

DEVELOPING PERMEABLE CONCRETE USING WASTE TYRE

Submitted in partial fulfillment of the requirements for award of
Bachelor of Engineering degree in civil engineering

by

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**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

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APRIL-2024



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BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of **S.Himalayan goud** (Register No: 40200709), **G.Sarath Chandra** (Register No: 40200703) who carried out the project entitled "**DEVELOPING PERMEABLE CONCRETE USING WASTE TYRE**" under our supervision from June 2023 to April 2024.

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DECLARATION

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ACKNOWLEDGEMENT

We are pleased to acknowledge our sincere thanks to Board of Management of **SATHYABAMA** for their kind encouragement in doing this project and for completing it successfully. We are grateful to them.

We convey our thanks to **Dr. Devyani Gangopadhyay, B.Arch., M.T.P., Ph.D.,** Dean, School of Building and Environment and **Dr. S. Packialakshmi, M.E., Ph.D.,** and **Dr.R. Padmapriya, M.E., Ph.D., Head of the Department,** Dept. of Civil Engineering for providing us necessary support and details at the right time during the progressive reviews.

We would like to express our sincere and deep sense of gratitude to our Project Guide **Mr.J.VANJINATHAN** for her valuable guidance, suggestions and constant encouragement paved way for the successful completion of our project work. As well as we would like to thank our non-teaching staff member for their guidance to finish all the experiments which have been involved in this research.

We wish to express our thanks to all Teaching and Non-teaching staff members of the Department of Civil Engineering who were helpful in many ways for the completion of the project

ABSTRACT

In recent years, due to increase of growth in construction industry and increasing demand for construction materials therefore, there have been a several attempts in the building material industry to put to good use waste materials products, e.g., worn-out tires into useful and costeffective items. By agreeing to this, and as a consequence of the increase in the motor vehicle production, large quantities of tirewaste material have to be disposed of. As a result of the depletion of the waste tireavailability landfills, many countries put a restriction of disposing of tires in landfills in their countries. Waste tire disposal alternatives had been under research for a long time. Recycling the waste tire rubber is among these alternatives. Recycled waste tire rubber is currently the most utilised method. Recycle wasted Tyre Rubber one of the promising materials in construction industry is the recycle wasted Tyre Rubber . These are light in weight, elasticity, energy absorption sound and heat insulating properties. By applying this waste material as a raw material for other product helps in tackling the problem of waste material dumping and at the same time the success of the investigation will contributes to improvement of the newer Application of this waste material in this preparation of fibrous concrete. The work isaimed to investigate the strength behaviour i.e. compressive and flexural strength of rubberised concrete with different volume of waste-Tyre rubber.strength test, water absorption test and flexural test. In our paper the density and compressive strength of the concrete made with waste tire rubber has been studied.

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CHAPTER 1

INTRODUCTION

1.1 GENERAL

Recycled waste tyre rubber in construction assiduity Reclaimed waste tyre rubber, the most promising material that can be used in the construction assiduity because of its featherlight, pliantness, energy absorbs, sound and heat separating parcels waste rubber tire is the most suitable for concrete which is a partial relief of mineral coarse summations It has the two-fold advantage that is, ve the different habituated material arising severe pitfalls for the terrain condition. The parcels of the low unit weight, high bruise resistance, continuity, absorbing the shocks and climate, high rigidity can be bettered by the partial relief of the coarse summations of the concrete. Can you believe how waste rubber ti-res can make a significant difference in building constructions today It's truly a game changer when we take into account the environmental benefits as well. The innovative potential of using recycled rubber is unlimited. We should embrace this opportunity to make our world a better place, one construction site at a time! If you could use the rewritten article to lean on it's just sensational with the thought of incorporating recycled rubber into construction materials. The limitless possibilities are unknown and surely this can be the start of change settlement in the building industry was considered as "green" and environmentally friendly building materials to reduce the constituents of cement in the production of concrete. It is one of the waste materials that has introduced by the Construction. Therefore waste tyre rubber concrete has widely used for the developing the projects such as roadways or road intersections, recreational courts and pathways and skid resistant ramps.

CHAPTER 2 LITERATURE SURVEY

2.1 GENERAL

The following major research project has been taken from international journals as reference to analyse the concepts for project.

AUTHOR . SHAHID RASOOL TARY

Impact of using treated and untreated tyre rubber aggregates in place of some of the coarse particles in concrete. Rubber's many good qualities, such as greater flexibility, low weight, and ease of availability, make it an excellent product to become a permanent member of the concrete family. The utilization of this waste material in the construction industry can be highly environmentally good. The compressive strength of treated rubberized concrete is higher than that of untreated rubberized concrete. Rubber only regains 92.57% of the standard conventional concrete's compressive strength even after receiving surface treatment.

AUTHOR . A.NASEER , A.A.SHAH , M.ASHRAF

An analysis of the structural and thermal behavior of concrete that contains rubber aggregate. The important technique was utilized to investigate the thermal behavior of concrete . There were no notable alterations in the characteristics of the concrete up to a 5% substitution. Concrete characteristics change significantly above 5% replacement. With an increase in rubber content, the properties of rubberized concrete such as compressive strength, flexure strength, workability, stiffness, and unit weight reduced. As the amount of rubber in rubberized concrete increased, so did its impact resistance, air content, and water absorption

AUTHOR . KOTRESH K.M , MESFIN GETAHUN

Research on Used tyre Rubber as Aggregates for Concrete. Based on the current experimental study, we came to the conclusion that, even though rubberized tyre concrete has a lower compressive strength than conventional concrete, there is still a bigger market for concrete products in which it would be possible to use rubber aggregates, which would use the rubber tyres that have been discarded and give an important environmental pollution risk. Improving the binding characteristics of rubber particles can increase the strength of rubberized concrete. Only four or five of India's 36 tyre producers are major tyre recyclers; the remaining twenty make up the majority. Of these, M/S Gujarat Reclaim's tyre recycling facilities at Haridwar, Uttarakhand, India, generate around Rs. 15 crore in revenue annually.

AUTHOR . TANJA KALMAN SIPOS AND KRISHTINA

Using Recycled tyre in Place of Aggregate in Self-Compacting Concrete. tyre landfilling is one of the biggest ecological issues of the near future . However recycling and reusing recycled tyre rubber prevents this from happening. However, the mechanical characteristics of selfcompacting concrete, such as its compressive strength, flexural strength, splitting tensile strength, and modulus of elasticity, may be adversely affected if natural aggregate is substituted with waste tyre rubber. However, scrap tyre rubber can be used to replace natural gravel or sand to increase impact resistance, ductility, and fatigue resistance.

