillment of the requirements for the award of Bachelor of
Engineering in Civil Engineering

By

AKASH KING D (Reg. No. 39200004)

VISHANTH P (Reg. No. 39200044)



**DEPARTMENT OF CIVIL ENGINEERING
SCHOOL OF BUILDING AND ENVIRONMENT
SATHYABAMA
INSTITUTE OF SCIENCE AND TECHNOLOGY (DEEMED TO BE
UNIVERSITY)**

Accredited with Grade “A” by NAAC

JEPPIAAR NAGAR, RAJIV GANDHI SALAI, CHENNAI - 600 119

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SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)

Accredited with 'A' grade by NAAC
Jeppiaar Nagar, Rajiv Gandhi Salai, Chennai - 600 119.

Phone: 044 - 2450 3150 / 3151 / 3152 / 3154 / 3155 Fax: 044 - 2450 2344
www.sathyabama.ac.in



DEPARTMENT OF CIVIL ENGINEERING

BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of **AKASH KING D (39200004), VISHANTH P (39200045)**, who carried out the project entitled **“Comparative Study on Partial Replacement of Fine Aggregates with Wood powder and Quarry Fines in Cement Blocks”** under our supervision from July 2022 to April 2023.

Internal Guide

Mrs. S. VANITHA M.E.,

Head of the Department

Submitted for Viva voice Examination held on **19.04.2023**

Internal Examiner

External Examiner

DECLARATION

We AKASH KING D (39200004), VISHANTH P (39200045), hereby declare that the Project Report entitled Comparative Study on Partial Replacement of Fine Aggregates with Wood powder and Quarry Fines in Cement Blocks done under the guidance of Mrs. S. VANITHA is submitted in partial fulfillment of the requirements for the award of Bachelor of Engineering degree in Civil Engineering.

DATE : 13.04.2023

PLACE : Chennai

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SIGNATURE OF THE CANDIDATE

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ABSTRACT

This project aimed to investigate the potential of using wood powder and quarry fines as partial replacements for fine aggregates in cement bricks. The study included a comparative analysis of the mechanical properties and water absorption of cement bricks made with varying proportions of wood powder and quarry fines. Compressive strength tests were carried out on the bricks for 7, 14, and 28 days. Water absorption tests were also conducted on the bricks after 7, 14 and 28 days.

The results of the study indicated that the use of wood powder and quarry fines as partial replacements for fine aggregates in cement bricks led to a decrease in compressive strength and an increase in water absorption. However, it was observed that the reduction in compressive strength was not significant, and the water absorption values were still within acceptable limits for building materials. Additionally, the cost analysis showed that the use of wood powder and quarry fines could lead to cost savings in the production of cement bricks.

Overall, the findings of this study suggest that the use of wood powder and quarry fines as partial replacements for fine aggregates in cement bricks is a viable option that could lead to cost savings without compromising the mechanical properties and water absorption of the bricks. This research provides valuable information for the construction industry, particularly in areas where the cost of traditional building materials is a significant barrier to construction.

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CHAPTER 1

INTRODUCTION

1.1 GENERAL

Cement blocks are an essential building material used in construction projects around the world. These blocks are typically made from a combination of cement, sand, and water, which are mixed together and then poured into molds to create a range of different shapes and sizes. One of the primary advantages of cement blocks is their strength and durability. They are resistant to weathering, pests, and fire, and can withstand heavy loads without cracking or breaking. They are also relatively inexpensive compared to other building materials, making them a cost-effective choice for construction projects of all sizes. Another benefit of cement blocks is their versatility. They can be used for a variety of different applications, including building walls, foundations, and retaining structures. They can also be manufactured with different surface finishes and colors to meet specific aesthetic requirements.

In addition, cement blocks offer good thermal insulation properties, helping to keep buildings warm in the winter and cool in the summer. This can result in significant energy savings and reduced utility bills. Overall, cement blocks are an important building material that provide strength, durability, versatility, and cost-effectiveness, making them a popular choice for construction projects of all types and sizes. Cement blocks have been in use for more than a century, and their popularity has only continued to grow due to their many benefits. They are widely available, and can be found in a variety of sizes, shapes, and colors to meet the needs of any project.

.....One significant advantage of cement blocks is their ease of

installation. Unlike many other building materials, they do not require any specialized skills or equipment to install, making them accessible to both professional contractors and DIY enthusiasts. This can help to speed up construction projects and reduce labor costs. Cement blocks also offer excellent fire resistance. They do not burn, and can even help to prevent the spread of fires in buildings. This can improve safety and potentially reduce the damage caused by fires. In addition, cement blocks are environmentally friendly. They are made from natural materials and can be recycled, making them a sustainable choice for construction projects. They also have a long lifespan, reducing the need for frequent replacements and minimizing waste. Overall, cement blocks offer a wide range of benefits that make them a versatile and reliable building material. From their durability and strength to their ease of installation and environmental friendliness, they have become an essential component of modern construction projects around the world.

Quarry fines, also known as quarry dust, quarry screenings, or stone dust, are a byproduct of the crushing and screening process used in quarries. They are composed of fine particles of rock, gravel, and sand that are produced during the extraction and processing of stone. Quarry fines can vary in composition depending on the type of stone being quarried, but they are typically composed of angular particles ranging in size from dust to fine sand. Despite being a byproduct of the quarrying process, quarry fines have a number of practical applications in construction and landscaping. They are commonly used as a base material for roads, pathways, and parking lots due to their stability and compact ability. They can also be used as a bedding material for pipes and utility trenches. One of the primary benefits of quarry

finer is their affordability. Since they are a byproduct of the quarrying process, they are often sold at a lower price than other types of aggregate materials. This makes them an attractive option for contractors and homeowners looking to save money on construction projects. In addition, quarry fines can provide environmental benefits. By utilizing this byproduct instead of disposing of it in landfills, quarries can reduce their waste and environmental impact. Furthermore, the use of quarry fines can help to reduce the need for virgin aggregate materials, which can help to conserve natural resources. However, it is important to note that there are also some potential drawbacks associated with the use of quarry fines. For example, they may contain high levels of dust, which can be a health hazard for workers and nearby residents. In addition, their angular shape can make them less suitable for certain applications, such as decorative landscaping. Overall, quarry fines are a valuable byproduct of the quarrying process that can be used in a variety of construction and landscaping applications. While they have some potential drawbacks, their affordability and environmental benefits make them an attractive option for many projects.

Wood powder, also known as wood flour, is a fine-grained wood product that is produced by grinding or milling wood into small particles. It is commonly made from softwoods such as pine, spruce, and fir, although hardwoods such as oak and maple can also be used. Wood powder has a wide range of applications in various industries, including construction, furniture manufacturing, and even food production. In construction, it can be used as a filler material for composite materials such as wood-plastic composites (WPCs) and engineered wood products. It can also be used as a binding agent in construction adhesives and sealants. One of the

primary benefits of wood powder is its sustainability. Since it is made from wood waste and byproducts, it can help to reduce the amount of wood that would otherwise be sent to landfills. Furthermore, it is a renewable resource that can be sourced from sustainably managed forests, making it an environmentally friendly choice for many applications. Another advantage of wood powder is its versatility. It can be processed to create different particle sizes and shapes, allowing it to be tailored to specific applications. It can also be combined with other materials, such as plastics and resins, to create composite materials with enhanced properties. In addition, wood powder has a number of desirable properties, including high strength, low density, and good thermal insulation. These properties make it an attractive choice for a variety of applications, from furniture manufacturing to building insulation. However, it is important to note that there are also some potential drawbacks associated with the use of wood powder. For example, it can be combustible and may pose a fire hazard in certain applications. It can also be prone to moisture absorption, which can affect its properties and performance over time. Overall, wood powder is a versatile and sustainable material that has a wide range of applications in various industries. While it has some potential drawbacks, its desirable properties and environmental benefits make it an attractive choice for many applications. Wood powder and quarry fines can both be used as additives in cement blocks to improve their properties and enhance their sustainability. Cement blocks are a popular building material that are widely used in construction due to their durability, ease of installation, and fire resistance. By adding wood powder and quarry fines to cement blocks, manufacturers can create a product with enhanced properties and reduced environmental impact.

Wood powder can be used as a filler material in cement blocks to reduce their density and improve their insulation properties. This can make the blocks lighter and easier to handle, while also improving their thermal performance. In addition, wood powder can help to reduce the amount of cement required in the manufacturing process, which can help to lower the carbon footprint of the blocks. Quarry fines, on the other hand, can be used as a replacement for sand in cement blocks. This can help to reduce the environmental impact of the manufacturing process by utilizing a byproduct of the quarrying process. In addition, quarry fines can provide some desirable properties to the blocks, such as improved compaction and stability. By combining wood powder and quarry fines with cement, manufacturers can create a product with enhanced properties that is also more sustainable. These additives can help to reduce the environmental impact of the manufacturing process and create a product with improved insulation and stability properties. Furthermore, using wood powder and quarry fines in cement blocks can help to reduce the amount of waste generated by the construction industry and promote more sustainable building practices. Overall, the use of wood powder and quarry fines in cement blocks represents an innovative and sustainable approach to construction. By utilizing byproducts of other industries, manufacturers can create a product with enhanced properties and a reduced environmental impact, helping to promote a more sustainable future for the construction industry.

1.2. HISTORY

Cement blocks, also known as concrete blocks or cinder blocks, have a long and fascinating history that dates back to the

19th century. The invention of cement blocks revolutionized the construction industry, providing a new and affordable building material that would go on to shape the modern world. The earliest known use of cement blocks can be traced back to the mid-19th century in England, where they were used as a cheap and durable alternative to traditional block construction. The blocks were made by mixing cement, sand, and water together and pouring the mixture into molds, which were then left to dry and harden. In the late 19th century, the use of cement blocks began to spread throughout Europe and the United States. The blocks were used to construct a variety of buildings, including houses, schools, and public buildings. The popularity of cement blocks was due in part to their durability and fire resistance, as well as their affordability. In the early 20th century, the use of cement blocks became even more widespread. The development of new manufacturing techniques, such as the use of machines to mass-produce blocks, made the blocks even more affordable and accessible. As a result, cement blocks began to replace traditional building materials such as brick and stone in many parts of the world. During the mid-20th century, the popularity of cement blocks continued to grow. In the United States, for example, they were used to construct a wide range of buildings, including hospitals, schools, and even high-rise apartments. The blocks were prized for their strength, durability, and versatility, as well as their low cost. Today, cement blocks remain a popular building material around the world. They are used in a variety of construction projects, from small-scale residential buildings to large-scale commercial and industrial projects. The blocks have evolved over time, with new materials and manufacturing techniques being developed to improve their properties and performance. One of the most significant

developments in the history of cement blocks has been the use of additives to enhance their properties. For example, the addition of fly ash, a byproduct of coal combustion, can improve the strength and durability of cement blocks. Other additives, such as wood powder and quarry fines, can be used to improve the insulation and sustainability of the blocks. In recent years, there has also been a growing interest in using cement blocks to construct energy-efficient buildings. By combining cement blocks with other sustainable building materials and techniques, it is possible to create buildings that are both durable and environmentally friendly. In conclusion, the history of cement blocks is a testament to the ingenuity and innovation of the construction industry. From humble beginnings in the 19th century, cement blocks have become a staple of modern building practices, providing a durable, affordable, and versatile building material that has helped to shape the world we live in today.

Quarry fines, also known as quarry dust or quarry screenings, are a byproduct of the quarrying process that has been used in construction for many years. The history of quarry fines dates back to the 19th century, when they were first used as a cheap and readily available alternative to sand. The use of quarry fines in construction began in England in the mid-19th century, where they were used as a filler material in concrete and as a bedding material for paving stones. At the time, quarry fines were considered a waste material and were often discarded, but their usefulness as a construction material soon became apparent. By the early 20th century, the use of quarry fines had spread throughout Europe and the United States. They were used in a variety of construction projects, including roads, buildings, and bridges. The fines were prized for their ability to improve the

compaction and stability of soils and aggregates, as well as their ability to improve the strength and durability of concrete. During World War II, the use of quarry fines in construction increased dramatically, as the demand for building materials outstripped supply. Quarry fines were used extensively in the construction of military buildings and infrastructure, as well as in civilian construction projects. In the post-war years, the use of quarry fines continued to grow. They were used in the construction of highways, bridges, and other infrastructure projects, as well as in residential and commercial buildings. The fines were often used in combination with other materials, such as cement and sand, to improve their properties and performance. As the construction industry grew and became more sophisticated, new uses for quarry fines were discovered. For example, they were found to be an effective soil stabilizer, helping to prevent erosion and improve the stability of slopes and embankments. They were also used in the construction of landfill liners and as a filler material in asphalt and concrete products. Today, quarry fines are still widely used in construction, particularly in the production of concrete and asphalt products. They are often combined with other materials, such as cement, sand, and fly ash, to improve their properties and performance. In addition to their use in construction, quarry fines are also used in a variety of other industries, including agriculture, mining, and environmental remediation. Despite their many benefits, the use of quarry fines has not been without controversy. Concerns have been raised about the potential health risks associated with exposure to quarry dust, particularly for workers in the quarrying and construction industries. Efforts have been made to reduce the amount of dust generated during quarrying and to improve ventilation and other safety measures to protect workers.

