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Experimental Investigation on Reuse of TYRE Waste Dust as Partial Replacement of Fine Aggregate in Concrete

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Abstract:
Disposal of waste tyres is considered one of the major environmental challenges the whole country is facing as a result of waste rubber is not simply perishable even when treatment. One of the solutions suggested was the use of tyre waste dust as partial replacement of fine aggregate in cement-based materials. An experimental program was carried out to investigate the compressive strength of concrete with tyres waste dust as a fine aggregate in concrete. A number of cubes were casted of M20 grade for this study. The replacement of fine aggregates with tyre waste dust was partial in the concrete specimens according to the mix designs required in terms of weight and strength. The specimens were cured in water for required number of days before testing. Test results indicate clear substantial reduction in strength of the concrete when fine aggregate is replaced beyond 15% tyres waste dust compared with the compressive strength of concrete with no tyre waste dust.
Keywords: *Concrete; replacement of fine aggregate; tyre waste dust, ATMA*

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I. INTRODUCTION

1.1 General:

Energy can't be created, nor be destroyed. it can be only transferred from one state to other, it's the base of all intellectual and spiritual studies of mortal beings. Energy is always Subdued to cycles. Thus, nothing as analogous is a waste. so called waste of one process is in fact a raw material for some other process. Encyclopaedically the tyre product is estimated to be 1 billion per time. With the exponential growth in number of buses in India during recent times, the demand of tyres as original outfit and as relief has also increased. In India a Periodic Cumulativegrowth rate of 8 % is anticipated in buses, exchanges, motorcars/ jeep/ hacks.

1.2 Background:

Considering the average life of the tyres used in these vehicles as 10 years after rethreading twice, the total number of waste disposable tyres will be in the order of 112 million per year.

pApproximately, one tyre is discarded per person per year. These tyres are among the largest and most problematic type of waste, due to the large volume produced and their durability. Those same characteristics, which make waste tyres such a problem, also make them one of the most reused waste materials, as the rubber is very resilient and can be reused in other products.

Accumulations of discarded waste tyres have been a major concern because the waste rubber is not easily biodegradable even after a long-period landfill treatment. Thus, it gets accumulated and creates variety of problems. It creates unsightly appearance. If burnt under conventional uncontrolled fashion it creates harmful vapours. If dumped in land fill sites, in rainy seasons it accumulates water and herbivorous mosquito and fly breeding. In landfill sites methane is generated by other sources and bulk of tyre waste fetches fire. It creates hazards in land fill sites

Fig. 1 Material Used for Study

1.3 Objectives of Project work:

To evaluate the consequences of waste tyre rubber powder in concrete.

□ Application of used tyres in concrete construction may be a new technology and a well-developed combine style for material proportioning isn't offered. Through this study, it's meant to reach an appropriate mix proportion and % replacement using domestically offered materials by partial replacement of the natural coarse aggregates with recycled coarse rubber aggregates. Hence the likelihood of exploitation waste tyres as an alternative construction material are going to be investigated.

□ With the rise in urbanization, the number of cars and consequently range of used tyre goes to extend considerably in the close to future. Hence, the nonenvironmental nature of those wastes is going to be a possible threat. This study will show another means of employment tyres by exploitation them into concrete construction. Therefore, it's the aim of this study to introduce associate degree environmentally friendly technology, which might profit the society and the nation.

□ By conducting totally different laboratory tests on prepared specimens, it's meant to research the results.

II. Literature Review

2.1 General:

This Project aims at the study of Partial Replacement of fine aggregate with waste tyre to attain high strength and economical concrete Also, this research deals with the environmental waste reduction by using tyres aggregate waste as fine aggregate

2.2 Review of past research in this field:

Kshirsagar P.S, Pardeshi P.B :- (2017) [1]

It has been stated that the disposal of waste material is one of the most serious environmental concerns globally. There is no difference of opinion that the increasing piles of tires are creating environmental issues. For that matter there must be a way to dispose-off these tires. These tires have potential risks to environment and health. Compressive strength of rubberized concrete depended on two factors; grain size and shape of rubber aggregate and percentage of replacement.

