Use of Plastic Bottles And Demolished Materials In Concrete

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Abstract- *Concrete is a widely used material in the world. More than ten billion tons of concrete are consumed annually. Conventional concrete is a versatile material and it is a mixture of cement, sand, aggregate and water. Aggregates occupy 65 to 80% of the total volume of concrete and affect the fresh and hardened properties of concrete. Plastic bottles used for storing and selling drinking water are taken into consideration. Demolished concrete material obtained from destructing slab, column and beam are used. The reason for considering this study is due to increasing plastic pollution and inappropriate disposal of demolished material. Recycling of plastic bottle is a costly project. Also demolished materials has very less tendency to be recycled. These product when dumped into landfills causes' soil pollution. It decreased the quality of soil and its nutrients. Hence dumping of plastic bottle or demolished material is not a good solution. The main purpose of this study is to explore the possibility of using plastic bottles and construction demolished material in concrete.*

Keywords- Concrete, aggregate, compression test, recycle, demolished material.

I. INTRODUCTION

Due to rapid industrialization and urbanization, construction industry is increasing. There is rapid development of cities as well as villages. Increase in development leads to increase in pollution. In last 15 years, plastic pollution is increasing due to inability in disposing plastic wastes. These plastic wastes are hazardous to the environment. Also new development leads to demolition of the old structures. The leftover material is difficult to be disposed in the environment. Also increase in concrete quantity gives rise to extinction of its raw materials. Hence to overcome all the problems this research has been carried out Municipal solid waste management continues to remain one of the most neglected areas of urban development and this has called for sustainable means of management. It is characterized by a number of waste types and of these are plastic solid wastes (PSW).

Usage of plastic water bottles are increasing rapidly in and this is facing the challenge of overflowing of landfills and impacts of disposal of plastic water bottles. Beverage packaging using plastic bottles are commonplace nowadays. A lot of plastic bottle waste will increase the burden for the government in recycling plastic waste. The advantage of Plastic (PET) is strong but lightweight. It is thermoplastic and not rusty, which can be colored. It will become soft by heating and melts at 110° C. Characteristics of PET are: high strength, rigid, stiff, chemical and heat resistant. It also has good electrical properties. PET has low water vapor absorption, so does the absorption of water Recycling of plastic is costly and hence not a sustainable solution to the increasing crises. Hence instead of recycling plastic, reusing them is a better option. Andreas Forses originated the idea of using plastic bottles in concrete in Eco-Tec 2001. PET bottles were used along with mortars between then in wall construction.

Recycling of crushed concrete from old demolished structures as coarse aggregate in new construction can contribute towards more sustainable design, engineering, and construction in our infrastructure needs. Recent research has shown that RCA can be a suitable material for use in structural members undergoing long-term service loading as well as ultimate loading conditions. Although RCA has a significant effect on the concrete stiffness (Young's modulus), the effect on the compression strength is relatively small. Demolished waste can be obtained from destruction old structure, bridges, and airports, concrete roadbeds etc. As natural aggregate are depleting, use of demolished material as aggregate is a better option. Recycling demolished waste helps to protect natural resources. It also helps to reduce environment pollution.

II. RESEARCH OBJECTIVE

1) To determine the influence of recycled concrete aggregates and plastic bottle used in new mixes of concrete blocks on the compressive strength of these blocks.
2) To reduce plastic pollution.
3) To reduce construction waste.
4) To reduce use of raw material in concrete.

5) Compare of compressive strength of concrete with plastic bottles and demolished material and concrete without plastic bottles and demolished material.

III. SCOPE OF STUDY

The management and recycling of plastic bottle waste is rapidly growing as it is a valuable resource of current standard of living and it is very hazardous substances and with low recycling rate. Every year more than 500 billion plastic are used. Hundreds of thousands of sea turtles, whales and other marine mammals die every year from eating discarded plastic for mistaken food. On land many animals suffer from similar fate to marine life. Collection, hauling & disposal of plastic waste creates an additional environmental impact. In a landfill or in Hundreds of thousands of sea turtles, whales and other marine mammals die every year from eating discarded plastic for mistaken food. On land many animals suffer from similar fate to marine life.Collection, hauling & disposal of plastic waste creates an additional environmental impact. In a landfill or in environment, plastic take up to 1000 year to degrade. The utilization of plastic bottle waste materials is a partial solution to environmental & ecological problems. As the use of plastic bottle waste will reduces the aggregate cost and provides a good strength for the structures and roads. It will reduces the landfill cost and it is energy saving.

