The Partial Replacement of Cement by Waste Marble Dust and Fine Aggregate by Tyre Rubber Waste

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Abstract: ***Leaving the waste materials to nature straightforwardly can cause ecological issue. Henceforth the reuse of waste material has been underscored. Marble is one of the vital materials utilized in the development business. Marble powder is delivered from handling plants amid the sawing and cleaning of marble squares and around 20 - 25% of the prepared marble is transform into powder structure. Overall creation of tyre increments because of increment of vehicle industry, it is hard to arrange the waste tyre as the accessibility and limit of spaces of landfill diminishes. In this examination, execution of waste materials, waste marble dust and tyre rubber waste as a halfway substitution of cement and fine aggregates for M30 grade of concrete is learned at various rates and its impact on solid properties like Compressive Strength , Flexural Strength and Split Tensile Strength is examined. The waste marble dust was utilized in the level of (20%, 25%, and 30%) and tyre rubber waste was utilized in the level of (5%, 10%, and 15%). Results showed that substitution of waste marble dust to the cement and tyre rubber waste to the fine aggregates in concrete at proportions 20% and 5% there was no impact on the properties of concrete however for different proportions changes were watched.***

Index Terms: Waste Marble Dust, Crumb Rubber, Mechanical Properties, Fine Aggregates, Waste tyre.

I. INTRODUCTION

Reusing waste as helpful material is a vital ecological administration instrument for accomplishing maintainable improvement. Then again, reusing waste without legitimately based logical innovative work can result in ecological issues more noteworthy than the waste itself. In India, total 6million tons of marble waste is being released by the marble ventures. In Tamil Nadu state, Salem is a region that focuses a huge amount of marble process ventures, which are dependable by the discarding many huge amounts of waste in nature every year. . The marble dust is normally has a noteworthy natural concern. In dry season, the marble powder or residue dangles noticeable all around, flies and stores on vegetation and harvest. All these fundamentally influence the earth and nearby biological systems. The marble dust arranged in the stream bed and around the generation offices cause decrease in porosity and penetrability of the topsoil and results in water logging.

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Substantial measure of waste tyre rubber on the planet consistently, and the simple procedure to disintegrate the tyre rubber waste is by consuming but since of consuming of tyre rubber waste, a lot of smoke and contamination is produced. Another technique to arrange waste tyre rubber waste is via landfill, however at this point day's accessibility and limit of land fill places diminishes, the fundamental target of this examination is to arrange the tyre rubber waste, utilized in solid blend as a profitable substitute for total at various rates to acquire great building properties of concrete.

II. EXPERIMENTAL STUDY

2.1 Material used

1. Cement- OPC 43 grade concrete is utilized for the trial reason and is examined according to Indian Specifications: 12269-1987.

2. Fine Aggregate- The aggregates which passes through sieve number 4 (4.75mm) is known as fine aggregate.

- Specific gravity of fine aggregates is 2.6
- Water absorption for fine aggregate is 1%
- Fineness modulus for fine aggregates is 2.6%

3. Coarse Aggregates- The coarse aggregates are those which retain on sieve greater than 4.75mm sieve.

- Specific gravity for coarse aggregates is 2.67
- Average abrasion value of aggregate sample is 15.82%
- Average crushing value of aggregate sample is 19.81%

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4. Marble Powder- It was collected from the local vendor in Chandigarh and hence matching the properties of cement.

5. Tyre Rubber Waste- Crumb rubber having size between0.075mm to 4.75mm is used in the concrete being made for the experiment.

2.2 Mix design

The blend configuration was set up with consistent amounts of cement, aggregate and water. Controlled blend configuration was set up according to IS: 10262-2009 to have 28days compressive strength of 28.66 N/mm2.

After that the cement and fine aggregates were supplanted by Waste Marble Dust and tyre rubber waste in the level of (20%, 25%, 30%) and (5%, 10%, 15%).

Material	Mix proportion 1	Mix proportion 2	Mix proportion 3
Marble Powder	20%	25%	30%
Crumb Rubber	5%	10%	15%

III. TEST RESULTS

3.1 Compressive Strength

Compressive Strength is characterized as the limit of a material or structure to oppose pressure when a load is connected on it, so as to push it together. At the end of the day, we can say compressive strength of a material can likewise be characterized as the base measure of load required at which that specific material separates.

In this examination we have tested the entire cubes that we had tested with various proportions of waste marble dust and tire rubber waste for their compressive qualities. Cubes of size 150 mm were gave a role according to the Indian Standard determination IS: 516-1959. The specimens were de-molded following 24 hours and after that kept in water for curing. The compressive quality test was done following 7 and 28 days.

Property	Percentage of Marble Dust (%)	Percentage of Tyre rubber (%)	7days	28days
Compressive Strength (n/mm2)	20	5	14	27.33
	20	10	15.18	27.1
	20	15	9.91	18.8
	25	5	11.9	23.7
	25	10	13.32	24.7
	25	15	7.66	16.69
	30	5	13.87	25.11
	30	10	12.72	22.4
	30	15	11.32	21.8

3.2 Flexural Strength

Flexural Strength is characterized as the tendency of the material to restrict its deformation when a particular measure of load is connected on it. It is otherwise called as bend strength and fracture strength. The beam of size 10 × 10 × 50 cm that we have casted were compacted in vibrators and afterward after de-molding and curing them the tests were led on them following 7 and 28 days separately to check there flexural strength.

Property	Percentage of Marble Dust (%)	Percentage of Tyre rubber (%)	7days	28days
Flexural Strength (n/mm2)	20	5	3.94	5.99
	20	10	2.176	3.9
	20	15	2.185	3.1
	25	5	2.190	3.3
	25	10	2.194	3.2
	25	15	2.107	3.2
	30	5	2.113	3.4
	30	10	2.161	3.1
	30	15	2.119	2.8

3.3 Split Tensile Strength

Split Tensile Strength is characterized as the tendency of a material to restrict an applied force attempting to pull it apart. The tensile strength of a material can be characterized as the base measure of force that is required to part that particular material apart. The cylinders of size 150 mm by diameter across and 300mm by length that we have threw were compacted in vibrators and after that de-molding and curing them, the tests were directed on them following 7 and 28 days individually to check there split tensile strength.

Property	Percentage of Marble Dust (%)	Percentage of Tyre rubber (%)	7days	28days
Split Tensile Strength (n/mm2)	20	5	1.94	2.99
	20	10	0.176	1.9
	20	15	0.185	2.1
	25	5	0.190	2.3
	25	10	0.194	2.2
	25	15	0.107	1.2
	30	5	0.113	1.3
	30	10	0.161	1.7
	30	15	0.119	1.4

IV. CONCLUSIONS

According to the experimental investigation, the utilization of marble dust and tyre rubber as the partial replacement of cement and

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fine aggregates has been used in the different proportions (20%, 25%, 30%) and (5%, 10%, 15%). Based on the results, following conclusions are drawn:

1. For compressive strength, the replacement can be made upto 20% and 5% for marble dust and tyre rubber waste. Further increment in the percentage will decrease the compressive strength of concrete.
2. The lower percentages of marble dust and tyre rubber waste i.e. crumb rubber is to be used to meet the required properties of concrete i.e. Split tensile strength & Flexural strength.
3. The 20%, 5% of both the materials can well be used for non load bearing walls.
4. The lower percentages of both the waste materials can be used as substitute in the concrete.

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