Sree D, Gowthama Raja G, Kumar K K, Prabhakaran R:- (2016) [2]

It has been stated that the substitution of waste tyre to concrete is taken to 5% replacement of weight of coarse aggregate and the compressive strength is somewhat same to the concrete without substitution At the same time, 15% replacement of weight of coarse aggregate, the than 5% weight tends to reduce the bonding between cement and aggregate leading to a consequent decrease in strength. The use of rubber aggregates from waste tyres addresses many issues such as reduction of the environmental threats caused by waste tires, introduction of an alternative source to aggregates in concrete.

Radhakrishnan A, Das A, John E(2016) [3]

It has been stated that slump tests are used to find the workability of concrete and super plasticizer content in concrete. All mixes prepared show adequate workability (100 mm to 115 mm) by varying the super plasticizer content in small percentage. Mixes are made by replacing fine aggregate with 5%, 10%, and 15% crumb rubber are tested. The compressive strength, flexural strength and splitting tensile strength are studied for 3, 7 and 28 days. Compressive strength, Flexural strength and splitting tensile strength decreases with increase in the percentage of crumb rubber. Maximum values for compressive strength, flexural strength and splitting tensile strength of concrete after the replacement is obtained at 5% which is 14.81 N/mm2, and 1.13 N/mm2 (28-day strength) The loss of strength may be due to the lack of adhesive property of crumb rubber. Mixes are made by replacing fine aggregate with 10% crumb rubber and cement with 5%, 10% and 15% silica fume are tested. The compressive

strength is studied for 7 and 28 days. From the result it is observed that the strength of concrete increases as compared to the concrete in which 10% fine aggregate is replaced by the crumb rubber. There for the strength increases in crumb rubber silica fume combination rather than the crumb rubber cement combination. The compressive strength obtained for the concrete block is less than that of the concrete cubes for the same mix. Maximum strength is obtained at 5% cement replacement with silica fume and it is 11.55N/mm2 and that of the concrete block is 9.69N/mm2.

Shirule P.A, Husain M:- (2015) [4]
It has been stated that use of the waste rubber tyre in concrete is a techno-economically feasible and environmentally consistent method of waste disposal. The addition of rubber tyre under certain proportion of rubber tyre for a specific property. Further higher proportion of rubber tyre degrades the concrete properties. The optimum values for specific concrete properties are presented in the previous section. (Results and Discussions). The proportion of rubber tyre, higher than the optimum can also find application in uses like partition walls etc. Where low density is the major requirement. Thus, there is great potential to use rubber tyre waste in concrete.

More T.A, Jadhav P.D, Dumne S.M:- (2015) [5]
It has been stated that addition of recycled crumb rubber aggregates into normal concrete mix leads to decrease in workability for the various mix samples. Flexural strength of concrete decreases about 40% when 3% sand is replaced by crumb rubber aggregates and further decrease in strength with increase of percentage of crumb rubber aggregates.

Alam I, Mahmood U.A, Khattak K:- (2015) [6]
It has been stated that when rubber was used instead of aggregates in concrete it shows less compressive strength when compared with ordinary concrete. But it also shows some ductile behaviour before failure. Rubberized concrete shows reduction in density of concrete when compared with control concrete specimen. Concrete made of crumb rubber as fine aggregate shows much strength when compared with concrete made of chipped rubber as coarse aggregate.

Shah S.N, Jadhav P.D, Dumne S.M :- (2014) [7]
It has been stated that reduction of solid load carrying material in rubberized concrete is directly affects to reducing the strength of concrete. It can be concluded that as the amount of rubber content increases then there is reduction in flexural strength. The results of splitting tensile strength test shows that, there is a decrease in strength with increase in rubber aggregate content like reduction observed in the flexural strength tests. One of the reasons that split tensile strength of rubberized concrete is lower than the normal concrete is that the bond strength between cement paste and chipped rubber aggregates is poor.