IV. MATERIALS

The research is expected to be done in several stages determined by the achievement of the predefined objectives.

1) Casting of M25 concrete & M25 concrete with addition of plastic bottles and demolished material in it.
2) Testing of M25 concrete & M25 concrete with addition of plastic bottles and demolished material in it.
3) Comparison of compressive strength of both concrete.

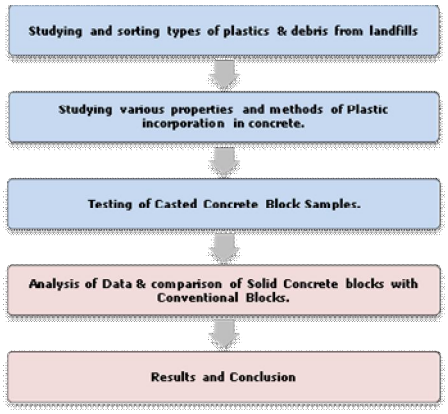

Fig. no. 1

(a) Cement

Table no 1. Properties of Cement

Physical Properties	Result	Requirement as per IS 8112-2013
Soundness	1.0	10 Max
Initial Setting Time	110	Min 30 min
Final Setting Time	280	Max 600 min
Compressive Strength for 3 days	29.45	23 min
Compressive Strength for 7 days	37.65	33 min
Compressive Strength for 28 days	51.55	43 min
Sp. gravity	3.15	3 – 3.5
Fineness	276	225 m^2/kg min

(b) Fine Aggregate

Table 2: Properties of Natural Sand

Physical Properties	Test Results
Specific gravity	2.73
Water Absorption	2.42 %
Moisture content	1.83 %

(c) Crushed Sand

Table 3: Properties of Crushed Sand

Physical Properties	Test Results
Specific gravity	2.78
Water Absorption	3.78 %
Moisture content	0.60 %

(d) Coarse Aggregate

Table 4: Properties of 10 mm coarse aggregate

Physical Properties	Test Results
Specific gravity	2.81
Water Absorption	1.22%
Moisture content	0.20%

Table 5: Properties of 20 mm coarse aggregate

Physical Properties	Test Results
Specific gravity	2.88
Water Absorption	1.11 %
Moisture content	0.20%

(e) Demolished Materials

Table 6: Properties of Demolished Material as Aggregate

Nominal Max. Size (mm)	20
Fineness modulus	6.79
specific gravity	2.48
Absorption (wt. (%))	2.03
Moisture content (wt. (%))	1.57

V. METHODOLOGY & PROCEDURE

- **Methodology**

Plastic bottles used by companies for storing and selling drinking water are used. Its diameter ranges from 65mm to 70 mm. height of bottle taken into consideration ranges from40 mm to 80 mm.

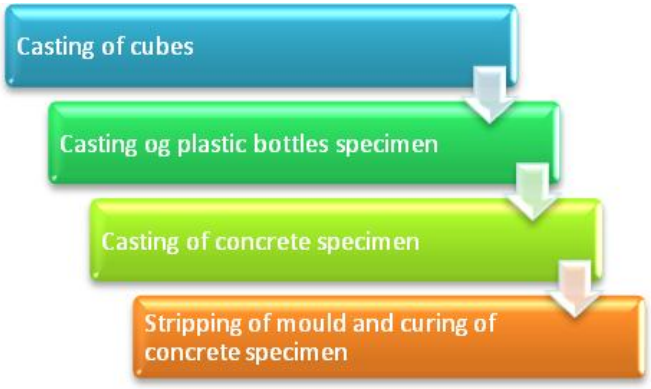

Fig. 2 Methodology

- **Procedure**

1. Specimens stored in water shall be tested immediately on removal from the water and while they are still in the wet condition. Surface water and grit shall be wiped off the specimens and any projecting fins removed.
2. Specimens when received dry shall be kept in water for 23 hours before they taken for testing.
3. The dimensions of the specimens to the nearest 0.2mm and their weight shall be noted before testing.
4. Placing the specimen in the testing
5. machine as shown in figure 5.4.The bearing surfaces of the testing machine shall be wiped clean and any loose sand or other material removed from the surface of the specimen which is to be in contact with the compression platens. In the case of cubes, the specimen shall be placed in the machine in such a manner that the load shall be applied to opposite sides of the cubes as cast, that is, not to the top and bottom.

Fig. 3 Compressive strength test setup

Fig. 4 Specimen of bottle

Fig. 5 Formation of specimen with demolished materials and placing in cube.