In conclusion, the history of quarry fines is a testament to the ingenuity and resourcefulness of the construction industry. From humble beginnings as a waste material, quarry fines have become an important and versatile construction material, used in a wide range of applications around the world. As the construction industry continues to evolve and grow, it is likely that new uses for quarry fines will be discovered, ensuring their continued importance in the years to come.

Wood powder, also known as wood flour, is a finely ground wood material that has been used for centuries in various applications. The history of wood powder dates back to ancient times, when it was used as a filler material in pottery and other clay-based products. In the 19th century, wood powder began to be used in the production of paper, as a filler material to improve its strength and durability. This led to the development of wood pulp as a key ingredient in paper production, and wood powder became an important byproduct of the pulp and paper industry. During the early 20th century, wood powder was used in the manufacture of linoleum flooring, which was popular at the time. Wood powder was mixed with linseed oil and other materials to create a durable and attractive flooring material. In the 1930s, wood powder was discovered to be an effective filler material in the production of synthetic resins, such as phenol formaldehyde and urea formaldehyde. This led to the development of wood-plastic composites, which are now used in a wide range of products, including decking, fencing, and furniture. During World War II, wood powder was used as a filler material in the production of synthetic rubber, which was needed for the war effort. After the war, wood powder was used in the production of a wide range of consumer products, including automotive parts, toys, and

kitchenware. In the 1960s and 1970s, wood powder was used in the development of particleboard and other composite wood Products. These products became popular for their low cost and versatility, and are now widely used in the construction industry for a variety of applications. In recent years, wood powder has gained popularity as a sustainable alternative to traditional materials. It is often used as a filler material in biodegradable plastics, and is also used in the production of renewable energy, such as wood pellets. Despite its long history and versatility, the use of wood powder has not been without controversy. Concerns have been raised about the potential health risks associated with exposure to wood dust, particularly for workers in the wood processing industry. Efforts have been made to reduce the amount of dust generated during wood processing and to improve ventilation and other safety measures to protect workers. In conclusion, the history of wood powder is a testament to its versatility and adaptability as a raw material. From ancient pottery to modern composite wood products, wood powder has played an important role in the development of many different industries. As the world continues to seek out sustainable and renewable alternatives to traditional materials, it is likely that wood powder will continue to play an important role in the years to come.

1.2 EXISTING PROBLEM

Cement blocks, are a widely used building material due to their strength, durability, and affordability. However, like any other construction material, cement blocks have their share of problems and challenges. One of the most common problems with cement blocks is cracking. This can occur due to a variety of reasons, including excessive water in the mixture, inadequate curing, or poor mixing. Cracking can weaken the structural integrity of the

building and lead to water leakage, mold growth, and other problems. Another issue with cement blocks is efflorescence, which is the formation of a white powdery substance on the surface of the block. This occurs when soluble salts from the cement and other materials in the mixture are deposited on the surface as water evaporates. Efflorescence is not harmful to the block itself, but it can be unsightly and detract from the appearance of the building. Cement blocks are also vulnerable to moisture-related problems, such as mold and mildew growth, water infiltration, and freeze-thaw damage. These issues can be especially problematic in areas with high humidity or frequent precipitation. In addition, the production of cement blocks is resource-intensive and can have negative environmental impacts. Cement production is a significant contributor to greenhouse gas emissions, and the extraction of raw materials, such as sand and gravel, can have negative effects on local ecosystems. Furthermore, cement block production requires significant amounts of water, and the disposal of waste materials can pose challenges for environmental management. To address these issues, efforts are being made to develop more sustainable and eco-friendly alternatives to traditional cement blocks. These include the use of recycled materials, such as quarry fines and wood powder, and the development of new manufacturing processes that use less water and energy. In conclusion, while cement blocks are a popular building material due to their strength and affordability, they are not without their problems. Issues such as cracking, efflorescence, and moisture-related problems can occur, and the production of cement blocks can have negative environmental impacts. However, ongoing efforts to develop more sustainable and eco-friendly alternatives to traditional cement blocks hold promise for

the future of construction.

Wood powder, also known as wood flour, has a variety of applications in industries such as construction, paper production, and plastics manufacturing. However, there are some existing problems associated with its use. One of the main issues with wood powder is its potential to cause respiratory problems. The fine particles of wood powder can become airborne during processing and can be inhaled by workers, leading to respiratory irritation and long-term health problems such as asthma and bronchitis. Proper ventilation and respiratory protection measures are necessary to minimize these risks. Another challenge with wood powder is its tendency to absorb moisture. When exposed to humidity or moisture, wood powder can swell, which can affect the quality and durability of products made with it. Moisture can also promote mold growth, which can be problematic in certain applications. In addition, the production of wood powder can be resource-intensive and have environmental impacts. The extraction and processing of raw materials can contribute to deforestation and other environmental issues, and the production process can generate waste and pollutants. Efforts are being made to address these challenges associated with wood powder. Improved processing and production methods can reduce the risk of respiratory exposure to workers, and moisture-resistant coatings or additives can be applied to wood powder to improve its durability and resistance to moisture. Sustainable sourcing and processing of raw materials can also help minimize environmental impacts. In conclusion, while wood powder has a wide range of applications and benefits, it is important to be aware of the existing problems associated with its use. Respiratory risks, moisture absorption, and environmental impacts are all potential issues that

need to be addressed through proper handling, production methods, and sustainability practices.

Quarry fines, also known as quarry dust or stone dust, are byproducts of the crushing and screening process during the production of aggregates. While quarry fines have a variety of applications, they also have some existing problems that need to be addressed. One of the main issues with quarry fines is their potential to contribute to air pollution. During handling and processing, quarry fines can become airborne and create dust, which can cause respiratory problems for workers and nearby residents. Additionally, the dust can settle on nearby surfaces and cause aesthetic issues. Another challenge with quarry fines is their potential to negatively impact water quality. Quarry fines contain high levels of fine particles and minerals, which can leach into nearby water sources and affect aquatic life. Additionally, runoff from quarry fines can contribute to sedimentation and erosion in nearby streams and rivers. In addition, quarry fines can pose a disposal problem for quarry operators. As a byproduct of the production process, they can accumulate in large quantities and take up valuable storage space. Disposing of them in landfills can be costly and can contribute to environmental issues. Efforts are being made to address these challenges associated with quarry fines. Dust control measures can be put in place to minimize the risk of respiratory problems, and water management strategies can be implemented to reduce the impact on water quality. Alternative uses for quarry fines, such as in construction materials or as a soil amendment, can also help reduce disposal issues. In conclusion, while quarry fines have a variety of applications and benefits, they also have some existing problems that need to be addressed. Air pollution, water quality issues, and disposal

challenges are all potential issues that can be minimized through proper handling, management, and alternative use strategies

CHAPTER 2

LITERATURE REVIEW

2.1. LITERATURE STUDY

Akshay Mangraj, et al (2018) was explained about the purpose of this research is to study the properties of fresh and hardened states of M40 grade concrete, using Crushed ROCK Powder (CRP) as fine aggregate to full amount of sand with Partial replacement of block powder at 0%, 5%, 10%, 15% and 20% to existing cement content. This paper investigates quantitatively the strength of concrete mix at different ages. The overall test results revealed that in concrete mixtures, Crushed Rock Powder can be fully substituted as an alternative material for natural sand (fine aggregate) in presence of Block powder upto 15%. These findings guide the practitioner in selecting fly ash and Crushed Rock Powder contents to meet the strength and workability requirements in a concrete mix. The concurrent use of two byproducts will lead to a range of economic and environmental benefits.

Pooja V. Danao, et al(2021) was explained about the main objective of this paper is to provide an alternative to conventional cement and lime for production of fly ash block. Two widely used fly ash blocks (fly ash cement block and fly ash lime block) were selected for this experimental study. However, the block specimen of size 230x 110x 90mm was cast for diff mix proportions of raw material for testing. The experimental study was performed in two stages. In first stage, cement partially replace by granite powder in fly ash cement block. And in second stage, lime partially replace by granite powder in fly ash lime block. In both stages,

replacement of cement and lime by granite powder in range of 0 to 15 % with interval of 5% was done. The compressive strength of fly ash blocks at the age of 7, 14 and 21 days was obtained at room temperature. On studying results, it was found that the maximum compressive strength is obtained at 10% replacement of granite powder in both type of fly ash block and highest compressive strength was found in fly ash cement block with 10% replacement of granite powder from overall tested block. It was concluded that a sustainable fly ash block can be produced by replacing 10% granite powder, after increasing percentage of granite waste more than 10% strength was decreases in both fly ash block

Kiran C J, et al(2022) was explained on the study of cement, fine aggregate, coarse aggregate and water are the major constituents of cement block. Aggregate, being an important constituent, is used as a filler material and affects the strength and durability properties of concrete. The extraction process of aggregate from quarry contaminates air and water with sulphur dioxide and other pollutants, putting wildlife and local populations at risk. The use of river sand as fine aggregate leads to exploitation of natural resources like, lowering of water table, sinking of bridge piers and erosion of river bed. Red gypsum is the by-product of titanium dioxide extraction from the ilmenite ore and is an industrial waste. It often consumes a lot of space and its disposal is a hectic process. Recent research has confirmed that red gypsum generally contains low level of radioactive material, well below the permitted level stated in the environmental regulation [4]. This makes it desirably suitable for use in different application especially as a construction material. Control mix for the block was prepared in the ratio 1: 4.5: 4.5 (cement: fine aggregate: coarse

aggregate). Fine aggregate was replaced by red gypsum at 5%, 10%, 15% and 20%. Different tests were carried out on these mixes to investigate its strength and water absorption, hence established the optimum percentage of red gypsum that can be used as a replacement to fine aggregate in cement block. Cost comparison of control block and red gypsum incorporated block was analyzed

Surya Prakash Sharma, et al(2022) was studied with increase in industrialization in a developing country like India cost is an important area of concern for the modern day construction. The recent study has shown us that amount of saw dust waste produced in our country is around 30000- 33000 tons annually. This study focuses on the experimental investigation of using saw-dust as a partial replacement of Fine Aggregate in the properties of concrete mix. Saw dust also known as wood dust is a by-product or waste product of woodworking operations such as sawing, milling, planing, routing, drilling and sanding. The purpose of this thesis is to investigate how block powder as a replacement the cement and saw dust replace the fine aggregate. Specially, it is aim to examine the impact of block powder content in concrete and to compare it with the compressive and tensile strength of M30 grade concrete. We are also trying to find the percentage of block powder in concrete that makes the strength of the concrete maximum. Nowadays block powder has become a waste material. So, by partially replacement of cement with block powder and fine aggregate with saw dust, we are proposing a method that can be of great use in reducing waste materials to a great extent.

Nisha Devi. A(2016) was explained about the reduction in natural resources requires a substitute for those materials. In order to replace the natural resources used in the concrete many

replacements has been made such as replacement of cement by fly ash, silica fume, wood ash, etc., replacement of fine aggregates by quarry dust, copper slag, industrial waste etc., In the present investigation, concrete made of crushed spent fire blocks replacing fine aggregates up to 25% are used to study the strength parameters of M30 grade of concrete. Fine aggregates was replaced with crushed spent fire blocks in proportions 0%, 10%, 15%, 20% and 25% and cement can be replaced by glass powder in varies proportions of 10%, 20% & 30%. No additional catalyst/plasticizers have been used for this project for improving their workability. This paper recommends that glass powder and crushed spent fire blocks can be used as an alternative construction material to cement and sand in concrete.

N. S. Potty,et al(2011) was explained about the demand for high quality sustainable materials has increased and encouraged the researchers in building technology to find new alternatives. Rice husk generated from the rice production poses a major problem of disposal especially when open burning is no longer permitted due to the environmental issues. The use of pozzolanic materials is being investigated to reduce the carbon dioxide emitted per tonne of concrete produced and utilized. This study investigates the potential of using Microwave Incinerated Rice Husk Ash (MIRHA) in mortar mixes made of Ordinary Portland Cement (OPC). The MIRHA was obtained by burning rice husk at controlled temperature using microwave incinerator. In the experimental study on compressive strength of cement mortar the water-binder ratio was kept constant at 0.5. Control mortar without any replacement of cement and also mortar with 5%, 10%, 15%, 20% and 25% of OPC replaced by MIRHA were studied with different binder-sand ratio of 1:3, 1:4. 1:5 and 1:6. The

compressive tests were conducted for the samples at 7 and 28 days. The result has revealed that, the MIRHA could be used in cement mortar due to its refined microstructures. In addition to that, the compressive test results were compared with three different standards: ASTM, MS and BS for blocks manufacturing. The results show the potential of using MIRHA in cement block production. Amongst the cement replacement mixes, 20% MIRHA has shown highest compressive strength.