Turer A et al:- (2009) [8]
It has been stated that this chapter illustrated various uses of scrap tires through recycling as a whole, in parts, or after chemically decomposition of materials inside scrap tires. Industrial development brought luxury of cars to our modern lives that produces scrap tires in an increasing rate. As in the cases of other natural resources in the world, we need to learn using less of natural resources while recycling readily available tires by finding ways not to pollute the environment. All cars in the world constantly generating about one scrap tire per person every year causes scrap tires generation in the order of billions on a global scale. The ideal solution would have been recycling each scrap tire to a brand new tire, since when someone throws away a used tire has to buy a new tire. Using tires on slope stability and land fill, inside asphalt and concrete is not adequately spread enough and in right quantities to use all manufactured tires. Structural uses of scrap tires remain to be at limited instances either enforced by government such as in the case of roads and pavements or experimentally sparse and rare mostly applied by good intentioned environmentalists or low-budgeted projects. Chemical decomposition using pyrolysis is a highly promising approach; however, could not quite reach its full potential yet. On the other hand, burning scrap tires at high temperature furnaces at cement producing kilns and thermos electric power plants as fuel is quite efficient and widely used. Provided that chimney filtering is defined by regulations and rules are properly enforced from toxic material emissions, scrap tire burning seems to be a good source of recycling and transforming otherwise useless and harmful discarded material into energy.

Liu H , Wang X, Jiao Y and Sha:- (2002) [9]
It has been stated that in this paper, crumb rubber concretes with different replacement forms and replacement levels were produced. The effect of the volume content of crumb rubber and pre-treatment methods on the performances of concrete was investigated. The following conclusions have been obtained. Adding crumb

rubber into concrete resulted in a significant decrease of the mechanical properties, but increased the durability. The effect caused by replacing the mixture with crumb rubber was higher than that caused by fine aggregate replacement.

2.3 Conclusion from literature survey is as follows:

After studying above papers, it is evident that tyre waste is generated on a large scale due to automobile industry. The addition of rubber tyre under certain proportion of rubber tyre for a specific property. Further higher proportion of rubber tyre degrades the concrete properties. The optimum values for specific concrete properties are presented in the previous section (Results and Discussions). The proportion of rubber tyre, higher than the optimum can also find application in uses like partition walls etc. where low density is the major requirement Hence, there is great potential to use rubber tyre waste in concrete. Higher content of waste tyre shredded rubber particle in concrete increases workability of concrete. The disposal of waste material is one of the most serious environmental concerns globally. There is no difference of opinion that the increasing piles of tres are creating environmental issues. For that matter there must be a way to dispose-off these tyres. These tyres have potential risk to environment and society.

III. Methodology

3.1 General:

The tyre is remoulded so that it can be used again. Fine rubber particles are obtained during the remoulding process by polishing the layer of tyre machine. These rubber waste tiny particles are as a substitute for locally available natural sand. He utilised scrap in a component of their research project. Rubber as a partial or total replacement is acceptable. aggregate in concrete and reported on the many types of aggregate Concrete performance levels are affected by a variety of factors. shrinkage, segregation, and other phenomena Flexural bending stresses, shear bending, and workability tensions, typical cement paste consistency, and the Determination of the start and ultimate setting timings.

Because of the rapid growth of the vehicle industry, the consumption of tyres is increasing every day, and there is no way to reuse them to reduce pollution. The It is difficult to decompose and dispose of scrap tyre rubber. damaging to the environment This project is a reflection of after recycling leftover tyre rubber into concrete examining their characteristics in that research project, Rubber aggregates have been substituted by natural fines. by different percentages of 5, 10, and 15% 15 comparisons with a replacement rate of 0% The practicality of Slump is used to determine the freshness of concrete. the cone test Workability was determined using the slump cone test. decreases as the percentage of chipped chips increases rubber. Increasing the amount of rubber aggregates as a partial replacement Compressive strength is reduced when concrete is replaced strength. As a result, these can be used in non-primary structural applications. The percentage of discarded waste tyres that were substituted into the concrete mix by weight (0, 10%, 15%, and 20%, respectively). There are two sorts of Waste tyres are used as a source of energy (chips and grounded shape) submitted themselves to 68 experiments and were put to the test characteristics mechanical, physical, and chemical 260 test to determine the most effective boosting (dry density, performing slump, compressive and flexural strength and hardness indices) at curing ages of (3, 7, 28, and 30) For both the conventional and enhanced concrete mixes, 56 days are required. The results of the tests reveal a decrease in compressive strength. the concrete's strength, on the other hand, an increase in its hardness combined with excellent approach qualities Reduce the cost of additive materials while also addressing a problem Waste tyre are a big concern.