AUTHOR . T.ISHWARYA

In this work, a 20% weight replacement of recycled scrap tyre rubber has been utilized in place of coarse aggregate. The findings indicate that while the compressive strength of waste tyre rubber-infused concrete was significantly lower than that of regular concrete, the failure mode of the waste tyre rubber-infused concrete was ductile and flexible rather than brittle. In this study, we employ the replacement method to determine the compressive strength of concrete.

AUTHOR . JAVIER CASTRO

In this paper states that an experimental study on transport properties of concrete are controlled by characteristics of its pore network. This test was conducted to determine the properties of concrete like compression test, flexural strength and also permeability of concrete. pervious concrete has proven to have properties suitable for use in low volume traffic areas.

AUTHOR . PRIYANKA ASUTKAR , S.B.SHINDE

Study on the behaviour of rubber aggregates concrete beams using analytical approach. A modified concrete is prepared by replacing coarse aggregates in concrete with rubber aggregates by varying the replacement proportion from 0% to 20% with increment of 5%. 3 cubes for each percentage of replacement are casted and tested after 28th days of curing. The physio mechanical properties like density, compressive strength and elastic properties of modified concrete are determined from concrete cubes experimentally and further stresses and displacement at every 50mm depth of beams are determined analytically by method of initial functions (MIF). MIF is an analytical method in which elastic properties and theoretical loads are used to analyse the beams without conducting any experimental programme. The analytical results by MIF are compared with bending theory.

CHAPTER 3

AIM AND SCOPE

3.1 Setting Of Objectives

To find out the water absorption test of concrete which is made up of rubber waste tyre.

To find the compressive strength of the concrete block made up of rubber tyre waste.

3.2 Need Of Project

To overcome these specific terrible circumstances, it is, like, super vital to like, completely utilized reused squander tires as an a total, This can give like, arrangement of for two major problems, that is, like, the natural issue caused by squander tires and the consumption of characterstic resources from total generation thus like driving to the deficenecy of common materials in like, few nations destroyed elastic completely diminish the weight of the concrete. With like, the increment in development exercises, there is like, large demand on concrete and in this way on its fixing like, aggregate also So like, squanded tire rubber can be utilized as an like, elective to this request. In any case, the objective of the project is like, to study and compare the quality content behaviour of concrete using waste tyre rubber as a substitution material.

3.3 SCOPE OF THE PROJECT

In this investigation the compressive strength and flexural strength of concrete utilising waste tyre rubber has been investigated by replacing the fine aggregate by weight using different percentages.

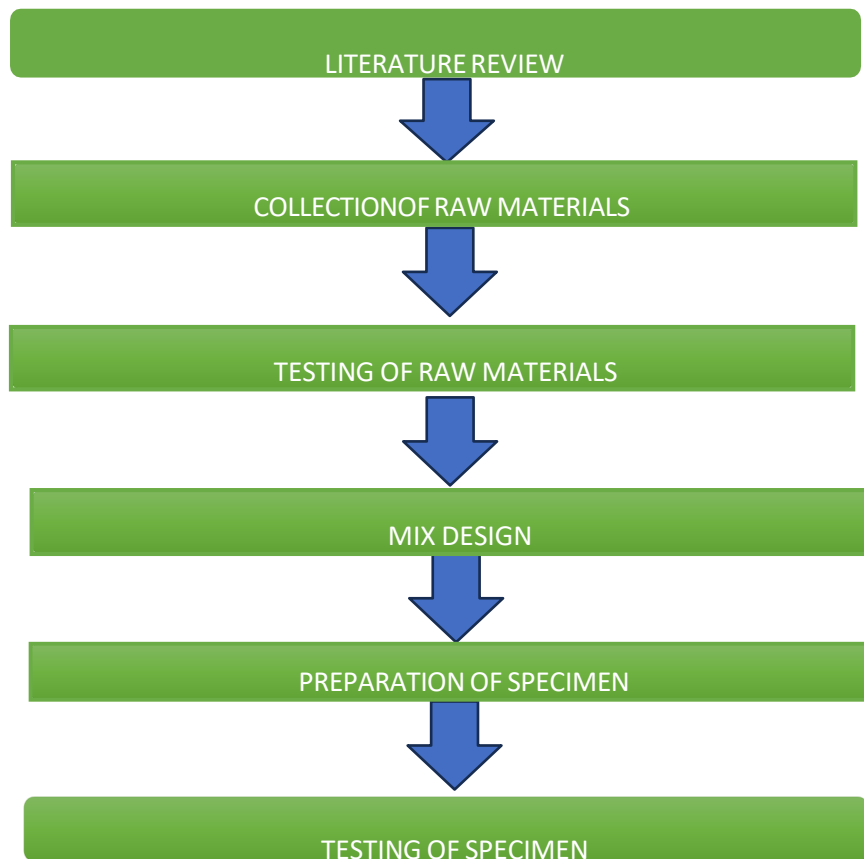
The project will be considered successful if it achieves the following:

- a. Development of a cost-effective cellular block using rubber waste tyre.
- b. Successful prototyping with results meeting industry standards.

CHAPTER 4

METHODOLOGY AND EXPERIMENTAL PROCEDURE

4.1 Methodology



4.2 COLLECTION OF RAW MATERIALS

4.2.1 Waste rubber tyre

Waste rubber tyre is an material for recycling. The use of waste rubber tyre saves a lot of energy .The increasing awarness of waste tyre rubber,recycling speeds up the focus on the waste tyre rubber with so many different forms in various fields. The use of waste tyre in the concrete will helps in reducing the waste composition in the society and helps in improving the environmental beneficts. The complete process of making the waste tyre rubber particles for use in concrete involves in cuttuig of the whole scrap tyre into two halves and cutting the wired edges cleanly. Not only inthe concrete blocks but it can be also used in the road constructions and it can be used in building the dams and other heavy structures.



FIG : 4.2.1 : RUBBER TYTRE

4.2.1.1 Advantages Of Waste Tyre In Concrete

Reduced Material Costs

Using waste tires as a partial replacement for conventional aggregates in concrete production can lead to tremendous cost savings. It reduces the need for virgin aggregates, thereby reducing material procurement expenses. Waste tires, which are typically bulky and heavy, are often available at very low or even no cost, especially in regions where tire disposal fees are high or where tire recycling programs are in place. This accessibility makes waste tires a notably economically attractive alternative to traditional construction materials, which may incur higher procurement and production costs. Waste tires are usually cumbersome to handle and transport, which can sometimes make transportation costly. However, by incorporating waste tires as construction materials locally or regionally, transportation costs can be significantly minimized compared to sourcing materials from distant locations.

