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# Study on Comparison between Ordinary Concrete and Rubberized Concrete'

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**Abstract:** *The concrete is an important part of the construction industry. Tyre waste is a major threat to the environment and dumping in landfills can lead to various problems such as fire, breeding ground, land waste, etc. Therefore, if tyre waste can be used in the construction industry, it will help reduce pollution. This can help reduce construction costs. For M20 grades of concrete, rubber fiber piece is added in different percentages [0%, 5%, 7.5%, 10%,] of fine aggregates. Features like, Compressive Strength and compare with control mix of M20 concrete. In terms of compressive strength increases significantly with 10% substitution..*

**Keywords:** Rubberized Concrete, Sand Replacement (0 % ,5 % ,7.5 % ,10 %) Workability, Compressive Strength etc.

## I. INTRODUCTION

Hazardous waste is generated and accumulated in large quantities nowadays. Tyre rubber is one of the wastes which is continuously increasing all over the world. It is difficult for municipal authorities to store and dispose the waste tires generated from vehicles. In many countries municipal authorities have banned dumping of waste tires into the landfills due to its non-decaying nature as it causes serious environmental problems. Over last two decades it has been seen that there is an exponential rise in number of motor vehicles. According to the report of World Health Organization 53% of motorized vehicles are in middle-income countries and only 46% are in high income countries about 1.5 billion of waste tire rubber is generated globally and 40% of them in emerging markets such as China, India, South Africa, South Asia, South America and Europe. In India around 0.6 million tons of scrap tire is generated annually. Annually 285 million scrap tires are added to stockpiles, landfills or illegal dumps across the United States. The United States of America is been the largest producers of waste tyre globally, an estimate of about 290 million a year.

## II. METHODOLOGY

Collection of Raw Materials: The materials used in this project are Ordinary Portland cement (OPC), Coarse aggregate, Fine aggregate, Rubber (Tyre Rubber Waste) are easily available in market.

**Table 1: Material Required**

| Sr. No | Material Used |
|---|---|
| 1 | Cement |
| 2 | Course Aggregate |
| 3 | Fine Aggregate |
| 4 | Rubber |

**Compressive Strength:**

The compressive strength of concrete is an indicator of its strength once it has hardened. Testing should be carried out with care. The test specimens shall be made as soon as practicable after mixing, and in such a way as to produce full compaction of the concrete with neither segregation nor excessive laitance. In placing each scoopful of concrete, the scoop shall be moved around the top edge of the mould as the concrete slides from it, in order to ensure a symmetrical distribution of the concrete within the mould. After the top layer bas been compacted, the surface of the concrete shall

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be finished level with the top of the mould, using a trowel. Each specimen shall be compacted by vibration or hand compaction. When compacting by vibration, each layer shall be vibrated by means of an electric or pneumatic hammer or vibrator or by means of a suitable vibrating table until the specified condition is attained. The test specimens shall be stored in a place, free from vibration, in moist air of at least 90 percent relative humidity and at a temperature of 27° ± 2°C for 24 hours ± ½ hour from the time of addition of water to the dry ingredients. The test specimen is cubical in shape and measures 150mmx150mmx150mm. If the highest normal dimension of the aggregate is less than 20mm, 10mm cubes would be used instead. Compressive strength checks are conducted on specimens of proven age, ideally from different batches made for each age of processing

## III. MIX DESIGN FOR M20 GRADE OF CONCRETE

**A) Stipulations for proportioning**

a) Grade of designation : M20
b) Type of cement : OPC 53 grade
c) Maximum size of nominal size : 20mm
d) Exposure condition : Severe
e) Degree of site control : Good

**B) Test data for material**

a) Cement used : OPC-53
b) Specific gravity of cement : 3015
C) Specific gravity of
a) Fine aggregate : 2.65
b) Coarse aggregate : 2.67

## IV. TEST ON MATERIALS

**1.Test on Cement-**

**Fineness Test-**

Cement hydrates when cement is mixed with the water and a thin layer are formed around the particle. This thin layer grows bigger and makes cement particles to separate. Because of this, the cement hydration process slows down. On other hands, cement smaller particle react much quicker than the larger particle. A cement particle with diameter 1µm will react entirely in 1 day, whereas the particle with diameter 10µm takes about 1 month but, there is a side effect of having too much of smaller particles in cement results in quick setting, leaving no time for mixing, handling and placing, therefore to increase the setting time of cement, cement is must be manufactured in a different range of particle sizes.

**Acceptable range-** The fineness of cement should not exceed 10%.

**Consistency Test-**

The volume of water used to make the cement paste is referred to as the cement's regular consistency. This paste is used to assess the initial and final setting times of cement, as well as its soundness. The Vicat apparatus is used to determine the consistency of the cement paste.