RK Jain, et al(2022) was explained about construction is the key for the development of any Nation. Cement is the most widely used construction material on the earth after water. The production of one thousand Kg of cement releases approximately 870Kg of CO₂ in the atmosphere. This further pollutes the environment. It contributes about 4% of global total CO₂ emissions from fuel use and industrial activities. Some of the pozzolonic materials viz. fly-ash, block powder, marble dust etc. are found to be possessing cementitious properties, hence the use of these waste materials can replace the cement by some percentage without compromising the strength and workability of cement. The reduction in the quantity of cement will reduce CO₂ content in the atmosphere, thereby saving the environment and our mother earth. The aim of this research is to investigate the feasibility of using Waste block powder (WBP) 4 successfully in concrete as a substitute of cement. The replacement levels were kept at 5%, 10% and 15%, compared to the reference concrete. The tests on concrete include slump and compressive strength tests. Results show an increase in workability and decrease in compressive strength after certain percentage of block dust

Harindranath S, et al (2019) ;This paper reports an overview of experiments evaluating the use of egg shell powder

from egg production industry and waste block powder as partial replacement for ordinary Portland cement in concrete. The main aim of this study is to investigate the feasibility of using waste block powder and egg shell powder in concrete as partial replacement for cement. The cement concrete in which cement is partially replaced with block powder and egg shell powder as 0%, 2.5%, 5%, 7.5%, 10% by weight of cement. The chemical composition of the egg shell powder, appropriate mix design and compressive strength of the experimental concrete will be determined. Also the performance of conventional concrete and partially replaced concrete is going to be compared. The compressive strength will be determined at curing ages 28 days. In this direction, an experimental investigation of Compressive strength, Slump test and Water Absorption test will be under taken to use egg shell powder and block powder as partial replacement for cement in concrete

Bincy U I, et al(2019) was studied on the purpose of this research is to study the properties of fresh and hardened states of M40 grade concrete using block powder as partial replacement of cement at 5%,10%,15% and fly ash at 15%,30%and 45%. This project investigates quantitatively the strength of concrete mix at different ages.

Sanjay Raj. A, et al (2018) was explained about the purpose of this research is to study the properties of fresh and hardened states of M40 grade concrete, using Crushed ROCK Powder (CRP) as fine aggregate to full amount of sand with Partial replacement of block powder at 0%, 5%, 10%, 15% and 20% to existing cement content. This paper investigates quantitatively the strength of concrete mix at different ages. The overall test results revealed that in concrete mixtures, Crushed Rock Powder can be

fully substituted as an alternative material for natural sand (fine aggregate) in presence of Block powder upto 15%. These findings guide the practitioner in selecting fly ash and Crushed Rock Powder contents to meet the strength and workability requirements in a concrete mix. The concurrent use of two byproducts will lead to a range of economic and environmental benefits.

R.Mahidhar Reddy, et al (2017) was analyzed about the cost of construction material is rising mainly due to high demand of concrete and scarcity of raw material affecting the economy of the structure. With increasing demand and consumption of cement, researchers and civil engineers are in search of developing alternate binders that are eco-friendly and contribute towards waste management. In such case, the use of industrial and agricultural waste produced by industrial processes has been the focus of waste reduction research for economic and environmental. In ceramic industry, about 15%-30% production goes as waste. These wastes create a problem in present-day society, requiring a suitable form of management in order to achieve sustainable development. The use of the waste materials in cement, concrete and other construction materials has numerous indirect benefits such as reducing the cost of concrete manufacturing, protecting environment from possible pollution effect. It may also result in foreign exchange earnings. In this study, the properties of concrete enhanced with partially replacement of Ceramic powder in the ratio of 0%, 5%, 10% and 15% by weight of cement in concrete were studied for M 30 grade. The properties for fresh concrete are tested like slump cone test and for hardened concrete compressive strength and split-tensile strength at the age of 7-, 28- and 56-days curing period and

durability properties are also considered. The aim behind the use of Ceramic Powder as partial replacement in the concrete is to reduce the cost of material and as an ecofriendly structure.

Dixit Patel, et al (2019) Global warming and environment demolition have become manifest problems in recent years. The present day world is witnessing the construction of very challenging and difficult civil engineering structures. In this study test will be conducted for concrete of grade M20 [1:1.5:3] and ratio 70 – 29 – 1 [i.e.70% of concrete and 29% f Fly Ash 1% of admixtures]. The compressing strength test will be conducted of 7, 14, 28 days strength. Experimental studies will show the comparison of compressive strength of material [glass fiber, wheat husk fiber / rice husk fiber, coconut fiber & fly ash]. Graphical representation of compressive strength results are shown & compared to that of each other.

R. Saravanakumar, et al (2019) was explained about the Concrete is the most material being used in infrastructure development throughout the world. Fine aggregate is a prime material used for preparation of mortar and concrete and which plays a major role in mix design. Fine aggregates are weathered and worn out particles of rocks and are of various grades or sizes depending upon the amount of wearing. Now-a-days fine aggregate is not readily available, it is transported from a long distance. Those resources are also exhausting very rapidly. The non-availability or shortage of fine aggregate will affect the construction industry, hence there is a need to find the new alternative material to replace the fine aggregate, such that harm to environment is prevented. Many researchers are finding different materials to replace fine aggregate. This study aimed to investigate the suitability of using block debris in concrete in place

of fine aggregate. Block debris originated from demolished masonry walls crushed in the laboratory and added in partial fine aggregate replacement. Four replacement levels, 5%, 10%, 15%, and 20%, were compared with the control. The tests on concrete showed that the mechanical properties (compressive strength test) of concrete containing block debris were well comparable to those of the concrete without ground block.

Syed Farrukh Anwar, et al (2018) was studied on Metakaolin (MK) and silica fume (SF) is a popular type of natural pozzolanic material which has been widely utilized in constructions since ancient times and silica fume is the largest group of silicate minerals. The present study is, carried out in two phases in first phase mix of M30 grade concrete with partial replacement of cement by 0%, 10%, 15%, 20%, and 25% Metakaolin (MK) and silica fume (SF) both are mixed with same percentages is carried out to determine the optimum percentage of replacement at which maximum compressive strength, tensile strength, flexural strength is achieved. It is observed that- when cement is partially replaced with 15% of MK+SF concrete maximum strength is achieved. In phase two mix of M40 grade concrete combination of Silica Fume and metakaolin is -partially replaced with cement. The composition 15% of silica fume constant + 5%, 10%, 15%, 20% of metakaolin is carried out to determine the maximum strength. It is observed that when cement is partially replaced with 15 % of silica fume + 10 % of metakaolin concrete maximum strength is achieved. The coarse aggregates are replaced by block bats with the 0% , 20 % , and 40 % replacements in the M40 grade concrete mixes .Test results indicate that use of combination of silica fume and metakaolin in partial replacement of cement in the concrete has improved the mechanical properties. And durability properties.

B. Manoj Yadavo, et al (2019) address the challenges of availability, price, quality, and pollution, this research analyses the viability of employing industrial waste such as Ground Granulated Blast Furnace Slag (GGBFS) and Rice Husk Ash (RHA) on cement. By replacing cement with GGBFS and RHA by weight at a percentage of 0%, 10%, 20%, 30%, and 40%, cubes of solid masonry blocks of size 150X150X15 of M30 Grade Concrete were cast and made ready for testing for 7 days, 1seven days, and 28 days. Strength tests were conducted. The results of the testing indicated that replacing RHA with GGBFS was preferable.

N. Bhuvaneswari, et al (2017) was studied about the main objective of this paper is to find out the alternative materials for concrete to meet the demand of fine aggregate for the upcoming years, to provide adequate strength at minimum cost, to make the eco-friendly structure. Use of steel and welded slag waste industrial by-product of welded and steel production provides great opportunity to utilize it as an alternative to normally available aggregate(fine).The comparative study on partial replacement of fine aggregate by steel and welded slag on the various strength and durability properties by using the mix design of m30 grades. In this paper literature survey of fresh and mechanical properties of different mixtures are evaluated by incorporating supplementary cementitious material, i.e., and different aggregate type considering various parameters, i.e., compressive strength, flexural strength and tensile strength.

Nicholas Niakoh, et al (2018) was studied explores and compares the properties of sandcrete blocks produced with sawdust as partial replacement to the traditional sandcrete blocks in an attempt to establish the percentage replacement of sawdust that yield properties and characteristics that meets acceptable

standards. After a review of relevant literatures, samples of materials (sawdust, sand, cement and appropriate water cement ratio) required were collected and batched by volume to a mix proportion of 1:6. The sawdust replacement varies from 10%, 20%, 30%, and 40% with water cement ratio of 0.5. A total of 30 blocks was molded, cured for 28 days, subjected to various tests, including water absorption, weight, density, and compressive strength. From the water absorption test conducted, it indicates that blocks produced from 10% to 40% sawdust replacement were found to be more porous than the traditional block since it exceeds the minimum standard of 130kg/m³ recommended by the ASTM. The weight and density of the sawdust block increases up to 10% sawdust replacement, and further more reduces when the sawdust exceeds 10%. With regard to strength test, it was revealed that, the compressive strength of the sawdust blocks exceeds the minimum requirement of 2.8N/mm² when the sawdust replacement does not exceed 10%. For blocks with sawdust as partial replacement to meet standard specification, the sawdust content should not exceed 10%. Further studies must focus on the factors that can affect the durability of the blocks produced with sawdust, people's willingness to adopt blocks produced with sawdust aggregates and to compare the cost per unit sawdust block to conventional sandcrete block..

Kamakshi Jamwal, et al (2018) was explained the process mortar containing flyash as a partial replacement of sand by weight as well as by volume were carried out to quantify its utilization. Both the types of pond and bottom flyash in various ratios were used in preparing cement mortar and their strengths in compression and tension were tested. Out of the various proportions the mortar mix 1:2.5:2.5 (cement: coarse sand: pond

flyash) designed by method of volume is found satisfactory as for as the strength is concerned. The maximum utilization of flyash almost 75% and cost saving about 58% were ascertained with the plain mortar of ratio 1:5 (cement : sand). The utilization of flyash in mortar designed by weight provides 50% to 60% financial saving while 9% to 16% by method of volume. However, the flyash mortar mix 1:1:5 (cement:flyash:sand) by weight consumes about 20% less quantity of cement and overall consumption of flyash is also less.

Bhavesh Joshi, et al (2017) was studied the increasing value of conventional construction materials needs more research and implementation of different alternative materials in civil engineering construction. By far the required coarse aggregate which was used in concrete is obtained from crushed natural rock, but this type of rock which is suitable for concrete making is not accessible everywhere. In a north-eastern state of India block aggregate concrete are used conservatively for ordinary concrete due to shortage of aggregate from natural resource. Due to development of concrete technology and to complete the resilience necessity it necessitated to use standard concrete, for which only stone aggregate is used, as a result, cost of construction has been skyrocketed as these are transported from other states. A mid this study, block aggregate is utilized as light weight mix in concrete. The undertaking paper goes for examining compressive strength characteristics with complete replacement of coarse combination with block aggregate to supply light weight concrete with completely different percentage (0%, 15%, and 30%) to urge smart strength like standard concrete. Concrete 18 cubes are casted with mix proportion (1:1:2) and their mechanical properties are determined and compared with standard concrete.

The employment of block aggregates as for standard aggregates ought to be inspired as an environmental protection and construction value reduction measure.

Athira A R. et al (2017) was explained about the concrete is a composite material composed mainly of water, aggregate, and cement. Usually there are additives and reinforcements included to achieve the desired physical properties of the finished material. For solving the disposal of large amount of recycled plastic material, reuse of plastic in concrete industry is considered as the most feasible application. The reuse of material can reduce the normal usage of ingredients in concrete and thereby reduce the cost of construction. This study is focused on the use of thermo setting plastics as a partial replacement of aggregates in concrete. The aim was to investigate the characteristics of concrete with the addition of plastic and comparing it with the control mix, thereby determining the advantages and disadvantages of doing so. In this phosphogypsum is added to a 10% by partial replacement of cement. It is proposed to replace the aggregates partially with thermosetting plastics on the basis of percentage by weight such as 0%, 0.5%, 1%, 1.5%, 2% and 2.5%. The fresh concrete is tested for slump test and the compaction factor test, while the hardened concrete for compressive, tensile, flexural strength and durability.

Sandeep Nasier, et al (2017) was studied on the use of sawdust and block dust in partial replacement of sand in the mortar will reduce the dependency on the natural sand. Extracting of sand from rivers led to the ecological imbalance of aquatic life. The sand is an important part of the construction field as it is used in both motors as well as in concrete which is the backbone of construction. Day by day the construction is increasing rapidly so

is the need for sand. So, it is necessary to find the replacement of sand. the sawdust and block dust is a waste product of their respective industries, so it is feasible to use them as partial replacement of sand. In the present study, the mixture is taken as (1:3). The partial replacement of sand is done in three different percentages (10%,20%,30%). In the first mix, 10% of sand is replaced with 5% each of sawdust and block dust. Similarly, in the next two mixes, 20% and 30% of sand are replaced. For all the mix strength tests, the abrasion test is carried out at 7, 14 and 28 days. Compressive strength increases to 20% and decreases afterwards. Higher compressive strength is at a 10% replacement of sand. The resistance to abrasion in partially replaced mixes is more than of conventional mortar. In all the mix, a 20% replacement of the sand shows higher resistance to the abrasion.