Rubberized Asphalt

Waste tire rubber can be used to modify asphalt mixtures, creating what is known as rubberized asphalt. Rubberized asphalt has been shown to significantly reduce road traffic noise compared to traditional asphalt pavements. The elastic properties of rubber particles help to absorb sound waves, thereby reducing the noise generated by vehicles traveling on the road surface. This makes rubberized asphalt an ideal choice for highways, urban streets, and areas where noise abatement is a concern.

Noise Barriers

Waste tire rubber can also be utilized in the construction of noise barriers alongside highways and railways. These barriers, often made from recycled rubber materials, act as sound-absorbing walls that help to mitigate noise levels for nearby residents and communities. Rubber-based noise barriers offer advantages over traditional materials such as concrete or steel, including lighter

Environmental Benefits

Incorporating waste tires into concrete helps in recycling and reducing the volume of tires in landfills, thereby addressing waste management issues and contributing to environmental sustainability. Recycling waste tires into construction materials requires less energy compared to producing equivalent materials from virgin resources. For example, manufacturing rubberized asphalt pavement using recycled tire rubber consumes less energy than producing conventional asphalt pavement. By reducing energy consumption in manufacturing processes, we can lower greenhouse gas emissions and mitigate climate change impacts. Improperly disposed of waste tires can leach chemicals and heavy metals into the soil and water, contaminating groundwater and surface water bodies. By recycling tires or incorporating them into construction materials, we can prevent these pollutants from entering the environment and protect water quality in rivers, lakes, and aquifers.

Improved Workability

Waste tire rubber can enhance the workability of concrete mixes, especially those with higher proportions of recycled aggregates, by acting as a lubricant between particles and reducing internal friction. Rubberized asphalt mixes, which incorporate waste tire rubber into asphalt concrete, offer enhanced workability compared to traditional asphalt mixes. The rubber particles act as a binder modifier, improving the flexibility and deformation resistance of the pavement. This makes the asphalt easier to lay and compact, resulting in smoother surfaces and better workability for paving crews.

4.2.1.1 Properties Of Waste Tyre

Elasticity

The rubber used in tires is highly elastic, allowing tires to deform and absorb shocks from the road surface. This elasticity makes waste tires suitable for applications requiring flexibility and resilience, such as playground surfaces, athletic tracks, and rubberized pavements. Waste tires are primarily composed of rubber, which is known for its elasticity. Rubber molecules have long chains that can stretch and return to their original shape when deformed. This property allows tires to absorb impacts from road irregularities, providing a smoother ride for vehicles and reducing wear and tear on vehicles and road surfaces. In applications like playground surfaces or athletic tracks, the elasticity of waste tires provides cushioning and impact absorption, enhancing safety for users.

Durability

Tires are designed to withstand harsh conditions, including exposure to heat, moisture, and mechanical stress. This durability makes waste tires suitable for use in construction materials, such as rubberized asphalt and concrete, where they can enhance the longevity and performance of structures. Tires are designed to withstand the harsh conditions of road use, including exposure to sunlight, heat, moisture, and mechanical stress. The rubber compounds used in tires are formulated to resist degradation from environmental factors, such as oxidation and UV radiation. As a result, waste tires retain their structural integrity and performance characteristics even after extended periods of use, making them suitable for repurposing in various applications where durability is essential.

Tensile Strength

The rubber compounds used in tires exhibit excellent tensile strength, allowing tires to withstand high forces and resist tearing and deformation. This property makes waste tires valuable for applications requiring strength and durability, such as reinforcing materials in civil engineering projects and manufacturing processes. Tires exhibit high tensile strength, meaning they can withstand pulling forces without breaking or tearing. This property is crucial for withstanding the forces experienced during vehicle operation, such as acceleration, braking, and cornering. In civil engineering applications, waste tires can be used as reinforcement materials to enhance the tensile strength of structures like retaining walls, embankments.

Chemical Resistance

Tires are resistant to many chemicals, oils, and solvents, which can help protect against degradation and corrosion in certain applications. Waste tires can be used in environments where exposure to harsh chemicals is a concern, such as industrial flooring, chemical containment barriers, and protective coatings. Rubber is inherently resistant to many chemicals, oils, and solvents, making waste tires suitable for applications where exposure to corrosive substances is a concern. For example, in industrial settings, waste tires can be used as protective liners for chemical storage tanks or as barriers to contain spills and leaks. The chemical resistance of waste tires helps prevent degradation and ensures the long-term performance of these applications in challenging environments.

Thermal Insulation

Rubber has low thermal conductivity, making waste tires effective insulators against heat and cold. This property makes waste tires suitable for applications requiring thermal insulation, such as roofing materials, building insulation, and thermal barriers in construction. Rubber has low thermal conductivity, meaning it does not conduct heat well. Waste tires can act as effective insulators against heat transfer, providing thermal insulation in applications such as roofing materials, building insulation, and thermal barriers. This property helps regulate indoor temperatures, reduce energy consumption for heating and cooling, and improve occupant comfort in buildings.

Sound Absorption

Rubber has the ability to absorb sound waves, making waste tires effective at reducing noise transmission. This property makes waste tires suitable for sound barriers, acoustic panels, and noise-reducing materials used in transportation infrastructure, buildings, and industrial facilities. Rubber has sound waves due to its porous structure and viscoelastic properties. Waste tires can be used to create sound-absorbing materials for applications like sound barriers along highways, acoustic panels in buildings, and noise-reducing mats in industrial facilities. The sound absorption properties of waste tires help mitigate noise pollution, improve acoustic comfort, and enhance the quality of the surrounding environment.

Recyclability

Waste tires are highly recyclable, with the potential to be transformed into a wide range of products and materials through processes such as shredding, grinding, and pyrolysis. This recyclability reduces the environmental impact of tire waste and conserves valuable resources by diverting tires from landfills and illegal dumping sites. Shredded or ground rubber from waste tires can be used as raw material for manufacturing products such as rubberized asphalt, rubber mulch, sports surfaces, and recycled rubber products. This recyclability reduces the demand for virgin resources, conserves energy, and minimizes the environmental impact of tire waste by diverting tires from landfills and incineration.

UV resistance

Old tires are resistant to ultraviolet (UV) radiation from sunlight, which extends their life when exposed to the outdoor environment. This UV resistance makes used tires suitable for applications where prolonged exposure to sunlight is unavoidable, such as exterior building materials, landscape products and recreational surfaces. Their UV-resistant properties help prevent degradation in these applications and maintain structural integrity over time.

Non conductive

Rubber is a nonconductive material, meaning it does not conduct electricity. Slip rings can be used in electrical insulation applications to prevent the passage of electrical current and protect against electrical hazards. For example, old tires can be used as insulation mats for substations, cable protection and shock absorbing materials for electrical equipment. Their non-conductive properties improve electrical safety and prevent accidents in various industrial and utility environments..