- **Materials to be used in project work are discussed below:**

A) Natural Aggregate:

Gravels are made from natural basalt stone that has been crushed. They are hard, sturdy, and tough, with no veins, alkali, vegetable debris, or other impurities. substances that are harmful Aggregates are free of such contaminants. substance that reduces the strength or durability of the product natural aggregates, which are made up of Among the materials used are crushed stone, sand, and gravel. one of the most abundant natural resources and a crucial basic resource Construction, agriculture, and other industries need raw materials. Businesses that use complicated chemical and biological processes metallurgical processes are a type of metallurgical process. Natural aggregates are a key contributor to an indication of the nation's economic well-being, despite the low value of the basic items. Natural aggregates are used extensively. This species is found all over the United States and can be found in a variety of habitats. They do, however, exist in a range of geologic contexts. It isn't available everywhere. Some parts are lacking in terms of quality. aggregates, or existing aggregate deposits, can't be replaced. mined for a variety of reasons, but primarily for economic considerations. Pits or quarries must be positioned close to the water. centres of population the most important features of the following are examples of natural rock aggregates:

(a) Natural radionuclide activity (radioactivity)
(b) Grain size distribution and form
(c) Fortitude
(d) Frost resistance

e) Dust and clay particle content

Densities (actual, average, and bulk) Aggregate strength is defined as the maximum strength of the excavated rock when squeezed. In a cylinder (crushed). For this reason, this indicator is mimicked. Theresistance of rock material, for example, is influenced by transport vehicles travelling over a road surface or by in the construction of roads, there is a mechanical impact (road rollers lay down and compact the asphalt). Depending Aggregates are identified based on mass losses during testing as 200,300, 400,600, 800, 1,000, 1,200, or 1,400 are some examples. The greater the mark, the more powerful the aggregates are. Depending on the type of rock and the grade at which it was found, the content of bad rock grains after crushing.

Aggregate Sample:

B) Sand

Sand is a granular material made up of finely divided rock and mineral particles that occurs naturally. It is distinguished by its size, which is finer than gravel and grittier than silt Sand can also refer to a certain type of texture. a soil type or class that contains more than one type of soil; for example, a soil that contains more than one type of soil. By mass, more than 85% of the particles are sand-sized. The Sand composition varies based on location. There are a variety of rock types and situations, but the most prevalent are in inland continental environments and as an ingredient of sand silica (silicon dioxide or SiO2), which is most commonly found in the form of quartz. Calcium carbonate, such as aragonite, is the second most prevalent type of sand, and it is primarily man-made. by many forms of life throughout the last half billion years Coral and shellfish are examples of living things. It is, for example, the in regions where reefs exist, the primary form of sand is visible. For millions of years, they have dominated the ecology. as in the Caribbean Silt-free natural sand with veins alkali, vegetable matter, and other harmful substances.

Sand Sample:

Sand Sample:

- **Moulding sand properties and itsclassification:**

Moulding is the technique of using a pattern to create a hollow or mould out of sand. To make the moulds, molten metal is poured into them. The characteristics of moulding sand

1. permeability or porosity:

Sand has a feature that allows steam and water to pass through it. additional gases are allowed to travel through the sand mould The Sand porosity is determined by grain size, grain shape, wetness, and clay components are the most important factors. sand for moulding If the sand is excessively fine, the porosity will be reduced. Will be minimal.