R. Rajendran, et al (2011) was studied on the Steel slag and crumb rubber is an industrial by product, It possesses the problem of disposal as waste and is of environmental concern. The demand for aggregate in construction industry is increasing rapidly and so, is the demand for concrete. Thus, these two material becomes important to seek suitable alternatives for aggregates in future. In this study the natural coarse aggregate were partially replaced with steel slag aggregate at various proportions of 10%,20%,30%,40% to find the optimum usage value of steel slag in concrete and the natural fine aggregate is partially replaced with crumb rubber at various proportions of 5%,10%,15% in the obtained optimum value of steel slag used concrete. Experiment was conducted on M30 grade concrete to determine the compressive strength, split tensile strength and flexural strength. The results were compared with conventional concrete.

Shivasharanappa, et al (2019) was explained about the

concrete is made up of cement, fine aggregates, coarse aggregate, water and admixtures if necessary. Aggregate is one of the main ingredients in producing concrete covering up to 75% of total concrete mix. Strength of concrete produced is dependent on properties of concrete. High cost is the dominating factor of conventional construction material which is affecting the housing system. Thus to overcome this drawback, it is necessary to make research on an alternative material which reduces the cost. Thus waste coconut shell may be used to replace conventional coarse aggregate. India is the third largest coconut producing country and accounts for over quarter of world's total coconut oil output. However, it is also the main contributor to the nation's pollution problem as a solid waste in the form of shells and represents more than 60% of the domestic waste volume. Coconut shell which is an abundantly available agricultural waste from coconut industries poses a serious disposal problem. These wastes can be used as potential material or replacement material in the construction industry. This will have the double advantage of reduction in the cost of construction material and also as a means of disposal of wastes. In this study, M20 grade of concrete was produced by partially replacing Coarse Aggregate by coconut shell. Cubes and cylinders were casted and their compressive strength and Split tensile strength were evaluated at 7, 14 and 21 days by replacing coarse aggregate by coconut shell at 10%,20%, 30%,40%,& 50%.

Priyadharshini et al (2021) was explained on the Concrete is a mix of cement, fine aggregate and coarse aggregate with water in correct proportion. Many attempts had been to replace the fine aggregate, coarse aggregate and cement in concrete. In this row replacement of coarse aggregate by cashew shells was tried. Over 66% of the overall country export cashew kernels. The

cashew seeds is well acclaimed for its good quality and appearance. Concrete cubes and beams had casted using cashew shell as a partial replacement of the coarse aggregate in the proportion of 10%,20% and 30% replacement. the specific gravity of the shell was analyzed and 16mm shell were selected for the experiment. The characteristic of concrete was determined and the result showed that 10% replacement of shell with coarse aggregate gives the optimum strength.

Loganayagan.S,et al (2017) was explained about the Chemical sludge produced by textile industries poses a high threat to the environment causing pollution in all stages of its treatment and disposal. In this study sludge from textile dying unit was collected. It has been partially replaced for fine aggregate in concrete up to 20% replacement to find out the possibility of reuse of this hazardous waste in build materials. Manufactured sand made by grinding angular aggregates was used as fine aggregate. Study shows that the samples failed to meet the desired compressive strength required for structural applications. The reason for failure in strength development is to be further experimented by individual analysis of sludge components.

Biju Mathew, et al (2011) was studied about the Major objective of the study was to examine the suitability of laterite as fine aggregate in mortar. Conventional Cement mortar was prepared using river sand for different cement mortar ratios from 1:3, 1:2 and 1:6. Replacing the natural sand by laterite and manufactured sand by laterite for the replacement level of 20, 40 and 60 % were cured at room temperature and tested in accordance with IS:2250- 1981. Water absorption and durability tests (sulphate attack, chloride attack and acid attack) are conducted after the initial curing of mortar cubes. Compressive

strength of masonry was examined by testing masonry prisms. The test result shows that up to 40 % of replacement of laterite in river sand and manufactured sand is suitable for masonry work. The rebound losses, has a moderate impact on the workmanship of the masonry work.

P.Manivel , et al (2019) was studied about the important constituents in concrete. Nowadays some alternative materials have been already used as part of coarse aggregates in concrete. For example light weight aggregate, Recycled aggregate etc. In this paper is mainly focused on utilizing the Granite waste as a replacement of coarse aggregate in concrete work is investigated. Granite is an igneous rock which is widely used as construction material in different forms. Granite industries produce lot of waste materials. The wastes from the granite industries are being disposed to open land which is cause hazard to environment. This granite waste can be utilized for the preparation of concrete as replacement of coarse aggregate. In order to explore the possibility of utilizing the granite waste as replacement to coarse aggregate, an experimental investigation has been carried out. The percentages of granite waste added by 25%, 50%, 75% and 100% Replace for coarse aggregate in concrete. Tests conducted for material using in concrete. Design mix of M30 is adopted for this paper and mix compositions were calculated by IS method. Cubes, Cylinders and Beams are to be casted. Compressive strength, split tensile strength and flexural strength are to be found at 7, 14 and 28 days. The test results indicate that the replacement of coarse aggregate by granite waste has beneficial effect on the mechanical properties such as compressive strength, split tensile strength and flexural strength of concrete.

M.R.Divya, et al (2019) was explained about the Concrete

is the single most widely used construction material in the world. Concrete is used in such large amounts because it is simply, a remarkably good building material. Aggregates generally occupy 60 to 80 percent of the volume of concrete and greatly influence its properties, mix proportions and economy. Use of vermiculite in concrete, enhances the shrinkage and crack resistance, fire resistance and reduces environmental impact and also reduces the cost. Important characteristics of a good quality aggregate include resistance to abrasion, resistance to freeze/thaw action, resistance to sulfates, correct shape and surface texture, proper gradation, density, and compressive and flexural strength. The main purpose of the research is to study the strength parameters such as compressive strength, split tensile & flexural strength of concrete using vermiculite as partial replacement with 40%, 50% and 60% by weight. The main aim of this study is to make economical and eco-friendly concrete.

N B Azmi, et al (2021) was studied on the Natural fine aggregate materials are commonly used in development and commercial construction in Malaysia. In fact, concrete production was increased as linear with the growing Malaysia economy. However, an issue was production of concrete was to locate adequate sources of natural fine aggregates. There lot of studies have been conducted in order to replace the fine aggregate in which natural fine aggregate replace with the waste material in concrete preparation. Therefore, this study aims to utilize the Recycled Concrete Aggregate (RCA) and ceramic waste which has great potential to replace the natural aggregate in concrete mix with different type of method, admixture, and parameters. This research were focused on compressive strength and water absorption test to determine the optimum mix ratio of concrete mix.

The concrete aggregate was chosen due to improvement capillary bonding mechanisms and ceramic presented similar strength compared to the conventional concrete using natural aggregate. Percent of replacement have been used in this study was at 25%, 35% and 45% of the RCA and 5%, 10% and 15% for ceramic, respectively. Furthermore, this research was conduct to find the optimum percentage of aggregate replacement, using water-cement ratio of 0.55 with concrete grade 25/30. The best percentage of replacement was the RCA35% C15% with the compressive strength of 34.72MPa and the water absorption was satisfied.

Tanweer Ahmad, et al (2019) was explained about the se of Glass Powder and other is Stone dust as partial replacement of cement and concrete production. In this research we analyze the strength of concrete made with using these waste materials one is Glass Powder and other is Stone dust. The Glass Powder is used as 20% replace by weight of cement and Stone Dust as the partial replacement of Fine Aggregate from 0%, 10%, 20%, 30% and 40%. The grade of the concrete here is M-25 and M-30 grade. It has been used as a replacement of fine aggregates in many literature works but this paper presents the feasibility of the substitution of marble waste for cement to achieve economy and environment saving . Slump Test was carried out for the fresh concrete whereas Compressive Strength, Flexure Strength and Split Tensile Tests were carried for the Hardened concrete. All tests are done at 7- day, 14 - day, 28 -day, and 56 days with 0 to 40% replacement of sand at an interval of 10%. Again above tests are carried out with 20% replacement of cement by glass powder. It is observed that the glass powder improve the strength and stone dust can be used as sand. Experiment such as specific

gravity test of stone dust and sand by pycnometer method, moisture content of sand and stone dust by oven drying method, normal consistency of cement, and initial setting time of cement, were performed to determine the physical property of concrete. On fresh concrete slump test was performed to check workability of concrete and after then compressive strength was checked. Thus stone dust is appropriate substitute of fine aggregates in concrete mix for construction. This is great saving in costly material.

CHAPTER 3

SCOPE OF THE PROJECT

3.1 OBJECTIVE

- To compare the compressive strength of cement blocks with different percentages of wood powder and quarry fines.
- To compare the water absorption of cement blocks with different percentages of wood powder and quarry fines.
- To assess the cost-effectiveness of using wood powder and quarry fines as partial replacements for fine aggregates in cement blocks.

3.2 METHODOLOGY

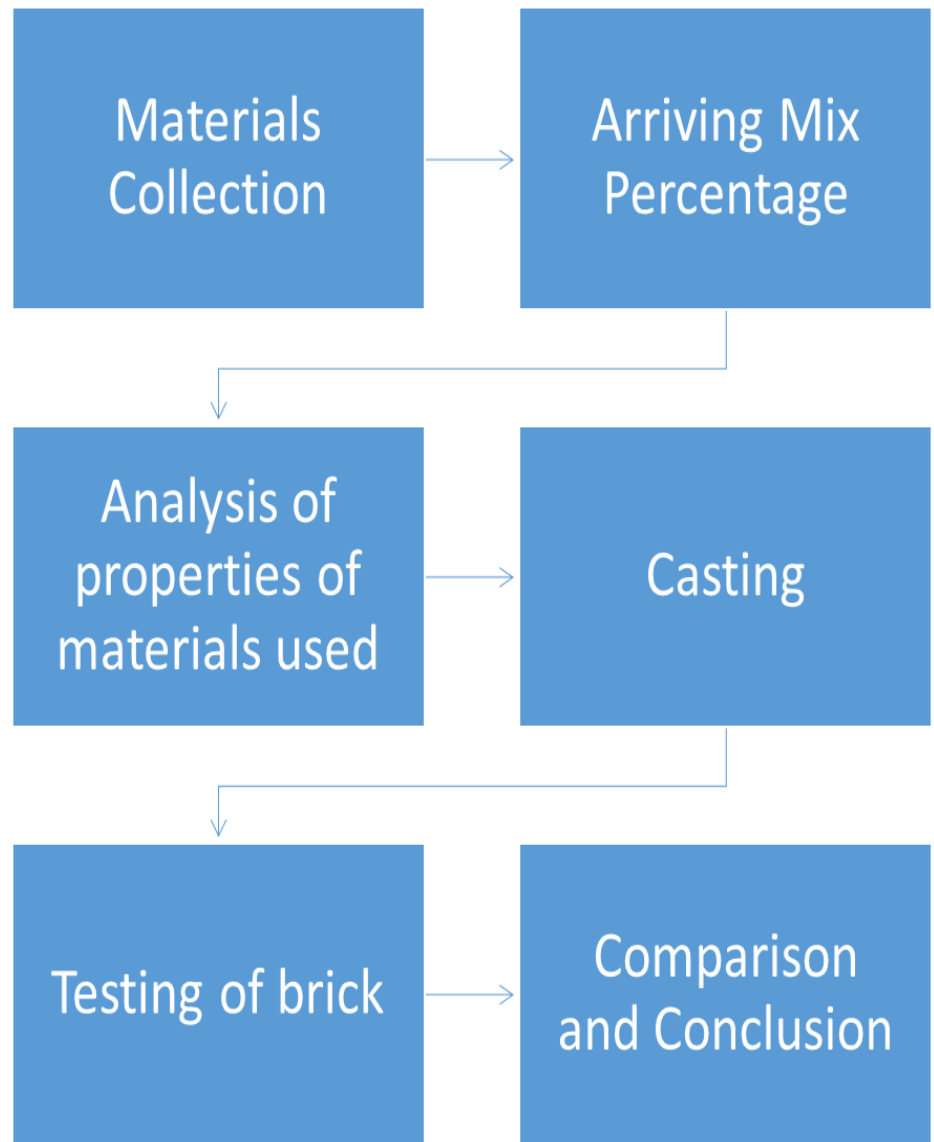


Fig.no.3.2, methodology

CHAPTER 4

EXPERIMENTAL ANALYSIS

4.1 MATERIALS AND MATERIAL PROPERTIES

4.1.1 QUARRY FINES

Quarry fines, also known as quarry dust or quarry screenings, are a byproduct of the quarrying industry. They are essentially crushed stone particles that are too small to be used as aggregate in concrete, but too large to be considered a fine aggregate. As a result, they are often discarded as waste. However, recent studies have shown that quarry fines can be used as a partial replacement for fine aggregates in concrete production, with potential benefits for both the environment and the construction industry.

The material properties of quarry fines vary depending on the source rock and the processing techniques used. Generally, they have a high percentage of fines, with particle sizes ranging from 75 microns to 5 mm. They typically have a higher specific gravity than sand, which can lead to higher density and strength of the resulting concrete. However, they can also have a higher water absorption rate, which can affect the workability and durability of the concrete.

In terms of chemical composition, quarry fines are primarily composed of silicon dioxide (SiO_2), aluminum oxide (Al_2O_3), and iron oxide (Fe_2O_3). Trace amounts of calcium, magnesium, and potassium may also be present, depending on the source rock. Due to their mineral composition, quarry fines can have pozzolanic properties, which means they can react with calcium hydroxide ($\text{Ca}(\text{OH})_2$) in the presence of water to form additional cementitious

materials, improving the strength and durability of the concrete.

