

# USE OF PLASTIC BOTTLES AND DEMOLISHED MATERIAL IN CONCRETE

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## ABSTRACT

*This work aimed to justify use of plastic bottles and demolished material in concrete. It also aims to investigate the strength of concrete when plastic bottles and demolished material is used. Due to ever increasing plastic pollution and construction waste pollution, it has become important to find a way for reducing such waste as it is hazardous to the environment. 12 cubes of M50 were casted in which plastic bottles filled with mortar made of using demolished material were inserted. Later on its compressive strength is tested and compared with M25. Use of plastic bottles and demolished material will reduce its aggregate cost. Hence it also proves to be cost effective.*

**KEYWORD:** *M50 Concrete Cube, Plastic bottles, Demolished Material, Compressive Strength*

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## 1.0 INTRODUCTION

Management of solid waste is a very serious challenge faced all over the world. Industrialization is increasing rapidly. Hence there is growth in construction industry. Standard of living is also enhancing. As there are some positive, there are also some negative effect of this growth. Billions are spend on construction due to accelerated urbanization. Construction development leads to demolition of old structure to establish new structure. Demolished material was used to be dumped in land. But now due to scarcity of land dumping of construction waste is becoming problem. This waste cannot be decomposed. Hence construction waste is increasing day by day.

Similarly due to increasing standard of living, people uses more plastic and plastic related material. It is difficult to dump plastic materials. Plastic pollution is increasing very fast in deserts and oceans. Also recycling of plastic material is very costly. Disposable plastic is the greatest source of plastic pollution. Plastic material cannot be decomposed. Also consuming plastic materials by animals is hazardous to their life. So in order to find a way for dumping of plastic waste and construction waste this project was carried out. Increasing construction industry leads to increase in use of raw material required for concrete. Natural sand being one of the raw material in concrete in getting extinct. Hence in order to saw raw material it should be replaced or reduced. Excessive use of natural resources has become an environmental concern.

Demolished material can be used in place of coarse aggregate up-to some extent. Plastic can be placed in concrete as it remains unaffected. Various studies are being carried out to reduce the use of natural resources as well as to take advantage of the available resources like demolished material. Use of demolished material and plastic bottle reduces the use of raw material. Recycling of plastic is not a sustainable solution to the crises of plastic pollution. Instead of recycling, reuse is more economical and beneficial. Andreas Froses originated the idea of using plastic bottles in walls along with mortar. Plastic bottles are installed horizontally with mortar between them. Use of such material reduces the cost of the project and increases the profit margin.

## 2.0 METHODOLOGY

## 2.1 MATERIAL

### *Cement*

Vasava dutta cement is used in this experiment. 43 grade of cement is used. Testing on cements are carried out confirming to IS 8112- 2013. Detailing of test carried out on cement are given as follows.

**Table 1: Properties of Cement**

Physical Properties	Result	Requirement as per IS 8112- 2013
Fineness	276	225 m <sup>2</sup> /kg Min
Compressive strength for 3 days	29.45	23 N/mm <sup>2</sup> Min
Compressive strength for 7 days	37.65	33 N/mm <sup>2</sup> Min
Compressive strength for 14 days	51.55	43 N/mm <sup>2</sup> Min

### *Fine Aggregate*

For the following experiment both natural sand and crush sand were used together in concrete formation. The properties of crushed sand were determined by conducting test as per IS 2386 (Part 1). The results are as follows.

**Table 2: Properties of Crushed Sand**

Physical Properties	Test Result
Specific gravity	2.78
Water Absorption	3.78%
Moisture Content	0.60%

### *Coarse Aggregate*

Crushed stone obtained from local quarries were used as coarse aggregate. Minimum size of coarse aggregate used is 10mm. Properties of aggregate was determined using IS 2386 (Part 3).

**Table 3: Properties of 10mm Coarse Aggregate**

Physical Properties	Test Result
Specific gravity	2.81
Water Absorption	1.22%
Moisture Content	0.20%

### *Plastic Bottle*

Water purifying and selling companies uses PET bottles for storing water. Such type of water bottles are considered in this experiment. Plastic bottles are cut into part such that its height is up-to 90mm and diameter is up-to 70mm.



Fig 1: Plastic bottles considered in Experiment

### *Demolished material*

Demolished material are obtained by demolishing concrete slab, concrete column, concrete beam and brick wall, old plumbing concrete pipes. Material considered in this experiment is taken from demolition of concrete slab. It is passed through sieve and the portion retained in 20mm sieve is taken into consideration.

## 2.2 EXPERIMENTAL PROCESS

### 2.2.1 Formation of specimen

Plastic bottle is cut in such a manner that its height is 90mm and diameter is 70mm. The main purpose of cutting the plastic bottle is to provide surface for adhesion of poured concrete. Concrete mortar is formed using demolished material as coarse aggregate. M25 mix design is used for formation of concrete mortar. These concrete mortar is poured into empty plastic bottles. After hardening, it is then kept in water tank for 7 days. After completion of curing, these specimen is taken out and used in further concrete block formation.

### 2.2.2 Concrete Cube Formation.

Once the specimen is ready, concrete cubes are made. Mix design of M50 is used. 12 cubes of M50 are made. Firstly 150mm \* 150mm \* 150mm size of mold is taken. It is filled with M50 concrete till 35mm. Later then plastic bottle specimen is inserted into mold placing at its center. Once the specimen is placed it is then fully filled with M50 mortar. Same procedure is repeated for other 11 cubes. After 24 hours, molds are removed and the concrete cubes are kept in water for curing.



Fig 2: Formation of Specimen



Fig 4: Placing of Specimen in Concrete Cube

## 3. RESULTS

### 3.1 Material Saving

Size of mold = 150\* 150\* 150 mm =  $3.375 * 10^6$

Size of specimen = 3.14 \* 70 \* 70 \* 90 =  $1.384 * 10^6$

Hence saving of material = size of specimen / size of mold \* 100 =  $(1.384 * 10^6) / (3.375 * 10^6) * 100 = 41\%$

### 3.2 Compressive Strength

**Table no 4: Compressive Strength Test Result N/mm<sup>2</sup> for M50 with Specimen**

SR. NO	DESCRIPTION	SPECIMEN 1	SPECIMEN 2	SPECIMEN 3	MEAN
1	7 Days	19.11	20	18.22	19.11
2	14 Days	21.28	22.45	21.36	21.70
3	21 Days	26.11	24.94	25.96	25.67
4	28 Days	27.11	26.22	29.45	27.79

**Table no 5: Compressive Strength Test Result N/mm<sup>2</sup> for M50 without Specimen**

SR. NO	DESCRIPTION	SPECIMEN 1	SPECIMEN 2	SPECIMEN 3	MEAN
1	7 Days	40.2	41.77	41.33	41.1
2	14 Days	51.62	49.82	49.33	50.26
3	21 Days	56.44	57.82	54.67	56.31
4	28 Days	64.44	58.22	60.44	61.03

### 4.0 CONCLUSION

- Using Plastic bottle and Demolished Material in Concrete M50, it was found that the compressive strength decreases by 54%.
- It is found that placing plastic bottle filled with mortar formed with demolished material, 41% of material is saved.
- Hence the experiment helps in saving raw material but fails to attain the required strength.
- As 7 more days are required for curing of specimen the time required for the completion of cycle is more.
- As material is being save, the product is a cost effective.

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