2. Flexibility:

Sand has a characteristic that allows it to flow to all parts of the moulding box or flask. To make adecent mould, the sand must be sufficient…

Refractoriness:

It has the ability to withstand high temperatures of molten metal without breaking down or fusing.
Classification of Moulding sandaccording to their use:

1] Green sand:

Green sand is sand that is in its natural or moist state. Tempered sand is another name for it. It's a unique situation. a sand-clay combination containing 20 to 30 percent clay Water content varies between 6 and 10%. The fungus green sand mould is a product made from this sand. which is used for ferrous and nonferrous small-scale casting metals that aren't ferrous.

2] Dry Sand:

Dry sand refers to green sand moulds that have been baked or dried before being filled with molten metal moulds. The sand in this situation is known as dry sand. Dry sand moulds provide more strength and rigidity than wet sand moulds. as well as thermal stability These are the moulds that are utilised for massive and complex objects. A lot of casting.

3] Loam Sand:

Loam sand is made up of 50 percent sand grains and 50 percent clay. It's a type of loam. Large grey iron casting moulds.

4] Facing Sand:

Before pouring the molten metal, a sand is employed. On the surface of metal, this is known as facing sand. It's true Sand made from silica sand and clay that has been properly prepared.

5] Backing or Floor Sand:

Backing sand is a type of sand that is used to support the facing sand but is not used near to the pattern. The sand that has been used several times to be used for this purpose It's also referred to as "black." Because of its colour, it's called sand.

6] Sand System:

A type of sand used in the manufacture of mechanical sand. System sand is the name of the handlingsystem. This particular sand
has high refractoriness, permeability, and strength.7] Parting Sand:
Parting sand is a sand used on the faces of the pattern before it is moulded. The Parting sand is madeout of dried silica sand, sea sand, or a combination of the two. Sand that has been burned

8] Sand Core:

The cores are sand bodies that are utilised to form the correct shape empty sections or holes in the casting, as well as size the sand that was utilised to make this Core sand is the name given to the cores. It's also known as oil sand.
It's a mixture of silica sand with linseed oil or another oil. Using oil as a binder.

C) Cement:

Cement 53 Grade Ordinary Portland Cement is used for all mixes.

This grade was introduced in the country by BIS in the year 1987 and commercial production started from 1991. Advent of this grade in the country owes it to the improved technology adopted by modern cement plants. OPC 53 Grade cement is required to conform to BIS specification IS:12269-1987 with a designed strength for 28 daysbeing a minimum of 53 MPa or 530 kg/sqcm.

53 Grade OPC provides high strength and durability to structures because of its optimum particle size distribution and superior crystallized structure. Being a high strength cement, it provides numerous advantages wherever concrete for special high strength application is required, such as in the construction of skyscrapers, bridges, flyovers, chimneys, runways, concrete roads and other heavy load bearing structures. Not only is this grade of cement stronger than other grades / types, it is also more durable. Further, by substituting lower grade cement with OPC 53, overall savings can be obtained through reduced quantity of cement that would be required to be used. A savings of 8-10% can be achieved with the use of 53 Grade OPC in place of any other grade.

53 Grade cement attains higher early strength as compared to any other grade of cement but because of early gain, does not increase much after 28 days. In addition, due to faster hydration process, the cement releases heat of hydration at a much faster rate initially and therefore, the chances of micro cracking of concrete are much greater. Thus, during initial setting period of concrete, the higher heat of hydration can lead to damage arising out of micro cracks with in the concrete structure, which may not be visible on the surface. The situation can be worsened when construction supervisors / masons tend to increase the quantity of cement in concrete with a wrong notion that such increases are better for both strength and durability of concrete. Grade 53 should therefore be used only where such application is warranted for making the concrete of higher strength, where good supervision and quality assurance measures are in place and where proper precautions are taken to relieve the higher heat of hydration through a proper curing process.

- **Properties of cement 53 Grade Ordinary Portland:**

Compressive strength – 3 days– 27 MPa7 days– 37 MPa
28 days – 53 MPa Fineness - 225 m2/kg
Setting time – Initial setting time 30 MinutesFinal setting time 600 Minutes
Soundness – Autoclave 0.8 %

D) Waste tyre rubber Dust:

Waste tyre rubber dust Taken from Samrat Tyres regarding works, Chalisgaon.