Overall, the use of quarry fines as a partial replacement for fine aggregates in concrete production can be a sustainable solution, reducing waste and potentially improving the properties of the resulting concrete. However, careful consideration must be given to the specific properties of the quarry fines being used, as well as the desired properties of the resulting concrete, to ensure optimal results.

Quarry fines have a range of physical and chemical properties that make them suitable for use as a fine aggregate replacement. They typically have a particle size distribution similar to that of sand, with a high proportion of fine particles. The presence of fine particles can improve the workability of fresh concrete, while the angularity of the particles can improve the bond between the aggregate and cement paste.

In terms of chemical properties, quarry fines may contain higher levels of impurities such as clay and silt compared to natural sand. However, this can be mitigated through careful processing and washing of the fines. The presence of these impurities can also affect the setting time and strength development of the concrete.

Research has shown that partial replacement of fine aggregate with quarry fines can improve the mechanical properties of concrete, including compressive strength, flexural strength, and modulus of elasticity. However, the optimal percentage of replacement depends on the specific properties of the quarry fines, as well as the mix design and curing conditions.

Overall, quarry fines have the potential to be a viable alternative to natural sand in concrete production, particularly in

regions where sand resources are limited or depleted. However, careful consideration must be given to their properties and performance in order to ensure their successful use in concrete mixes.



Fig.no.4.1.1 Quarry fines

Quarry fines are a byproduct of the quarrying process, which involves the extraction of natural rock, gravel, and sand from the earth's crust. The process of making quarry fines involves several steps:

Blasting: The first step in the process is to blast the rock face with explosives to break it into smaller pieces. The size of the blast depends on the size of the rock and the desired final product.

Crushing: The blasted rock is then transported to a primary crusher, which reduces it to smaller pieces. The crusher can be a jaw crusher, gyratory crusher, or impact crusher.

Screening: The crushed rock is then screened to separate it into different sizes. This is done using a series of screens with different size openings. The finer material that passes through the screens is the quarry fines.

Washing: In some cases, the quarry fines may be washed

to remove any remaining dust or debris. This is done using water and a washing screen.

Stockpiling: Once the quarry fines have been produced, they are stockpiled for later use. This can be done using a conveyor belt or by using loaders to move the material.

Quarry fines are often used as a replacement for natural sand in construction applications such as concrete and asphalt. They can also be used as a base material for roads and driveways. The process of making quarry fines is relatively simple, but it requires careful attention to detail to ensure that the final product is of high quality and suitable for its intended use.

4.1.2 WOOD POWDER

Wood powder, also known as sawdust, is a byproduct of sawmills, woodworking shops, and furniture manufacturing industries. It is a finely ground wood material that is created when wood is processed using machines like saws and planes. Wood powder can be obtained from various types of wood, including softwoods and hardwoods, and can have different properties depending on the wood species.

One of the key properties of wood powder is its particle size. The size of the particles can vary depending on the method used to produce the wood powder. In general, wood powder particles are small, typically ranging from 50 to 500 microns in size. The particle size affects the compaction and mixing properties of wood powder, as well as the strength and permeability of the final product.

Another important property of wood powder is its moisture content. The moisture content of wood powder can vary depending on the type of wood, the method used to produce the wood

powder, and the storage conditions. Moisture content can affect the flowability, strength, and durability of wood powder.

Wood powder is also characterized by its chemical composition. Wood is composed of cellulose, hemicellulose, and lignin, among other components. The chemical composition of wood powder can influence the properties of the final product, such as its density, strength, and moisture resistance.

The density of wood powder is another important property. The density of wood powder can vary depending on the wood species, the particle size, and the moisture content. The density of wood powder affects the compressive strength, tensile strength, and shear strength of the final product.

The thermal conductivity of wood powder is also an important property. Wood powder has low thermal conductivity, which can make it a suitable material for insulation applications. The low thermal conductivity also makes wood powder an attractive material for use in building and construction applications, where it can help to reduce energy consumption and improve thermal efficiency.

One of the most significant material properties of wood powder is its low density. With a density of approximately 400-600 kg/m³, it is significantly lighter than traditional building materials such as concrete, clay, or block. This makes it easier to handle, transport, and install, which can help reduce construction costs.

Another important property of wood powder is its high water absorption capacity. Due to its porous nature, wood powder can absorb a significant amount of water, which can impact its performance in certain applications. However, it can also be advantageous in some cases, such as when used as an additive

in concrete, where it can improve workability and reduce the need for additional water.

Wood powder also has good thermal insulation properties, making it suitable for use in building envelopes, such as walls, roofs, and floors. It has a low thermal conductivity, which helps to reduce heat transfer, resulting in lower energy consumption and costs for heating and cooling.

In terms of mechanical properties, wood powder is not as strong or durable as traditional building materials. It has a lower compressive strength and tensile strength, which may limit its use in load-bearing applications. However, it can be strengthened through the addition of binders, such as cement or lime, which can improve its performance and durability.

In conclusion, wood powder is a versatile material that can be used in a variety of applications, including as a partial replacement for fine aggregates in cement blocks. Its properties, including particle size, moisture content, chemical composition, density, and thermal conductivity, can all affect the final product. Understanding the material properties of wood powder is essential for ensuring its optimal use in various applications.



Fig.no.4.1.2. wood powder

The process of making wood powder typically involves the following steps:

Raw material preparation: The wood used to make wood powder is typically sourced from sawmills, furniture manufacturers, or other wood-processing industries. The wood is first debarked and then cut into small pieces or chips using saws or chippers.

Drying: The wood chips are then dried to reduce their moisture content to around 8-10%. This can be done using a variety of methods, including air-drying, kiln-drying, or microwave-drying.

Grinding: The dried wood chips are then ground into a fine powder using a mechanical grinder, such as a hammer mill, pin mill, or ball mill. The particle size of the wood powder can vary depending on the application, but is typically in the range of 10-500 microns.

Sieving: The wood powder is then passed through a series of sieves to remove any oversized particles or impurities. This

helps ensure that the wood powder has a consistent particle size and quality.

Packaging: The final wood powder product is typically packaged in bags or bulk containers for shipping and storage.

Overall, the process of making wood powder is relatively simple and can be done using standard equipment and techniques. However, the quality of the wood powder can vary depending on factors such as the type of wood used, the drying and grinding methods used, and the particle size distribution. Careful control of these variables is necessary to ensure that the wood powder is of a consistent quality and suitable for its intended application.

4.2 MIX DESIGN AND EXPERIMENTAL WORK

4.2.1 PROCEDURE

The samples are prepared by adding three different proportional materials.

4.2.2 SAMPLING OF MATERIAL

Representative samples of the materials of block for use in the particular construction work shall be obtained by careful sampling. Test samples of block shall be made of different proportion of materials on the site.

4.3 PROPORTIONS OF BLOCK

Now, we are going make 7 samples of cement block with different proportions in below table.

	CEMENT	SAND	QUARRY FINES	WOOD POWDER
SAMPLE(1)	9.09%	90.91%	0%	0%
SAMPLE(2)	9.09%	60.91%	30%	0%
SAMPLE(3)	9.09%	50.91%	40%	0%
SAMPLE(4)	9.09%	40.91%	50%	0%
SAMPLE(5)	9.09%	60.91%	0%	30%
SAMPLE(6)	9.09%	50.91%	0%	40%
SAMPLE(7)	9.09%	40.91%	0%	50%

Table.no.4.3.1 Proportions

of block

4.4 QUANTITY OF MATERIALS USED

	CEMENT	SAND	QUARRY FINES	WOOD POWDER
SAMPLE(1)	0.3kg	0.9kg	0	0
SAMPLE(2)	0.3kg	0.63kg	0.2kg	0
SAMPLE(3)	0.3kg	0.54kg	0.32kg	0
SAMPLE(4)	0.3kg	0.45kg	0.42kg	0
SAMPLE(5)	0.3kg	0.63kg	0	0.5kg
SAMPLE(6)	0.3kg	0.54kg	0	0.6kg
SAMPLE(7)	0.3kg	0.45kg	0	0.7kg

Table.no.4.4.1 materials

used

4.5 PREPARATION OF CEMENT BLOCK

Cement blocks are a common construction material used in the building industry due to their durability, strength, and affordability. The process of preparing cement blocks involves several steps, including selecting the raw materials, mixing, molding, drying, and curing.

The first step in the preparation of cement blocks is the selection of raw materials. The primary raw materials used in making cement blocks are cement, sand, water, and aggregates. The aggregates can be in the form of quarry fines, crushed stones,

or gravel. The quantity of each raw material used depends on the desired strength and quality of the blocks.

The next step is mixing the raw materials. The mixing process can be done manually or by using a mixing machine. The mixing process aims to ensure that all the raw materials are evenly distributed. Water is added during the mixing process to create a slurry or a paste.

After mixing, the slurry is molded into the desired shape using a block molding machine. The machine can be manual, hydraulic, or automated, depending on the scale of production. The molded cement blocks are then placed on wooden pallets or racks for drying.

Drying is a critical stage in the preparation of cement blocks. It involves exposing the molded blocks to air to remove excess moisture. The drying process can take several days, depending on the weather conditions. During the drying process, the blocks shrink and become hard.

After drying, the cement blocks are ready for curing. Curing is a process of maintaining the ideal temperature and humidity levels for the blocks to harden and gain strength. The curing process can take up to 28 days, and it is critical to achieving high-quality blocks.

Once the curing process is complete, the cement blocks are inspected for defects and imperfections. Defective blocks are discarded, and only those that meet the desired quality standards are packaged for distribution.

In summary, the preparation of cement blocks involves selecting raw materials, mixing, molding, drying, and curing. The quality of each step affects the final product's strength, durability,

and quality, and strict adherence to the process is critical to achieving high-quality cement blocks.



Fig.no.4.3. cement blocks

4.6 MOLDING OF BLOCK:

Molding a block is a process that involves preparing the block mold and filling it with the right materials to create a block of the desired size and shape. The following is a step-by-step guide on how to mold a block:

Prepare the block mold: The block mold is typically made of wood, steel, or plastic and can be of various sizes and shapes. The mold should be cleaned and oiled to ensure the block does not stick to it.

Prepare the materials: The materials needed for making a block include cement, sand, water, and any other additives such as fly ash, lime, or gypsum. The materials should be mixed in the right proportions to ensure the block has the required strength and durability.

Mix the materials: The cement and sand are mixed thoroughly in a concrete mixer or by hand. The water is added

gradually until the right consistency is achieved. The additives are added as required, and the mixture is stirred thoroughly.

Fill the mold: The prepared mixture is poured into the mold, and the surface is levelled with a trowel. The mold is then tapped gently to ensure the mixture is evenly distributed.

Release the block: After the mixture has hardened, the mold is removed by tapping the sides of the mold with a hammer. The block is then carefully removed from the mold and placed on a flat surface to dry.

Cure the block: The block is left to cure for a period of 7-28 days, depending on the climate and humidity. During this time, the block should be kept moist by spraying it with water regularly.

Finish the block: Once the block has cured, it can be sanded or painted to improve its appearance.

Molding a block is a simple process that can be done by anyone with the right tools and materials. It is important to follow the right proportions and techniques to ensure the block is of the right quality and strength. With the right care and maintenance, a well-molded block can last for many years

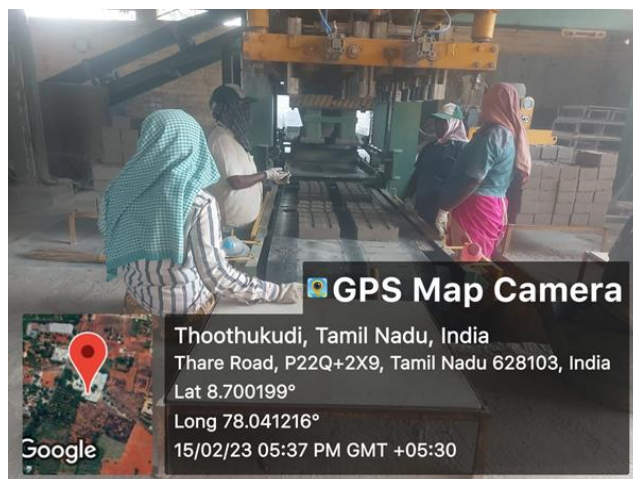


Fig.no.4.4 molding

4.7 DRYING OF BLOCKS:

After the cement blocks have been molded, they need to be dried to remove excess moisture and harden the cement mixture. The drying process is an important step in the manufacturing process, as it ensures that the blocks are strong and durable. Here is a general outline of the process for drying cement blocks:

Remove excess water: Once the cement blocks have been molded, excess water must be removed before the drying process can begin. This is typically done by allowing the blocks to sit in the mold for a short period of time, which allows any excess water to drain away.

Air dry: After the excess water has been removed, the blocks are typically left to air dry for several days. During this time, the blocks are typically placed on pallets or racks in a well-ventilated area to allow air to circulate around them.

Cover with plastic: To prevent the blocks from drying too quickly, they may be covered with plastic sheeting. This helps to retain moisture in the blocks, which can help to prevent cracking and other issues during the drying process.