4.2.1 Cement

Generally in the construction industry portland cement is the most used product. The main component in the production are concrete and mortar . It is the mostly used because of its strength,durability,and flexibility. In the below paragraph there is some information about portland cement :

4.2.1.1 Composition

Portland cement mainly consists of four components:

The primary component of Portland cement is clinker, which is produced by heating a mixture of raw materials like primarily limestone (calcium carbonate), clay, and other small additive es, to high temperatures (about 1450°C or 2642°F) in a kiln. This process is known as clinkerization, transforms the raw materials into clinker. It is a hard nodular material. Gypsum is added to the clinker during the final grinding process to control the setting time of the cement. It slows down the initial setting of the cement, allowing it to be workable for a longer period. Other Additives Depending on the specific requirements and desired properties, small amounts of other additives may be included in the cement formulation. These additives can influence factors like setting time, strength, and durability

4.2.1.2 Types Of Portland Cement

There are different types of cements are present based on there composition and its purpose .

They are :

TYPE I

This is the most common type of Portland cement and is used in general construction applications where high strength is required.

TYPE II

Type II Portland cement is known for its moderate heat of hydration and is often used in structures where heat buildup is a concern, such as large concrete masses.

TYPE III

Type III cement has a high early strength, making it suitable for applications where rapid strength development is essential in precasting concrete.

TYPE IV

Type IV Portland cement is designed to produce low heat during hydration and is used in massive concrete structures, like dams.

TYPE V

Type V cement is highly resistant to sulfate attacks and is commonly used in environments where the soil or ground water contains sulphates, which can degrade regular cement. Portland cement is mixed with water a chemical reaction called hydration occurs. During hydration, the clinker compounds react to form calcium silicate hydrates and calcium hydroxide, which bind together to create a strong solid matrix. This process gives concrete its strength and durability, Portland cement is the primary binding agent in the production of concrete, mortar and stucco.



FIG : 4.2.2.2 : CEMENT

4.2.2 Fine Aggregate

River sand is a naturally occurring sand that is collected from riverbanks. It is the most common sand used in building. River sand is sand with small particles. It has a soft feel .Because of this it is used for plastering projects that demand a flawless finish,as well as RCC projects. River sand has a whitish-grey hue to it. This sand binds well with cement, aggregates, and water to build concrete because of its smooth and fine texture. River sand is widely utilized in construction since it is less expensive than other types of sand because it is collected naturally.



FIG : 4.2.3 : SAND

4.2.3 Water

Water is an important ingredient of papercrete as it actively participates in the chemical reaction with cement. The water is required for preparation of mortar, mixing of cement concrete and for curing work etc. During construction work. The quality and quantity of water has much effect on the strength of mortar and cement concrete in construction work. The water used for mixing and curing should be clean and free from injurious quantities of alkalis, acid, oils, salt, sugar, organic materials, vegetable growth and other substances that may be deleterious to bricks, stone, concrete or steel. Potable water is generally considered satisfactory for mixing. The pH value should not be less than 6.

4.2.4 Coarse Aggregate

Coarse aggregate is a construction component made from rock quarried from the ground, such as crushed stone, river gravel, or previously used concrete. Coarse aggregates are typically larger than 3/16 inches (No. 4 sieve) but less than 2 inches in diameter. They are often used as a structural filler in concrete, and are an essential component of the construction industry. Coarse aggregates are used in a variety of applications due to their strength, durability, and load-bearing properties.

Coarse aggregates are obtained from natural resources by quarrying rocks or dredging from the river bed. They are used in a wide variety of construction applications, sometimes on their own, such as a granular base placed under a slab or pavement, or as a component in a mixture, such as asphalt or concrete mixtures. Coarse aggregates are different from fine aggregates, which more closely resemble sand. Coarse aggregates are larger, heavier, and less fine than fine aggregates, and come in various sizes, ranging from 3/8 inches to several inches in diameter. The usual range employed is between 9.5mm and 37.5mm in diameter.



FIG :4.2.5 : Coarse Aggregate

4.3 Testing of raw materials

4.3.1 Consistency of cement

Purpose

The test is normally done to find out the how much amount water is required the standard consistency of cement is that consistency, which permit the vicat plunger to penetrate to a point 5 to 7mm of the vicat mould when tested. Procedure to determine the quantity of water required to produce a cement.

Procedure

- Keep the vicat device on a level base (when utilizing vicat device with dashpot, keep the bearing mobile pole to its most noteworthy position and stick it.) Unscrew the best of the dashpot. Half fill the dashpot with any reasonable oil of thickness and screw the best. Work the plunger a number of times.
- Attach the plunger for deciding standard consistency to the mobile pole. Work the plunger a number of times.
- Take 400 gm of cement in a skillet and a weighed amount of water in a beaker.
- Prepare a glue with the water included to cement. Begin a stopwatch at the time of including water to cement.
- Keep the vicat mould on a non permeable plate and fill the cement glue in it.
- After totally filling the shape, shake it marginally to remove the discuss. Smooth off the surface of the glue making it level with the beat of the decay. The cement glue in this way arranged is the test block
- Lower the plunger delicately to touch the surface of the cement glue and rapidly discharge when vicat device with dashpot is utilized, put the shape filled with cement glue and the non retentive plate on the base plate of the vicat device. Raise the plunger of the sprint pot, bring it in contact with the best cap of the mobile bearing rod

TABLE: 4.3.1: Readings of Consistency Of Cement

SNO	PERCENTAGE OF WATER	HEIGHT OF THE PLUNGER
1	25 %	36 mm
2	26 %	33 mm
3	27 %	21 mm
4	28 %	15 mm
5	29 %	11 mm
6	30 %	7 mm



FIG : 4.3.1 : Vicat Appartus Readings

4.2.6 Slump Cone Test

The concrete slump test measures the consistency of fresh concrete before it sets. It performed to check the workability of the fresh concrete and therefore ease with flow. We got the result of 100 mm in this slump cone test.

Procedure

- The form for the concrete Droop test is a frustum of a cone, 300 mm (12 in) in tallness. The base is 200 mm (8in) in breadth and has a littler opening at the best of 100 mm (4 in).
- The base is set on a smooth surface, and the holder is filled with concrete in three layers, whose workability is to be tested.
- Each layer is temped 25 times with a standard 16 mm (5/8 in) distance across steel bar, adjusted at the end.
- When the form is totally filled with concrete, the beat surface is struck off (leveled with shape beat opening) by implies of screening and rolling movement of the temping rod.
- The shape must be solidly held against its base amid the whole operation so that it cannot move due to the pouring of concrete, and this can be done by implies of handles, or footrests brazed to the mould.
- Immediately after the filling is completed and the concrete is leveled, the cone is gradually and carefully lifted vertically; an unsupported concrete will presently Slump.
- The diminish in the stature of the center of the Drooped concrete is called Slump.