- **Physical Characteristics of the Rubber waste tyre:**

The used samples contain sword but sword not contain lower than 2 of cloth fibre. Since it wasn't possible to determine the gradation wind of the rubber greasepaint as for normal summations, a microscope examination was done. Confines of rubber greasepaint vary from mm to0.8 mm with an average flyspeck size of 1 mm. The viscosity of the rubber greasepaint is determined using helium pycnometer and it's about0.83.

Rubber greasepaint is also characterized by an insignificant water immersion lower than 3. I resume some characteristics of waste tyre rubber dust.

- **Properties of Rubber Dust:**

Density-0.83

Size 80 μm-1.6 mmExtension (%) – 42

E) Water

It chemically reacts with cement (hydration) to produce the asked parcels of concrete. When water is mixing in concrete it reacts with cement originally, Impacts depression of concrete and is used to determine the strength of concrete completely depends on water cement rate in the concrete admixture. concrete admixture. Strength and continuity of concrete is controlled to a large extent by its w/ cm. Mixing water added in the mixer at the batch factory, ice, free humidity on summations, water included in any significant volume with chemical cocktails, and water added after batching during delivery or at the job Point. Water absorbed by summations is barred from mixing water. Besides its volume, the quality of mixing water used in concrete has important goods First is plasticity and alternate it setting time; it also has important goods on the strength and continuity of hardened concrete.

- **Sources of water for concrete mixing:**

Utmost concrete shops have available of drinkable water but they do not take the water without any qualification testing. In pastoral areas wells, aqueducts or other bodies of water are fluently available. All concrete directors will also induce process water by drawing mixers and factory factors, also appertained to as marshland water. Also, rush on the point of the concrete factory generates storm water that may be collected at the factory. Reuse on storm water and after it refers on concrete shops Product operations in ASTM C1602. Process water is also generated when returned concrete is washed out in concrete reclaimer systems. These systems collect process water with the cement and aggregate used as mixing water in concrete. Water will used for mixing and curing.

- **Mixing of Concrete**

The cell mould assembled duly without any correction. And a thin subcaste of canvas also shall be applied on all the faces of the mould. It's important that cell side faces must be resemblant. The concrete sample filled into the cell mould in 3 layers, each subcaste Roughly 5 cm deep. In placing each scoopful of concrete, and it removed with care without disturbing the concrete block slides. Each subcaste shall be compacted by temping rod or by the vibration. The strokes shall be piercing into the underpinning Subcaste and the nethermost subcaste shall be rodded throughout its depth. Where voids are left by the tamping rod also the coming procedure is to joggle with vibrator table.

Mixing of Concrete:

Tests on Fresh ConcreteSlump test-
the most extensively used test for assessing the workability of concrete of normal thickness (depression10 mm to 200 mm)

Flow Table test-
for concretes that are more freeFlowing (depression 180 mm)

Vee- Bee Test-
for concretes that aren't workable in the normal sense, the test uses integral vibration. Control and dimension of air content is fluently assessed using a pressure type air cadence. Fresh viscosity, compatibility and bleeding can all be measured.

From Quality Control and Mix Design assessment to Amalgamation testing, Sandberg are suitable tocarry out a comprehensive range of fresh concrete tests.
To measure workability of concrete by Slump cone test.

- **Casting of Test Specimen:**

Cube Casting:

IS- 456 has laid down the acceptance criteria of quality concrete. In all the cases, the 28- days compressive strength shall alone be the criterion for acceptance rejection of the concrete. 7 days compressive strength of concrete can be carried out in order to get a fairly hastily idea regarding the quality of concrete. Sample of concrete for test instance shall be taken at the mixer or in the case of ready mixed concrete from the transportation vehicle at the time of discharge. Similar samples shall be attained by constantly passing a scoop or bucket through the discharge sluice of the concrete. The samples therefore attained shall be mixed on a non-Spongy base with shovel until it's invariant in appearance.

V. Experiment Analysis

5.1 Test for property of material: Tests conduct on materials are discussed below.

5.2 Test for cement: Following tests were conducted on cement.

Field test of cement:

- **Field test of cement Observation:**

- When hand is inserted into a cement bag it felt cool.
- It was free from lumps.
- When a pinch of cement was thrown on surface of water in bucket it floats.