Turn the blocks: During the drying process, the blocks should be turned regularly to ensure that all sides dry evenly. This can be done by hand, or with a machine that automatically rotates the blocks.

Move to a heated area: After the blocks have air-dried for several days, they may be moved to a heated area to speed up the drying process. This is typically done in a drying room, which is a temperature-controlled environment that is designed to promote rapid drying.

Monitor humidity: During the drying process, it is important

to monitor the humidity levels in the drying room. If the humidity is too high, the blocks may not dry properly, which can lead to cracking or other defects.

Final inspection: Once the blocks are fully dried, they should be inspected to ensure that they are free from defects and ready for use. Any blocks that are found to be defective should be discarded or repaired before they are used in construction.

CHAPTER 5

RESULTS AND DISCUSSION

5.1 GENERAL

In this chapter, compressive strength and water absorption should be tested to the prepared blocks. And compare the resulted values with the conventional blocks.

5.2 TESTING OF SAMPLE

The following test has to be conducted

- a) Compressive strength
- b) Water absorption test

a)Compressive strength test: Unevenness observed in the bed faces of blocks is removed to provide two smooth and parallel faces by grinding. It is immersed in water at room temperature for 24 hrs.. The specimen is then removed and any surplus moisture is drained out at room temperature. The frog and all voids in the bed face is filled with cement mortar. It is stored under the damp jute bags for 24 h followed by immersion in clean water for 3 days. The specimen is placed with flat faces horizontal, and mortar filled face facing upwards between two 3 ply plywood sheets each of 3 mm thickness and carefully centered between plates of testing machine. Load is applied axially at a uniform rate of 14 N/mm² per minute till failure occurs. The maximum load at failure is noted down. The load at failure is considered the maximum load at which the specimen fails to produce any further increase in the indicator reading on the testing machine.

b)Water absorption test: Water absorption test on blocks are conducted to determine durability property of blocks such as degree of burning, quality and behavior of blocks in weathering. A

block with water absorption of less than 7% provides better resistance to damage by freezing. The degree of compactness of blocks can be obtained by water absorption test, as water is absorbed by pores in blocks. The water absorption by blocks increase with increase in pores. So, the blocks, which have water absorption less than 3 percent can be called as vitrified. This test provides the percentage of water absorption of blocks. The average water absorption shall not be more than 20% by weight up to class 12.5 and 15% by weight for higher class.

5.3 COMPRESSIVE STRENGTH TEST OF BLOCK

The blocks are dried in room temperature for 7 days, 14 days and 28 days in two replaced blocks. In this test three blocks in each set of mix are taken for testing. The surface of the blocks was cleaned properly with a cotton cloth to make an even contact. Each block is placed on the bearing plate of UTM machine. One of the important properties of concrete is its strength in compression. The strength in compression has a definite relationship with all other properties of concrete i.e. these properties improved with the improvement in compressive strength. A total of 7 blocks of size 22.5x10.5x7 cm were casted and tested for 7days, 14 days, 28 days testing. The concrete is prepared with definite proportion is poured in the mold and tempered properly so as not to have any void. Load is applied gradually at a uniform rate of 550kg/cm² per minute. The load is applied until the specimen fails. Note the reading and the average of three specimens gives the Dry compression strength of block in MPa.

The formula used for the calculation of Dry compression of the block = P/A in MPa.

Where,

P = Ultimate load at which the specimen fails in N.

A = Loading area of the specimen in mm².

Size of the blocks = 22.5 x 10.5 x 7 cm

The values are given below for both, quarry fines and wood powder.

	7 DAYS	14 DAYS	28 DAYS
0%	6.1N/mm ²	7.02N/mm ²	7.76N/mm ²
30%	5.2N/mm ²	5.9N/mm ²	7.52N/mm ²
40%	5.1N/mm ²	5.7N/mm ²	6.3N/mm ²
50%	4.9N/mm ²	5.4N/mm ²	5.95N/mm ²

Table.no.5.3.1 Compressive
strength for quarry fines

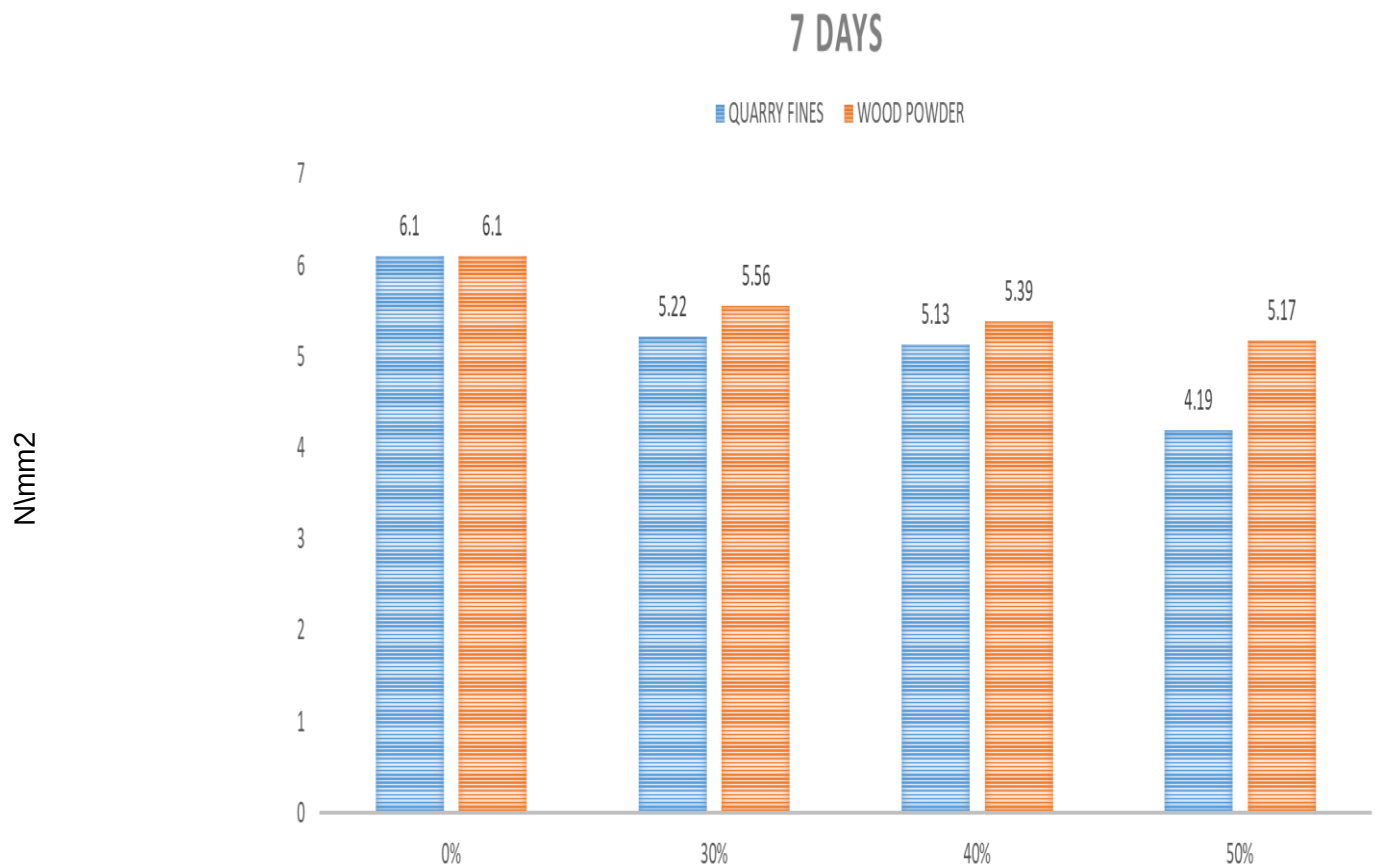
	7 DAYS	14 DAYS	28 DAYS
0%	6.1N/mm ²	7.02N/mm ²	7.76N/m m ²
30%	5.56N/mm ²	6.21N/mm ²	6.84N/m m ²
40%	5.39N/mm ²	6.03N/mm ²	6.52N/m m ²
50%	5.17N/mm ²	5.73N/mm ²	6.24N/m m ²

Table.no 5.3.2 Compressive strength for wood powder

Graph for Compressive strength- 7 days

The compressive strength of the cement blocks is taken in first session for after 7 days in drying in various percentage replacement of fine aggregates as 30%,40% and 50% in both quarry fines and wood powders with comparison of the conventional blocks.

Size of the blocks = 22.5 x 10.5 x 7 cm



Replacement percentage of fine aggregates

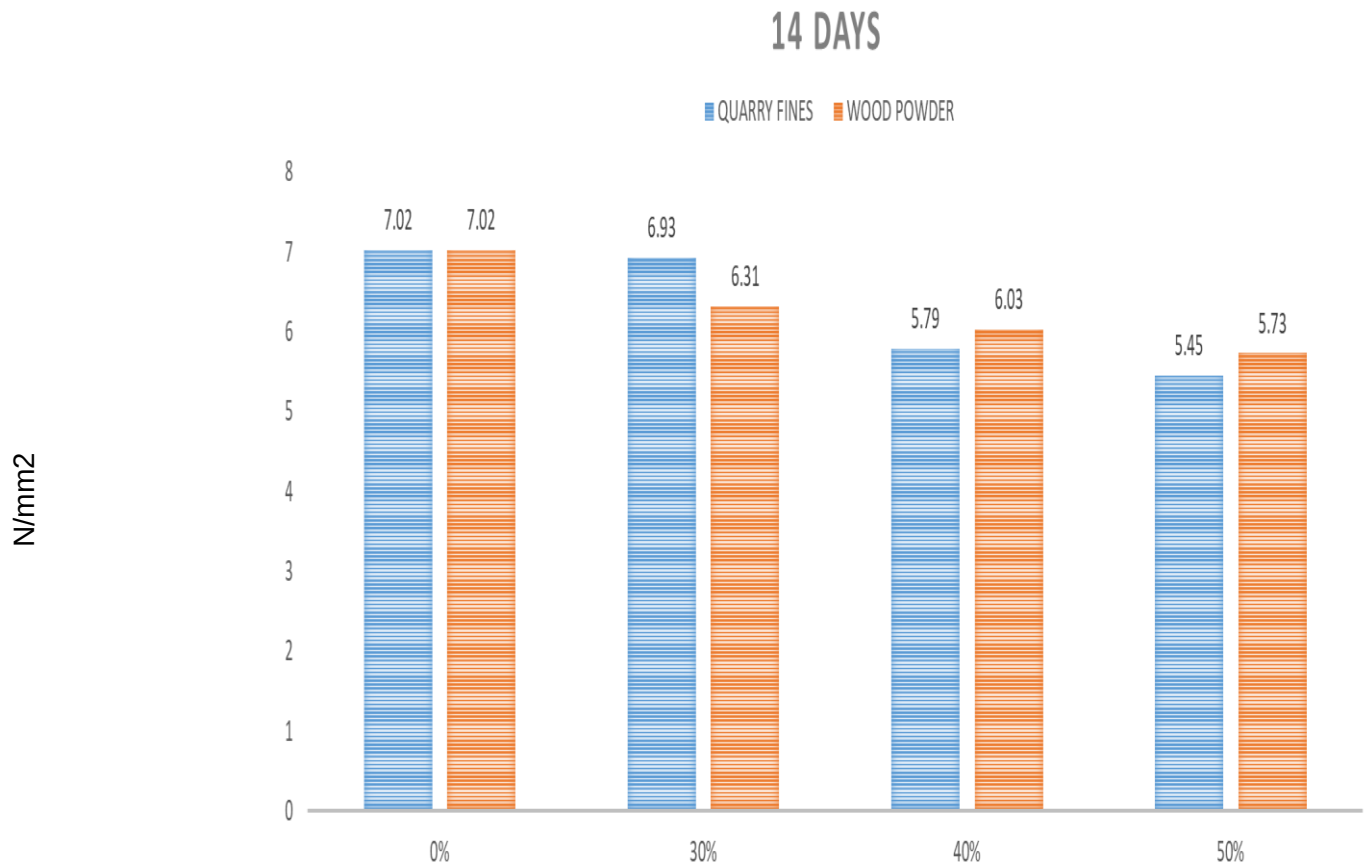
Fig.no.5.3.1 compressive strength graph for 7 days.

Graph for Compressive strength- 14 days

The compressive strength of the cement blocks is taken in second session for after 14 days in drying in various percentage replacement of fine aggregates as 30%,40% and 50% in both quarry fines and wood powders with comparison of the

conventional blocks.