**Initial Setting Time-**

The vicat apparatus used to determine the initial setting time of cement. Take 500g of cement and usual quality water content is used to make cement paste. After that, the paste was put in a vicat mould and left in place. The Vicat needle was put on the surface of the cement paste and then released. It was recorded how long it took to hit a depth of 33-35mm.

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**2 Test on Coarse Aggregate-**

**Flakiness Index Test-**

Particle shape and surface texture influence the properties of freshly mixed concrete more than the properties of hardened concrete. Rough-textured, angular, and elongated particles require more water to produce workable concrete than smooth, rounded compact aggregate. Consequently, the cement content must also be increased to maintain the water-cement ratio. Generally, flat and elongated particles are avoided or are limited to about 15 % by weight of the total aggregate.

**Acceptable range-** The value should not exceed 16%.

**Impact Test-**

Determine the relative measure of the resistance of aggregate to sudden shock or impact in which in some aggregate differs from its resistance to a slowly applies compressive load.

**Acceptable range-** The value of aggregate impact test should not be more than 45% by weight of aggregates, used for concrete other than wearing surface

**Water Absorption Test-**

Water absorption gives an idea on the internal structure of aggregate. Aggregates having more absorption are more porous in nature and are generally considered unsuitable, unless found to be acceptable based on strength, impact and hardness tests.

**Specific Gravity by Picnometer Method-**

Specific Gravity of an aggregate and rubber is considered as a measure of the quantity of strength of the material Stones having less specific gravity values generally are weaker than those having higher values. This test helps in identifying the stone specimen

$$\text{Specific Gravity } G = \frac{W2 - W1}{[W2-W1]-[W3-W4]}$$

**3 Test on Fine Aggregate**

**Specific Gravity by Picnometer Method-**

Specific Gravity of an aggregate and rubber is considered as a measure of the quantity of strength of the material Stones having less specific gravity values generally are weaker than those having higher values. This test helps in identifying the stone specimen.

$$\text{Specific Gravity } G = \frac{W2 - W1}{[W2-W1]-[W3-W4]}$$

**Bulking of Sand-**

The main purpose of adding sand in concrete is to minimize the segregation of concrete and to fill out the pores between the cement and coarse aggregate.

**4. Test on Rubber**

**Specific Gravity by Picnometer Method-**

Specific Gravity of an aggregate and rubber is considered as a measure of the quantity of strength of the material Stones having less specific gravity values generally are weaker than those having higher values. This test helps in identifying the stone specimen.

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$$\text{Specific Gravity } G = \frac{W2 - W1}{[W2-W1]-[W3-W4]} .$$

**5. Test on Fresh Concrete-**

**Slump Cone Test**

The slump cone scale, which employs a 30cm slump cone, is used to assess the intensity of fresh concrete. The slump cone was refilled with new concrete and
tamped 15 times. When the concrete has been cored, the slump cone is removed vertically and the concrete is able to remain alone. The concrete would then settle and the height of the subsided concrete will be measured. This experiment was repeated many times with various water cement ratio.

**Compaction Factor Test**

The compaction element is often used to evaluate the workability of fresh concrete. A compaction factor unit is used in this study. To begin, new concrete with a lower water cement ratio was mixed. The compaction factor machine is made up of an upper hopper, a lower hopper, and a cylinder. At the lower part of the hoppers, trap doors are provided. The empty weight of the cylinder was determined. After that, the upper hopper is packed with concrete and compacted. The trap door in the upper hopper was then opened, allowing concrete to spill into the lower hopper. After that, the lower trap door was opened, allowing the concrete to fall on the cylinder. The surface of the cylinder was rubbed clean, and the weight was taken. Following that, concrete as poured and compacted into the upper hopper, and the process was repeated.

**V. RESULT**

| Sr.no | % of Rubber | Compressive strength After 7 days | Compressive strength After 14 days | Compressive strength After 28 days |
|---|---|---|---|---|
| 1 | 0% | 13.75 Mpa | 15.70 Mpa | 20.4 Mpa |
| 2 | 5% | 14.2 Mpa | 16.35 Mpa | 22.45 Mpa |
| 3 | 7.5% | 15.75 Mpa | 18.80 Mpa | 24.27 Mpa |
| 4 | 10% | 14.35 Mpa | 16.72 Mpa | 21.90 Mpa |

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## VI. CONCLUSION

- The workability of the concrete decreases with the addition of rubber fibres.
- The value of compressive strength of rubberised concrete was slightly higher than ordinary concrete.
- From Simulation it is seen that , the total deformation increase with increasing percentage of rubber fiber under the applied loading

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