Result: Field test of cement has satisfied IS Code.

- **Fineness test:**

a) Take 100 gm of cement sample and sieve it through IS sieve no.9 (90microns).

b) Break down the air set lumps in sample with finger.

c) Continuously sieve the sample giving circular and radial motion for a period of 15 min.

d) Mechanical sieving may be used.

e) Take the weight of the residue on the sieve.

Observation:

a) Weight of cement sample = W1=100 gms
b) Weight of residue = 8gms
c) Percentage weight retained on sieve = (W2/W1) X100=8 %

Result: The fineness of cement sample is 8 %

Conclusion: The given sample is satisfied. It should not be more than 10%

5.3 Test for fine aggregate:

- **Specific gravity of fine aggregate by pycnometer method:**

PYCNOMETER:

a) Clean the pycnometer bottle and dry it. Find the empty mass (M1gm) of pycnometer, brass cap and washer up to accuracy 1 gm.

b) Take about 400 gm. of oven dry fine aggregate and put it in the pycnometer, find the mass (M2) of pycnometer with sample.

c) Fill the pycnometer to half of its height with distilled water and mix thoroughly with glass rod. Add more water stir it. Replace the screw at the top and fill the pycnometer and flush the hole in conical cap. Dry the pycnometer from outside and weight (M3).

d) Empty the pycnometer and clean it thoroughly. Fil it with distilled water up to the hole of conical cap and weight it (M4).

e) Find specific gravity by calculation.

5.5 Concrete mix design:

Concrete mix design is the process of finding the proportions of concrete mix in terms of ratios of cement, sand and coarse aggregates. For e.g., a concrete mix of proportions 1:2:4 means that cement, fine and coarse aggregate are in the ratio 1:2:4 or the mix contains one part of cement, two parts of fine aggregate and four parts of coarse aggregate. The concrete mix design proportions are either by volume or by mass.

- **Types of Concrete Mix Ratio – Mix Designs:**

a) Nominal Concrete Mix Ratios:

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. Nominal mixes offer simplicity and under normal circumstances, have a margin of strength above that specified. However, due to the variability of mix ingredients the nominal concrete for a given workability varies widely in strength. Nominal mix ratios for concrete are 1:2:4 for M15, 1:1.5:3 for M20 etc

a) Standard Mixes or Ratio:

The nominal mixes of fixed cement-aggregate ratio (by volume) vary widely in
in under or over-rich mixes. For this reason, the minimum compressive strength has been included in many specifications. These mixes are termed standard mixes.

IS 456-2000 has designated the concrete mixes into a number of grades as M10, M15, M20, M25, M30, M35 and M40. In this designation the letter M refers to the mix and the number to the specified 28day cube strength of mix in N/mm2.

The mixes of grades M10, M15, M20 and M25 correspond approximately to the mix proportions (1:3:6), (1:2:4), (1:1.5:3) and (1:1:2) respectively.

b) Designed Mix Ratio of Concrete:

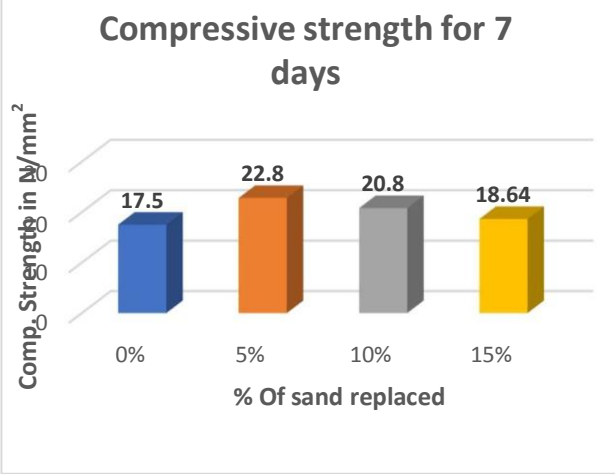
In these mixes the performance of the concrete is specified by the designer but the mix proportions are determined by the producer of concrete, except that the minimum cement content can be laid down. This is most rational approach to the selection of mix proportions with specific materials in mind possessing more or less unique characteristics.