Fig, 6 Compressive test on sample material

VI. RESULT

Compressive strength of M25 concrete with plastic bottle and demolished material are tested under CTM of 1400 kn/m3. Also Water absorption test is being carried out on M25 concrete. Comparison of both M25 concrete is being carried out.

1) Compressive strength

Table 7: Compressive Strength of M25 Concrete with Plastic Bottles and Demolished Material For 80mm length of bottle.

Sr. no.	Description	Specimen			Mean
		1	2	3	
1	7 Days	20.00	18.22	19.55	19.25
2	14 Days	21.34	20.85	21.3	21.16
3	28 Days	25.33	26.22	27.22	26.22

Table 8: Compressive Strength of M25 Concrete with Plastic Bottles and Demolished Material For 60mm length of bottle

Sr. no.	Description	Specimen			Mean
		1	2	3	
1	7 Days	20.18	20.44	21.04	20.55
2	14 Days	21.89	22.84	22.37	22.37
3	28 Days	25.9	27.10	26.25	26.61

Table 9: Compressive Strength of M25 Concrete with Plastic Bottles and Demolished MaterialFor 40mm length of bottle

Sr. no.	Description	Specimen			Mean
		1	2	3	
1	7 Days	20.18	20.44	21.04	20.55
2	14 Days	21.89	22.84	22.37	22.37
3	28 Days	25.9	27.10	26.25	26.61

Table 10: Compressive Strength of M25 Concrete with Plastic Bottles and Demolished Material

Sr. no.	Description	Specimen			Mean
		1	2	3	
1	7 Days	22.22	20.44	23.14	21.92
2	14 Days	25.33	24.44	24.00	24.59
3	28 Days	28.44	27.11	27.55	27.7

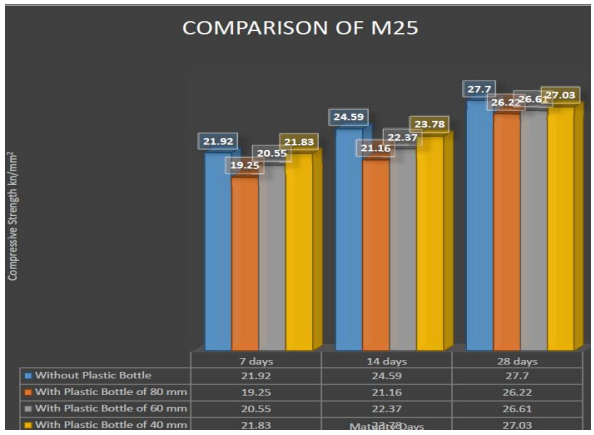

Fig. 7 Chart comparison of strength of M25 samples

2) Water absorption percentage

Table 11: average % water absorption after 90 days for m25 with specimen and m25 without specimen.

Concrete Specimen	Sample	Dry wt. in grams(Wl)	Wer wt. in grams(Wl)	% Water Absorption
M25	A1	8861	8914	0.59
M25	A2	8894	8945	0.57
M25	A3	8820	8865	0.51
M25 without specimen	B1	8995	9052	0.63
M25 without specimen	B2	9020	9082	0.69
M25 without specimen	B3	9017	9074	0.64

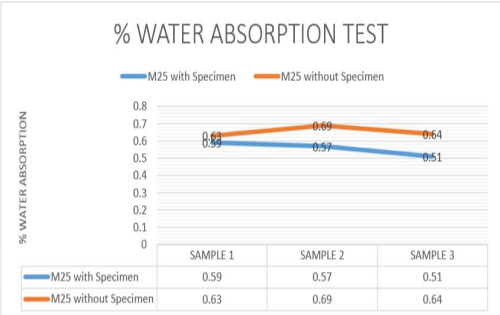

Fig. 8 Water absorption test

VII. CONCLUSION

- When plastic bottle filled with demolished material is casted in M25 concrete, there is reduction of 5-10% of compressive strength of the concrete as compared to M25 concrete without plastic bottle filled with demolished material.

- In M25 concrete, 35% of concrete is saved by replacing it with plastic bottles and demolished material.
- The average percentage of water absorption for M25 concrete with specimen is 0.56 while the average percentage of water absorption for M25 concrete without specimen is 0.65
- Placing of plastic bottles and demolished material helps to reduce plastic pollution as well as construction pollution.
- The percentage of water absorption for M25 concrete with specimen is less than the percentage of water absorption for M25 without specimen.

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