Size of the blocks = 22.5 x 10.5 x 7 cm



Replacement percentage of fine aggregates

Fig.no.5.3.2 compressive strength graph for 14

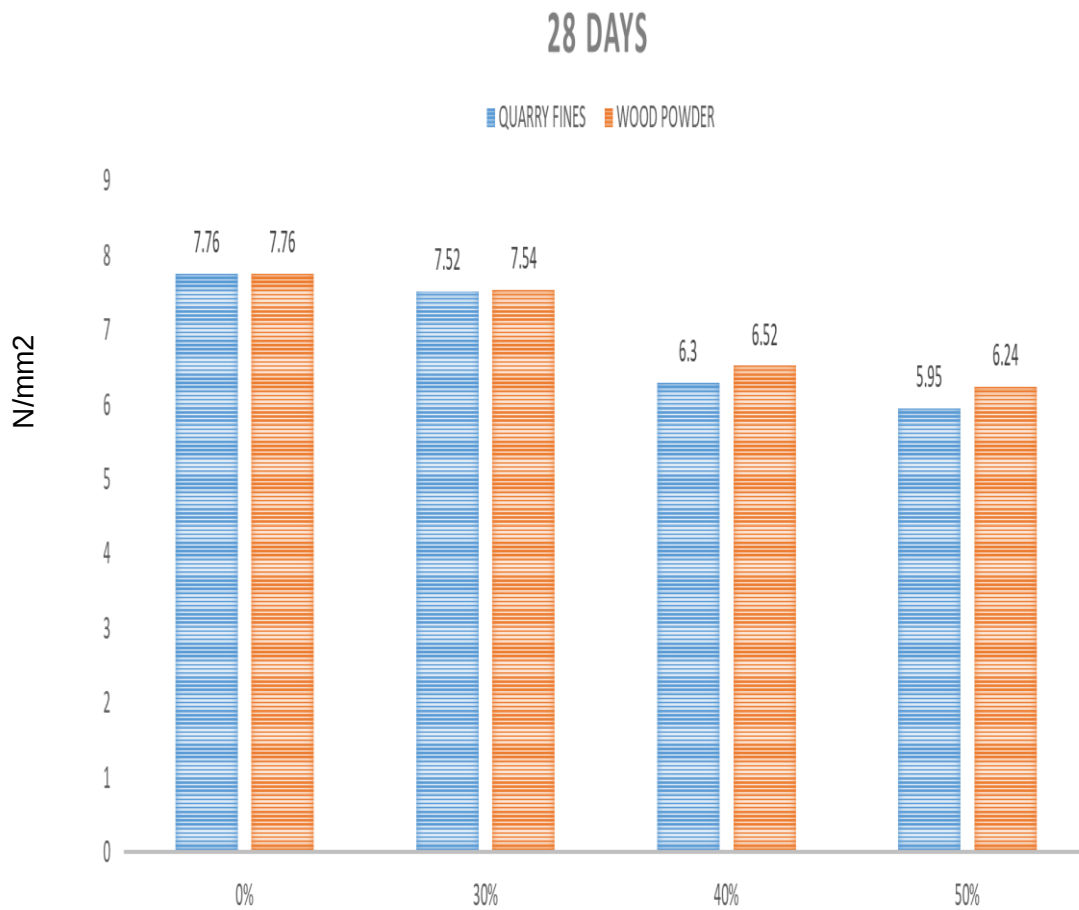
days.

Graph for Compressive strength- 28 days

The compressive strength of the cement blocks is taken in third session for after 28 days in drying in various percentage

replacement of fine aggregates as 30%,40% and 50% in both quarry fines and wood powders with comparison of the conventional blocks.

Size of the blocks = 22.5 x 10.5 x 7 cm



Replacement percentage of fine aggregates

Fig.no.5.3.3 compressive strength graph for 28 days.

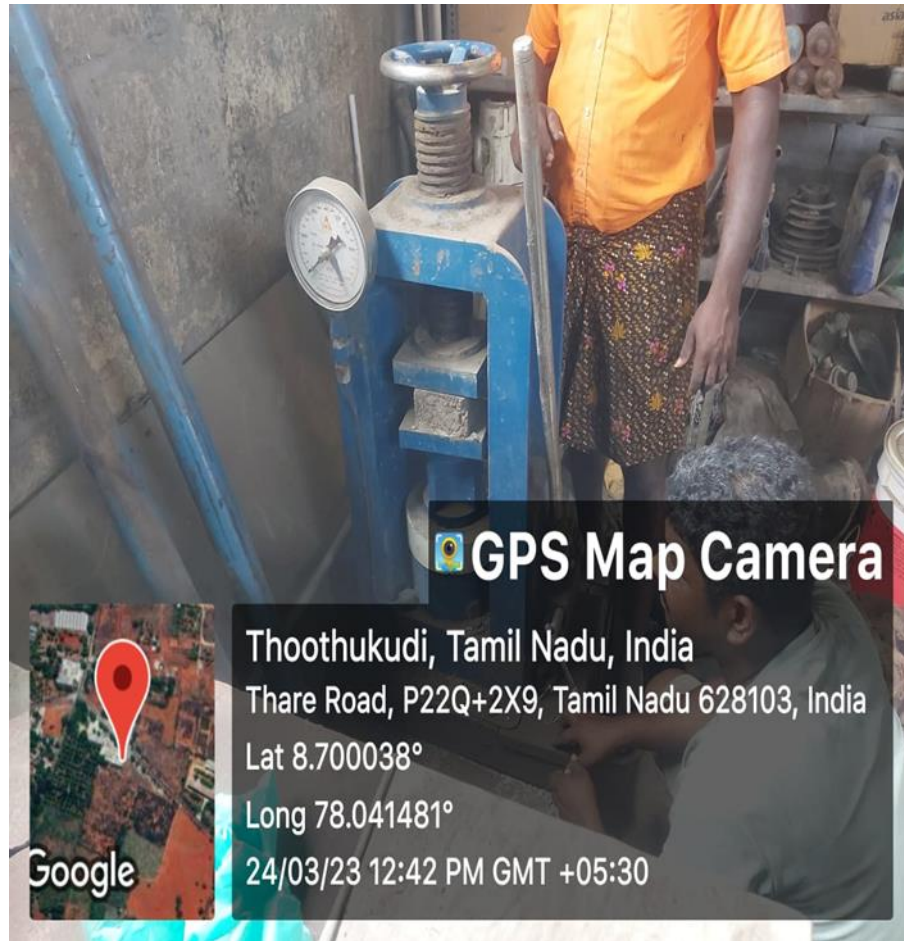


Fig.no.5.3.4

5.4 WATER ABSORPTION TEST

Five numbers of blocks were taken for this test. Take each block and weigh its dry weight in weighing machine. Note the readings as W_{dry} . The blocks are completely immersed in clean water for 24 hours. After 24 hours the blocks are taken out from water and the surface of blocks were wiped properly with a dry cloth. Then all the five blocks were weighed and wet weight is

noted as W_{wet} . The formula for the calculation of percentage of the absorbed water = $\frac{W_{wet}-W_{dry}}{W_{dry}} \times 100$

Initial rate of water absorption (IRA) of blocks was determined by keeping the blocks half immersed in water for one minute. IRA is defined as the water absorbed by the blocks in grams after one minute over 30 square inches of the block area of bed. As per ASTM: C67-94 the acceptable value of water to be absorbed by the blocks should be within 10 to 30 grams. The blocks which are having IRA above 30 grams are used for construction only after wetting the surface of blocks. Therefore, Dry weight-Weight of block after 1 minute/ Immersed area of block. Blocks are dry and porous; therefore, it has the ability to release and absorb moisture inherently from the weather. If the block dry, absorbs moisture from water when laid, the mortar will become weak and poor. It fails to make the bond between block and mortar due to insufficient water for the hydraulic reaction of cement in the mortar and overall reduces the strength of construction. Also, if the block absorbs more water than the recommended result, it gives adverse effects on the strength of block as well as the durability of the structure. The porous blocks will allow absorption of rainwater thereby giving rise to dampness in the wall. Even it cannot be grouted like concrete. So, water absorption of blocks is a significant and useful property of blocks. Water absorption is found out by the water absorption test of blocks.

The test is typically conducted by measuring the weight of the material before and after it is soaked in water for a specified amount of time. The difference in weight is used to calculate the water absorption of the material, which is expressed as a percentage of the original weight. A total of 7 blocks of size 22.5x10.5x7 cm were casted and tested for 7 days, 14 days, 28

days testing.

	7 DAYS	14 DAYS	28 DAYS
0%	14.38%	15.24%	15.59%
30%	15.61%	16.48%	16.79%
40%	17.47%	18.32%	18.56%
50%	19.71%	20.19%	21.06%

Table.no.5.4.1 water absorption for quarry fines

	7 DAYS	14 DAYS	28 DAYS
0%	14.38%	15.24%	15.59%
30%	14.20%	16.2%	17.5%
40%	13.70%	14.7%	16.5%
50%	13.1%	14.2%	15.9%

Table.no.5.4.2 water absorption for wood powders

Graph for water absorption test- 7 days

The water absorption test of the cement blocks is taken in first session for after 7 days in drying in various percentage replacement of fine aggregates as 30%,40% and 50% in both quarry fines and wood powders with comparison of the conventional blocks.

Size of the blocks = 22.5 x 10.5 x 7 cm

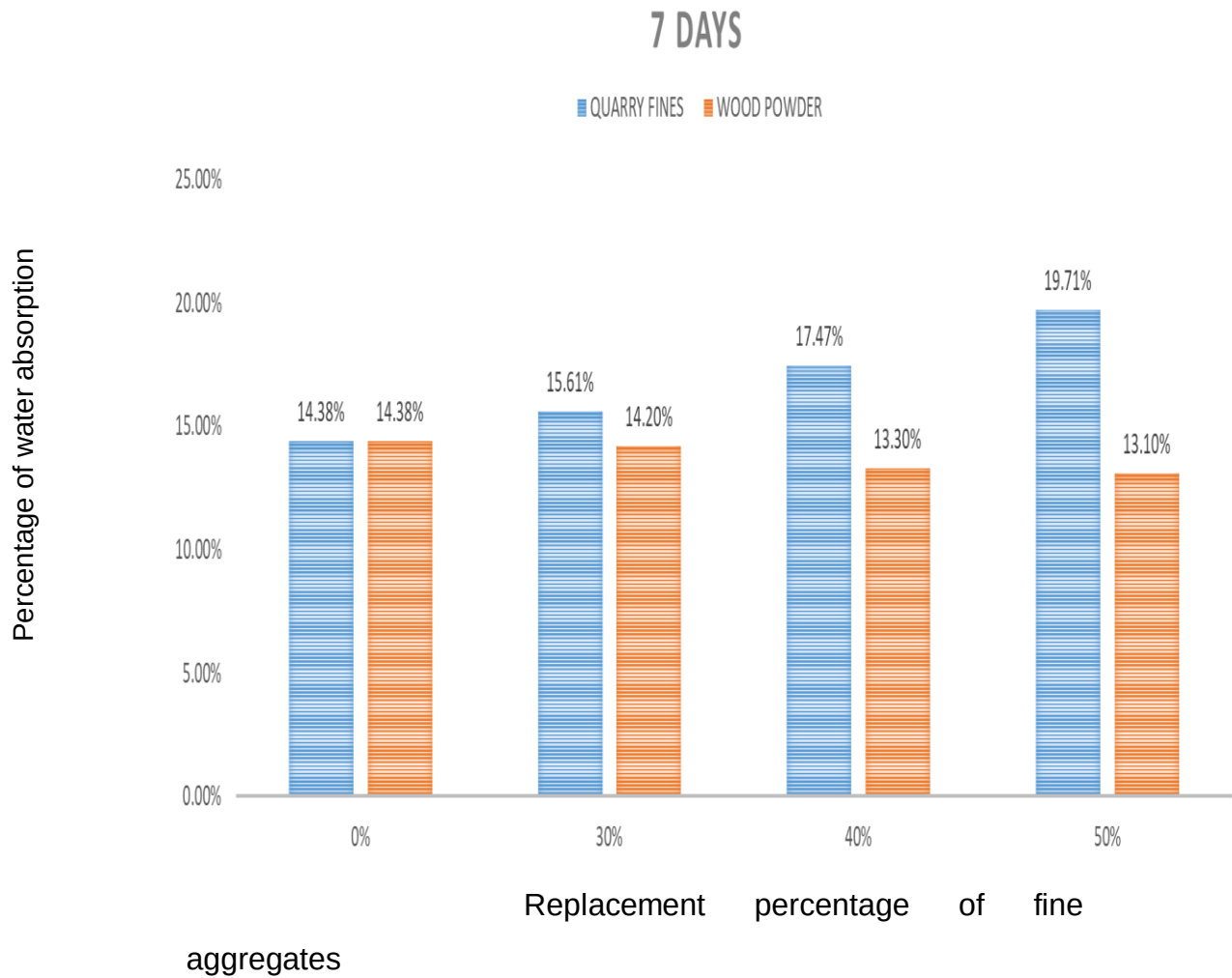


Fig.no.5.4.1. water absorption test graph for 7 days

Graph for water absorption test- 14 days

The water absorption test of the cement blocks is taken in second session for after 14 days in drying in various percentage

replacement of fine aggregates as 30%,40% and 50% in both quarry fines and wood powders with comparison of the conventional blocks.