The approach results in the production of concrete with the appropriate properties most economically. However, the designed mix does not serve as a guide since this does not guarantee the correct mix proportions for the prescribed performance. For the concrete with undemanding performance nominal or standard mixes (prescribed in the codes by quantities of dry ingredients per cubic meter and by slump) may be used only for very small jobs, when the 28-day strength of concrete does not exceed 30 N/mm2. No control testing is necessary reliance being placed on the masses of the ingredients. We have adopted, Design Mix Type.

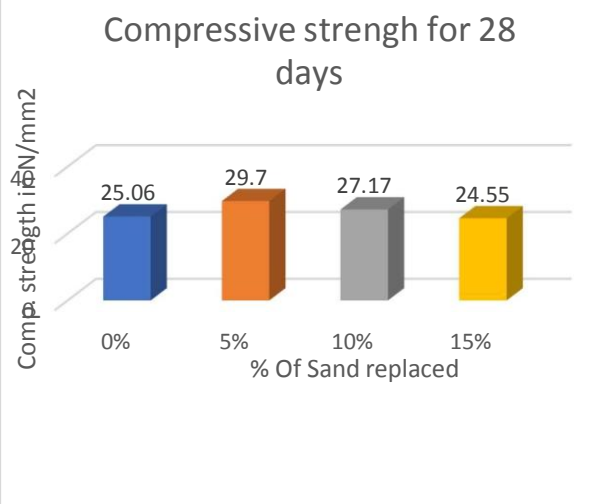
➢ **Implementation of mix design:**

Mix proportion:

Sr. No.	Grade of Concrete	Targetmean Strength N/mm2	W/cratio	Mix proportion
1	M25	25	0.4	1: 1: 2



Results for 7 days testing are shown below.



Test results for 28 days testing is show below

VI. Conclusion

The normal M25 has higher workability, compression strength, and tensile strength than the 5% replacementof tyre waste dust. Concrete.

- The cost of replacing 5% of tyre waste dust is negligible. It has less flexural strength than regular concrete, however as a result, it can be used to confirm the IS standard. utilised for building purposes.
- The test results for rubberized concrete demonstrate the delicate addition of rubber dust A total of more than 5% will result in a Compressive strength of concrete is reduced. compared to ordinary concrete This As the amount of reduction rose, rubber dust fine aggregate percentage Compressive strength losses are observed. The source of the power Lack of adhesion at the interface causes the decrease. fine aggregation of rubber dustborders soft rubber particles acts as voids in the environment. matrix of concrete.
- Rubberized concrete was shown to be capable of absorbing a considerable amount of plastic energy and to

be resistant to brittle failure during contraction. Alternatively, split pressure lading.

- The results of the tensile strength splitting test There is a reduction in strength, according to tests. total content after adding tyre waste dust the compressive strength has decreased. Tests of strength Nonetheless, there was a decrease. blistering tensile strength decreases as in comparison to the decrease in the strength in compression.
- Advanced tyre waste dust content Lightweight concrete is produced.
- The advanced plasticity of tyre waste dust flyspeck is advanced to medium.
- Because of the long-term success of in the field, these Composites are unknown. The usage of, particularly for pavement portions, comparable composites are suggested in where high concrete strength isn't required asessential (e.g., sidewalls).
- There is an implied significant request for concrete information. items in which tyre dust is used It is possible to make a summary that will use the disposal of discarded rubber tyres It is a major source of pollution on the ground.

- The reality of any chemical reactions between the whole tyre rubber and other rubberized concrete materials to make certain there are no unpleasant items These are similar to natural alkali-silica and alkali carbonate responses.

- It is necessary to investigate aggregates. This investigation was carried out by preparing size summations of single graded rubber 4.75 mm. The impact of various sizes should be considered. to be researched in the future Aside from that, the Other than products in various chance reserves Those discovered throughout this investigation must be preserved. delved.

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