- The shape for the concrete Droop test is a frustum of a cone, 300 mm (12 in) in stature. The base is 200 mm (8in) in distance across and has a littler opening at the best of 100 mm (4 in).
- The base is put on a smooth surface, and the holder is filled with concrete in three layers, whose workability is to be tested.
- Each layer is temped 25 times with a standard 16 mm (5/8 in) breadth steel bar, adjusted at the end.
- When the form is totally filled with concrete, the beat surface is struck off (leveled with shape best opening) by implies of screening and rolling

movement of the temping rod.

- The shape must be solidly held against its base amid the whole operation so that it cannot move due to the pouring of concrete, and this can be done by implies of handles, or footrests brazed to the mould.
- Immediately after the filling is completed and the concrete is leveled, the cone is gradually and carefully lifted vertically; an unsupported concrete will presently Slump.
- The diminish in the tallness of the center of the Drooped concrete is called Slump.

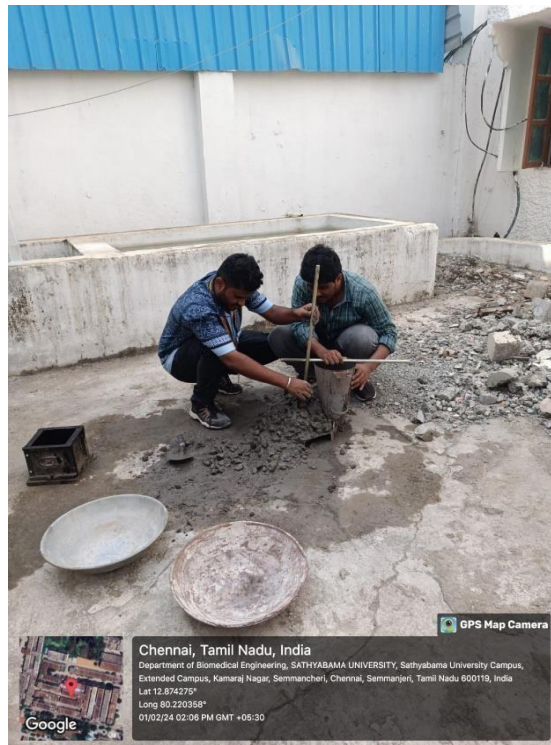


FIG : 4.3.2 :Slump Cone Test

4.4 Mix Design

Mix design can be defined as the process of selecting suitable ingredients of concrete and determining their relative proportions with the object of producing concrete of certain minimum strength and durability as economically possible.

4.4.1 Concept Of Mix Design

At this arrange, it is worth recalling the relationship between the total and the glue, which are two imperative fixings of concrete. The workability of the mash is guaranteed by the greasing up impact of the glue and is influenced by the weakening sum of the glue. The quality of concrete is constrained by the quality of the glue, since the total is, with uncommon special cases, more grounded than the glue. In quintessence, the porousness of concrete is decided by the quality and consistency of the glue, since exceptionally small water streams from the total either beneath weight or by capillarity. In expansion, the fundamental impact on the dried shrinkage of concrete is the impact of the glue. Since the properties of concrete are generally controlled by the glue, it is valuable to gotten to be commonplace with the structure of the glue. New glue is a suspension, not a cement-water arrangement. The more slender the glue, the more noteworthy the remove between the cement particles and hence the weaker the last structure of the glue. Other things being break even with, the quality of concrete shifts as an converse work of the water-cement proportion of the blends being prepared. Since water must be utilized as small as conceivable in mixture, and hence it is critical in sorting..

4.4.2 Type Of Mixes

4.4.2.1 Nominal Mixes

In the past the specifications for concrete prescribed the proportions of cement, fine and coarse aggregates. These mixes of fixed cement-aggregate ratio which ensures adequate strength are termed nominal mixes. These offer simplicity and under normal circumstances, have a margin of strength above that specified.

4.4.2.2 Standard Mixes

4.4.2.3 Factors Affecting The Mix Proportions

compressive strength

Workability

Durability

Maximum nominal size of aggregate

Type of fine aggregate

Quality of cement

4.5 Steps Involved in Mix Design

Determination of target strength

Selection of water cement ratio

Selection of water content

Calculation of cement content

Calculation of coarse aggregate content

Calculation of fine aggregate content

Calculation of water content

Calculation of the mix proportion

4.5.1 Strength

$f'_{ck} = f_{ck} + 1.65 s / f_{ck} + x$, whichever is higher where, f'_{ck} = target average compressive strength at 28 standard deviation x = factor based on grade of concrete as per table-1 $s = 5.0 \text{ N/mm}^2$ (IS-10262:2019, Table-2) $x = 6.5$

N/mm^2 (IS-10262:2019, Table-1) $f'_{ck} = 30 + 1.65 \times 5 = 38.25$

N/mm^2 $f'_{ck} = 30 + 6.5 = 36.5 \text{ N/mm}^2$

Then $f'_{ck} = 36.5 \text{ N/mm}^2$.

4.5.2 Water Cement Ratio

Exposure – severe

IS 456-2000, table – 3 and 5

Water cement ratio = 0.45

4.5.3 Water Content

IS-10262, Table-4

20mm aggregate – 186kg (for 50mm slump) for every 25mm-add 3% (IS-10262-Cl.5.3) for 125mm, $186 + 9\% \text{ of } 186 = 203 \text{ lit}$

Therefore, water content = 203 liters

4.5.4 Calculation Of Water Cement Ratio

Water cement ratio = water content / cement content
Cement content = water content / water cement ratio

$$= 203 / 0.45$$

$$= 452 \text{ kg/m}^3$$

For durability check with the minimum cement required

Minimum cement required for M30 = 320 kg/m^3

Therefore, cement content = 425 kg/m^3

4.5.5 Proportions Of Aggregates

I S-10262, Table-5, Cl.5.5.1 zone – 2 – 0.62 [w/c ratio –0.5] every 0.05 decrease , increase 0.01 [w/c ratio –0.45]

$$0.45 - 0.4 = -0.05$$

$$0.62 + 0.01 = 0.63$$

For concrete Cl.5.5.2(10% reduction)

$$0.63 \times 0.9 = 0.567 \text{ m}^3$$

For 1 m³ volume , Coarse aggregate = 0.567 m³

Volume of coarse aggregate = 0.567 m³

4.5.6 Mix Calculation

Volume of concrete = 1

Volume of cement = (mass / s.g) $\times$ (1/1000)

$$= 452 / (3.15 \times 1000) = 0.145 \text{ m}^3 \text{ Therefore,}$$

volume of cement = 0.145

Volume of Water (c) = (Mass/Sp.gravity) $\times$ (1/1000)

$$= 203 / (1 \times 1000)$$

Therefore, volume of water = 0.203 m³

Mix proportions = 1:1.7:2.3

Therefore , the mix proportion for casting of cubes and cylinders = 1:1.7:2.3

4.6 PREPARATION OF SPECIMEN

PROCEDURE

Creating a concrete block using the waste tyre

1. Gathering Tools and Materials : First, get all the things you'll need, like a mold for the block, cement, sand, water, and rubber tyre piecies
2. Mix the Ingredients: Mix the cement, sand, and water in the right proportions. Then, add the rubber tyre to this mixture.
3. Fill the Mold: Take the mixture and pour it into the block mould which is like a container in the shape of a block.
4. Setting : Leave the mould with the mixture to sit for a while. This allows it to harden.