Size of the blocks = 22.5 x 10.5 x 7 cm

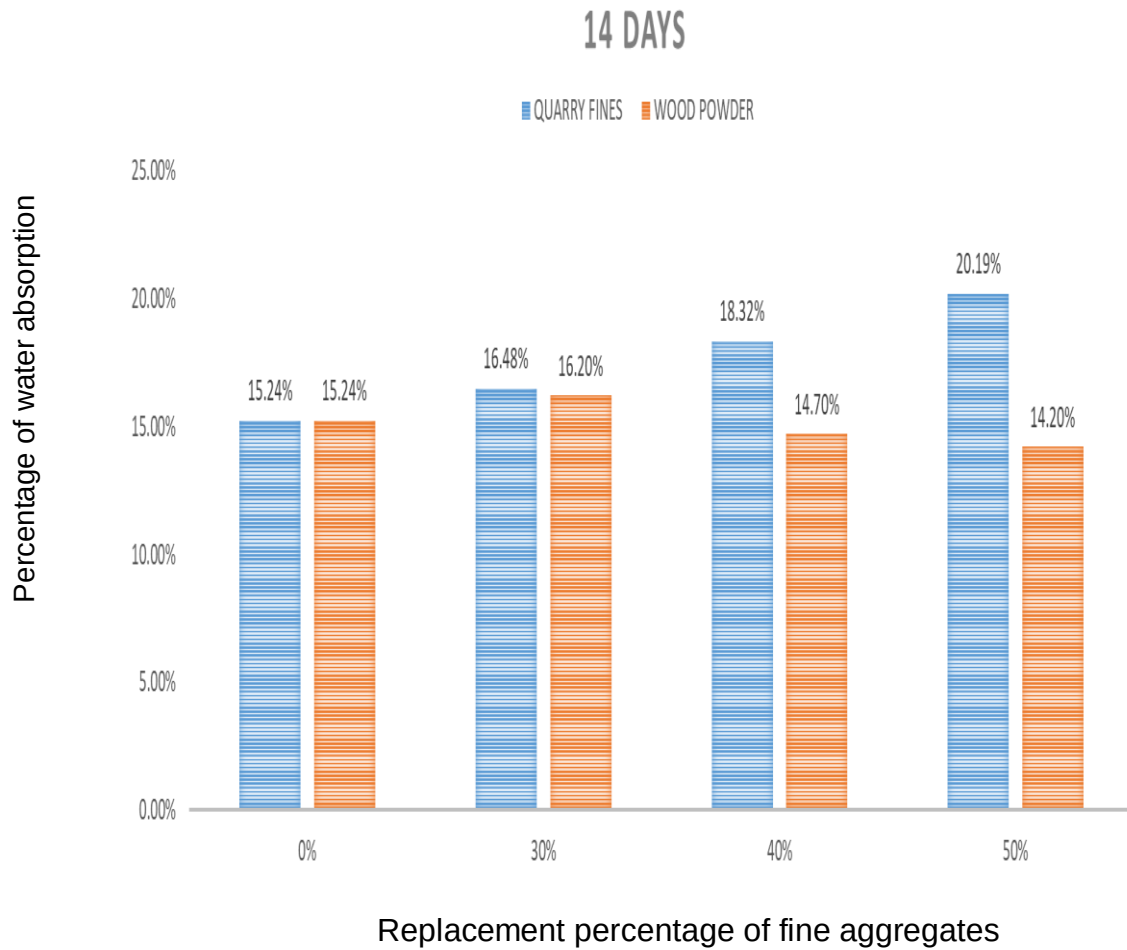


Fig.no.5.4.2. water absorption test graph for

14 days

Graph for water absorption test- 28 days

The water absorption test of the cement blocks is taken in second session for after 28 days in drying in various percentage replacement of fine aggregates as 30%,40% and 50% in both quarry fines and wood powders with comparison of the conventional blocks.

Size of the blocks = 22.5 x 10.5 x 7 cm

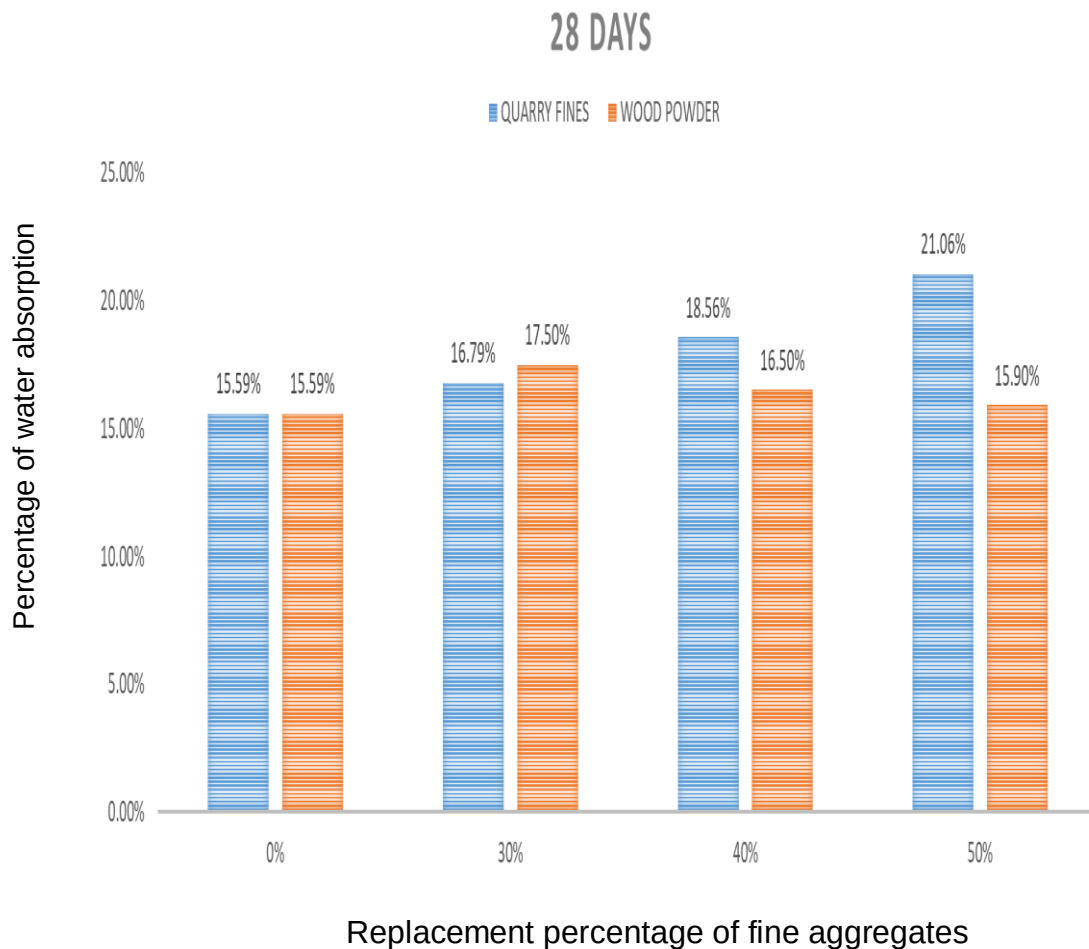


Fig.no.5.4.3. water absorption test graph for
28 days

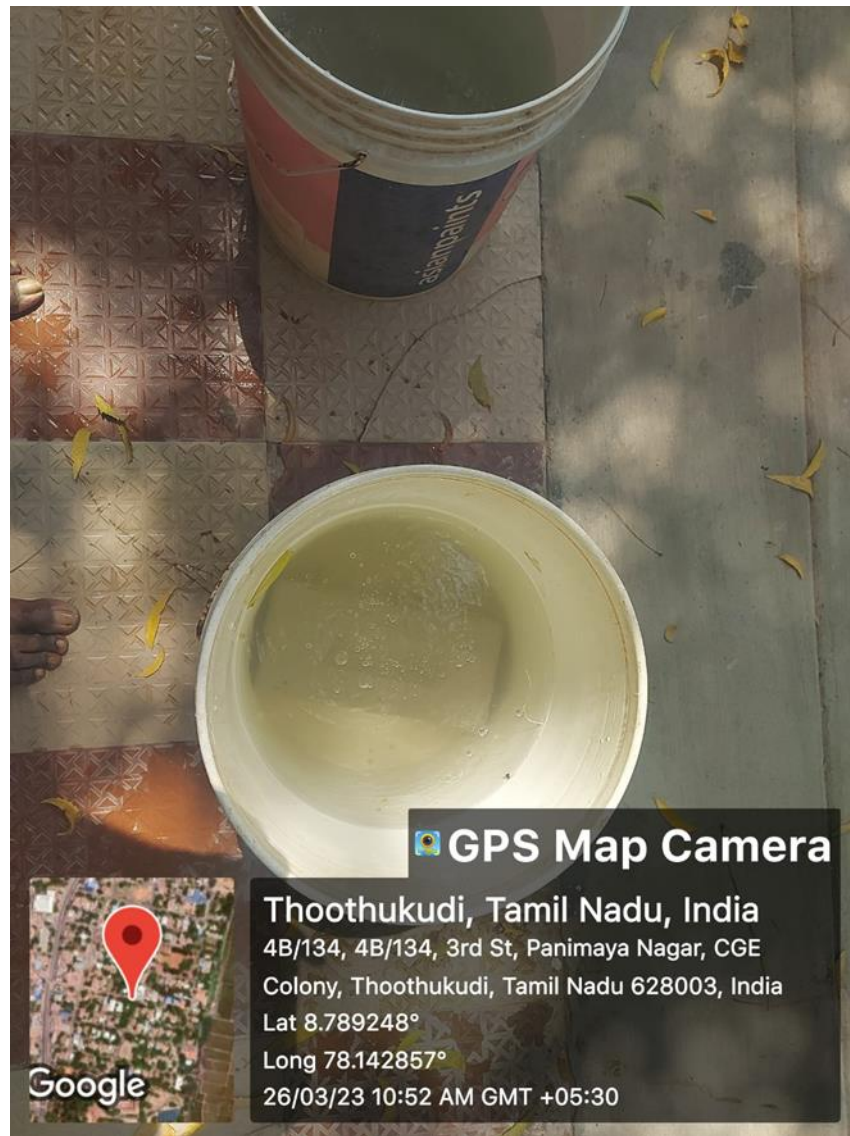


Fig.no.5.4.4

5.4 Cost Analysis

Cost analysis involves evaluating the expenses required to produce a product or service. In the case of a comparative study on partial replacement of fine aggregates with wood powder and quarry fines in cement blocks, the cost analysis would involve calculating the cost of each material used in the production of

cement blocks, as well as any additional expenses such as labor, equipment, and transportation costs. To conduct a cost analysis, a breakdown of the cost of each material would need to be determined. The cost of cement, sand, wood powder, and quarry fines would need to be calculated based on the current market value. The cost of other materials, such as water and additives, would also need to be included. Labor costs would need to be factored in, including the cost of the wages of the workers involved in the production process. Equipment costs would also need to be considered, including the cost of maintaining and operating machinery such as mixers, molds, and drying racks. Transportation costs would also need to be factored in, including the cost of transporting raw materials to the production site and delivering finished products to customers. Other costs such as utilities, rent, and taxes would also need to be included. Once all the costs have been calculated, the total cost per unit of cement block can be determined. This information can then be used to compare the cost of using wood powder and quarry fines as partial replacements for fine aggregates with the cost of producing traditional cement blocks. Overall, cost analysis is an important component of any production process, as it helps to identify areas where costs can be reduced and efficiency can be improved. By conducting a cost analysis of the production of cement blocks using wood powder and quarry fines, it can be determined whether this method is cost-effective and sustainable in the long term.

Commercial block

Cement used in one brick is 0.3 kg which price is 3 rupees

Sand used in brick is 0.9 kg which price is 10.6 rupees

Total amount is 13.6 rupees + Labor cost.

Quarry fines replaced blocks

Cement used in one brick is 0.3 kg which price is 3 rupees

In 30%, Sand used in brick is 0.63 kg which price is 9.2 rupees

Quarry fines used in brick is 0.2 kg which price is 0.16 rupees

= 3 (cement)+ 9.2 (sand) + 0.16 (quarry fines) = 12.36
+ Labor cost

In 40%, Sand used in brick is 0.54 kg which price is 6.3 rupees

Quarry fines used in brick is 0.32 which price is 0.26 rupees

= 3 (cement) + 6.3 (sand) + 0.26 (quarry fines) = 9.56
rupees + Labor cost

Wood powder replaced blocks

Cement used in one brick is 0.3 kg which price is 3 rupees

In 30%, Sand used in brick is 0.63 kg which price is 9.2 rupees

Wood powder used in brick is 0.5 kg which price is 1 rupee

= 3 (cement)+ 9.2 (sand) + 2 (wood powder) = 13.2 +
Labor cost

In 40%, Sand used in brick is 0.54 kg which price is 6.3 rupees

Wood powder used in brick is 0.6 which price is 1.4 rupees

= 3 (cement) + 6.3 (sand) + 0.6 (quarry fines) = 10.7
rupees + Labor cost

CHAPTER 6

SUMMARY AND CONCLUSION

- Both wood powder and quarry fines can be used as partial replacements for fine aggregates in cement blocks.
- Up to 40% replacement of fine aggregates with wood powder can be made without significantly compromising the compressive strength of the cement blocks, while up to 30% replacement of fine aggregates with quarry fines is possible.
- The cost savings are particularly significant when using wood powder or quarry fines as a replacement for a higher percentage of fine aggregates, such as 40%
- The optimal replacement percentage for wood powder and quarry fines appears to be around 30-40%, as higher percentages can result in reduced strength and increased water absorption.
- Despite the cost savings, it is important to consider other factors such as strength and water absorption when deciding on the optimal percentage of replacement for wood powder or quarry fines.

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