FIG : 4.6 (a) : Casting Blocks



FIG : 4.6 (b) : Casted Blocks

4.6.1 Preparation Of Specimen By Replacing 10% Of Waste Tyre

In this we have added the 10 percent of the waste tyre in the concrete by replacing the fine aggregate.



FIG : 4.6.1: Block Of 10% Tyre Waste

4.6.2 Preparation Of Specimen By Replacing 20% Of Waste Tyre

In this we have added the 20 percent of the waste tyre in the concrete by replacing the fine aggregate.



FIG : 4.6.2: Block Of 20% Tyre Waste

4.6.3 Preparation Of Specimen By Replacing 30% Of Waste Tyre

In this we have added the 20 percent of the waste tyre in the concrete by replacing the fine aggregate.



FIG : 4.6.3 : Block Of 30% Tyre Waste

4.6.4 Preparation Of Cyclinders By Replacing Waste Tyre

Creating a concrete block using the waste tyre

Gathering Tools and Materials : First, get all the things you'll need, like a cylinder mould for the block, cement, sand, water, and rubber tyre piecies

Mix the Ingredients: Mix the cement, sand, and water in the right proportions. Then, add the rubber tyre to this mixture.

Fill the Mold: Take the mixture and pour it into the block mould which is.

Setting : Leave the mould with the mixture to sit for a while. This allows it to harden.

In this we have casted the cyclinders by replacing with the waste rubber tyre



FIG : 4.6.4 : Cyclinders Of 10,20,30% Tyre Waste

4.7 Testing Of Specimen

4.7.1 Compression Strength Of Specimen

Purpose

The Compression Test for a concrete block with rubber tyre is like checking how strong the block is when you apply the load. It helps us understand how much force it can take before it breaks.

Aparatus Required

The standard sand to be used in the test shall conform to IS: 650-1966, Vibration Machine, Poking Rod, Cube Mold of 70.6 mm size conforming to IS: 100801982, Trowel, Stopwatch, Graduated Glass Cylinders, etc.

Procedure

Take the concrete block that you want to test.

Place the block on a compression testing machine that can push on it with a lot of force.

The machine slowly applies pressure to the block.

keep increasing the pressure until the block can't handle it anymore, and it starts to crack or break.

The machine measures how much pressure was needed to make the block break.

This pressure is a way of telling us how strong the block is.

This test helps in finding out if the concrete block with rubber tyre is strong enough for to bear the load . If it can handle a lot of pressure without breaking

Note down the values of the reading after founding the cracks on the specimen

4.7.2 Calculation

compressive quality of concrete depends on numerous components such as water-cement proportion, cement quality, quality of concrete fabric, quality control amid the generation of concrete, etc. Compressive quality is the capacity of fabric or structure to carry the loads on its surface without any break or avoidance. The concrete 3d shapes were cured for 7 and 14 and 28 days, separately. For each of the hydration period, 3d shapes were tried, and the normal compressive quality recorded. The concrete 3d shapes were tried in compression testing machine and the result were reported.

The example is tried by compression test machine after 7 days, 14 days and 28 days curing. Stack ought to be connected continuously at the rate of 140kg/cm² per miniature till example falls flat. Stack at the disappointment partitioned by range of example gives the compressive quality. Compressive stacking was connected to the 3d shape examples for a standard measurements 150 mm X 150 mm X 150 mm and testing has 3 trials with comparative examples, cruel values are famous in the table.

$$FC = P/A$$

Where, FC= Compressive quality (N/mm²) P = Extreme stack (N) or Breaking Stack A = Stacked range (150 mm X 150 mm) = 22500 m

4.7.3 Tensile Strength Of Specimen

Purpose

Tensile testing measures the force required to bend a structure of plastic material and determines the resistance to flexing and stiffness of material. Flex modulus is indicative of how much the material can flex before permanent deformation.

Apparatus Required

The standard sand to be used in the test shall conform to IS: 650-1966, Vibration Machine, Poking Rod, Cube Mold of 70.6 mm size conforming to IS: 10080-1982, Balance, Gauging Trowel, Stopwatch, Graduated Glass Cylinders, etc.

Procedure

Take the concrete block that you want to test.

Place the block on a compression testing machine that can push on it with a lot of force.

The machine slowly applies pressure to the block.

keep increasing the pressure until the block can't handle it anymore, and it starts to crack or break.

The machine measures how much pressure was needed to make the block break. This pressure is a way of telling us how strong the block is. This test helps in finding

If the concrete block with rubber tyre is strong enough for to bear the load .

If it can handle a lot of pressure without breaking

Note down the values of the reading after founding the cracks on the specimen.

4.7.2.1 Formula

$$F = PL / (bd^2)$$

L = length of specimen

B = breadth of specimen

D = depth of the specimen



FIG : 4.7.3.1 : Cylinder Readings

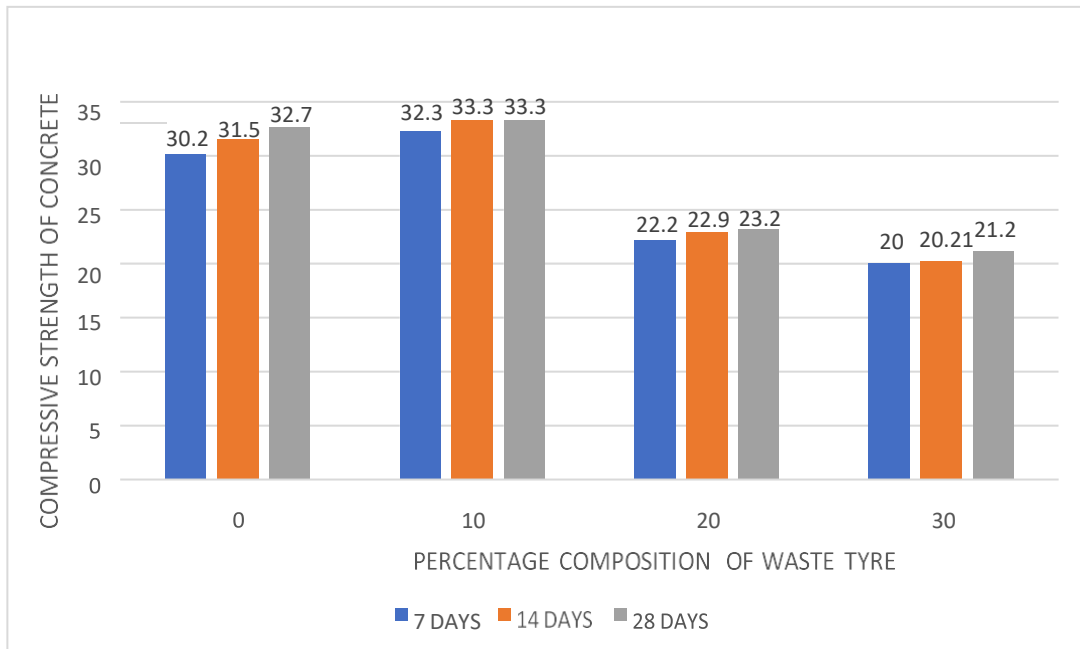
CHAPTER 5

RESULTS AND DISCUSSION

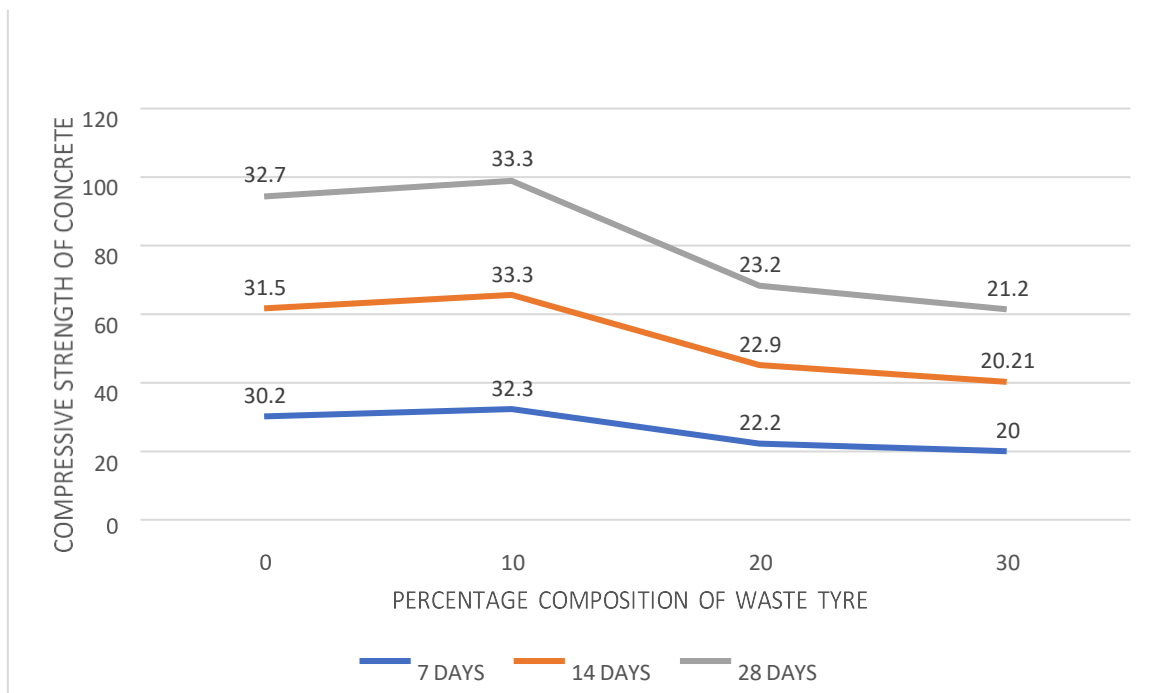
5.1 COMPRESSIVE STRENGTH OF CONCRETE CUBES

TABLE : 5.1 : Compressive Strength Of Concrete Cubes

SNO	SPECIMEN COMPOSITION	COMPRESSIVE STRENGTH AT 7DAYS (N/mm ²)	COMPRESSIVE STRENGTH AT 14DAYS (N/mm ²)	COMPRESSIVE STRENGTH AT 28DAYS (N/mm ²)
1	CLC 0	30.2	31.5	32.7
2	CLC 10	32.3	33.3	33.3
3	CLC 20	22.2	22.9	23.2
4	CLC 30	20	20.21	21.2



Graph : 5.1 : Compressive Strength Of Concrete Cubes



Graph : 5.1.1 : Graph of Compressive Strength Of Concrete Cube

5.2 Interpretation Of Compressive Strength Graphs And Table

Comparing waste rubber tyre concrete to normal concrete in terms of compressive strength and tensile strength at different curing periods (7, 14, and 28 days) involves several factors and can vary depending on the specific mix proportions, curing conditions, and the quality of materials used.

Compressive Strength :

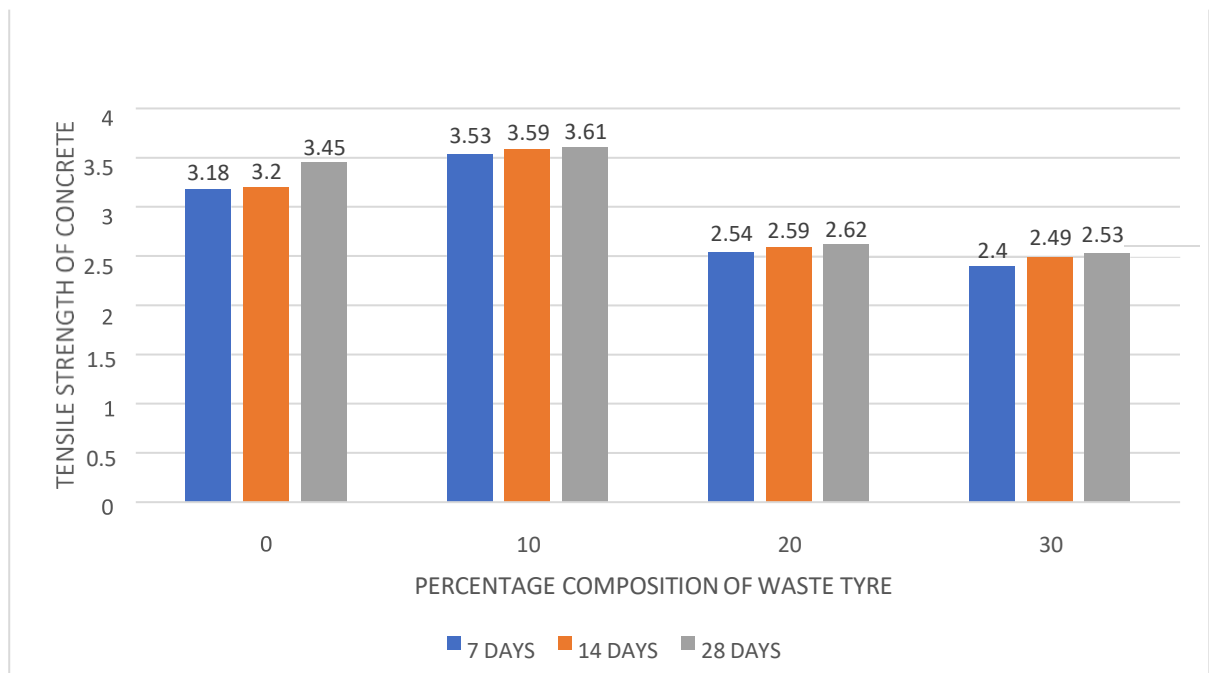
Waste rubber tyre concrete typically exhibits higher compressive strength compared to normal concrete for 10% of waste tyre replacement. And for the 20%, 30% replacement the strength is gradually decreased. This is because of rubber particles in the mix act as discontinuities in the concrete mix, reducing its overall strength. Compressive strength of concrete generally increases with curing time as the hydration process continues, leading to further development of the concrete mix.

While waste rubber tyre concrete may have higher initial compressive strength compared to normal concrete, the difference in strength may decrease with larger proportion of waste tyre .

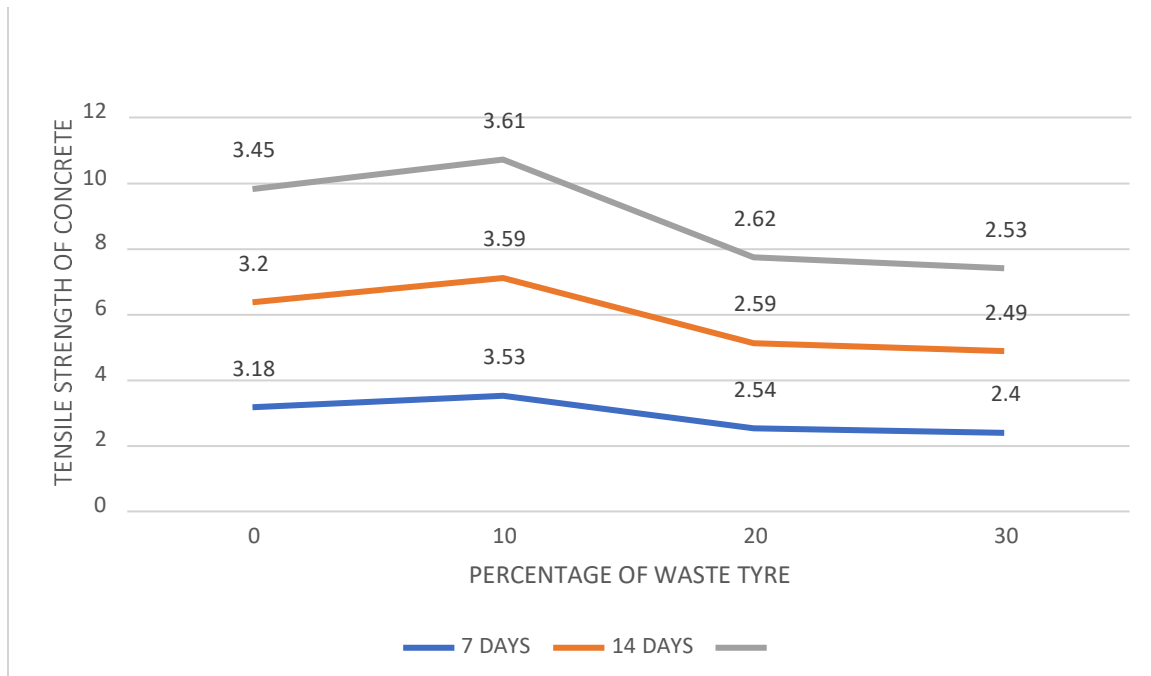
5.3 Tensile Strength Of Cylinder

TABLE : 5.3 : Tensile Strength Of Concrete Cylinder

SNO	SPECIMEN COMPOSITION	TENSILE STRENGTH AT 7DAYS (N/mm ²)	TENSILE STRENGTH AT 14DAYS (N/mm ²)	TENSILE STRENGTH AT 28DAYS (N/mm ²)
1	CLC 0	3.18	3.2	3.45
2	CLC 10	3.53	3.59	3.61
3	CLC 20	2.54	2.59	2.62
4	CLC 30	2.4	2.49	2.53



Graph : 5.3: Tensile Strength Of Concrete Cylinder



Graph : 5.3.1: Graph Of Tensil Strength

5.4 Interpretation Of Tensile Strength Graphs And Table

Concrete typically has low tensile strength compared to its compressive strength. When rubber particles are added to concrete, their impact on tensile strength depends on factors such as particle size, distribution, and the bonding between rubber and the cement mix.

As with compressive strength, the tensile strength of concrete generally decreases as the percentage of waste rubber tire increases during the hydration process. This decrease can be attributed to changes in cohesion within the concrete.

Waste rubber tire concrete may exhibit distinct tensile strength characteristics compared to normal concrete due to the presence of rubber particles. These particles may act as weak points in the concrete or potentially enhance properties such as flexibility.

CHAPTER 6

CONCLUSION AND REFERENCES

6.1 CONCLUSION

In this project we have casted the concrete cubes and cyclinders by using waste tyre as a partial replacement of fine aggregate. In this we replaced the waste tyre with 10%,20%,30% in fine aggregate section. Based on these results we get to know that compressive strength has been increased more for 10% of waste tyre replacement when compared to normal concrete. However, the strength has been decreased drastically by adding the 20% and 30% of waste tyre

Here's a breakdown of your observations:

Compressive Strength

- Increased with 10% replacement of waste tire compared to normal concrete.
- Decreased drastically with 20% and 30% replacement.

Tensile Strength

- Increased with 10% replacement of waste tire compared to normal concrete.
- Decreased drastically with 20% and 30% replacement..

Summary

From these results, it can be inferred that while a small percentage (10%) of waste tire replacement may offer some benefits in terms of compressive strength, and tensile strength higher percentages (20% and 30%) result in a significant deterioration of strength and workability. This suggests that there might be an optimal percentage of waste tire replacement that balances strength and other properties.

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