# Concrete for Sustainable Infrastructure Development using Building Demolshing Waste

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***Abstract***- *Titanic quantities of construction and demolition wastes are generated every year in developing countries like India. The disposal of this waste is a very serious problem because it requires huge space and very little demolished waste is recycled or refused. In this experimental study, the utilization of building demolished waste in the manufacturing of concrete as a replacement of coarse aggregate. This paper present the feasibility of the usage of building demolished waste substitutes for conventional aggregate in concrete. The mechanical properties of the concrete have been investigated for nominal mix and mix design as per the mix design codes IS 10262-2009. Matrices with compressive strength (as per IS 456:2000 & IS 10262:2009) M20 were design at different ratios (0, 25, 50, 75 and 100 %). Tests were conducted on cubes and cylinders to study the strength of concrete made of building demolished waste and the results were compared with the conventional aggregate Concrete.*

***Keywords***- Concrete, recycled aggregate, construction & Building demolished waste, Strength.

## I. INTRODUCTION

### 1.1 General

History has taught us that society has made the recovery and use of rejected elements a habitual practice. Numerous civilisations have reused building materials of earlier civilizations of their own destroyed architecture (either through war or natural causes) to construct new buildings.

### Need for the Present Study

- Non availability of Conventional Aggregates.
- Shortage of Dumping Ground and Disposal Problems.

### Objectives

To fulfill the objective, the thesis work is aimed at the following:-

- To carry out the mix design for the grade M20 for both Conventional Aggregate Concrete and Recycled Aggregate Concrete.
- To Study the strength characteristics of concrete like compressive strength assessment for both Conventional Aggregate Concrete and Recycled Aggregate Concrete.
- To arrive conventional coarse at the optimum percentage replacement of coarse aggregates with recycled coarse aggregates in the production of Structural Concrete.

### Properties of coarse aggregate & demolished waste

| S.N | Parameters | C A | B D W |
|---|---|---|---|
| 1. | Specific gravity | 2.8 | 2.6 |
| 2. | Water absorption | 0.3% | 4.54% |
| 3. | Sieve analysis | conforming table 2 of is 383-1970 | conforming table 2 of is 383-1970 |
| 4. | Crushing value | 22% | 35.25% |
| 5. | impact value | 25% | 27.42% |

### Use of recycled aggregates

Use of recycled aggregates fulfils three 'green' requirements as set out by the "World Environmental organization".

- Reduce natural resources and energy consumption.
- It will not affect the environment, and can maintain sustainable development.
- Granular Base Course Materials.
- Embankment Fill Materials.
- Backfill Materials.

The other general applications are:
Lean-concrete and bituminous concrete.
Low quality stabilization and filler material.
Thermal reservoirs.

**Ingredients of concrete**:
- CEMENT
- FINE AGGREGATE
- COARSE AGGRAGATE

- WATER
- DEMOLISHINGWASTE

**Cement**:

Cement is a fine mineral powder manufactured with very precise processes. Mixed with water, this powder transforms into a paste that binds and hardens when submerged in water. Because the composition and fineness of the powder may vary, cement has different properties depending upon its makeup.

Cement is the main component of concrete. It's an economical, high-quality construction material used in construction projects worldwide.

**Aggregates:**

Fine aggregates:

- ➢ Sand and other small particles of stone that will pass through a 1/4 inch mesh screen
- ➢ Clean and free of clay, silt and chaff

Coarse aggregates

- ➢ Gravel, pebbles or crushed rock ranging in size from 1/4 inch up.
- ➢ Size of coarse aggregate to use depends on the thickness of concrete slab being poured.
- ➢ In thin slabs or walls the coarse aggregate should not exceed 1/3 inch the thickness of the concrete being placed.
- ➢ To make good concrete, aggregates of various size should fit together to form a fairly solid mass.

Stone particles must be clean and free of clay, silt, chaff or any other material.

**Water:**

Water should be:

- Clean
- Free of oil
- Free of acid
- Free of alkali
- Free from harmful amounts of dirts

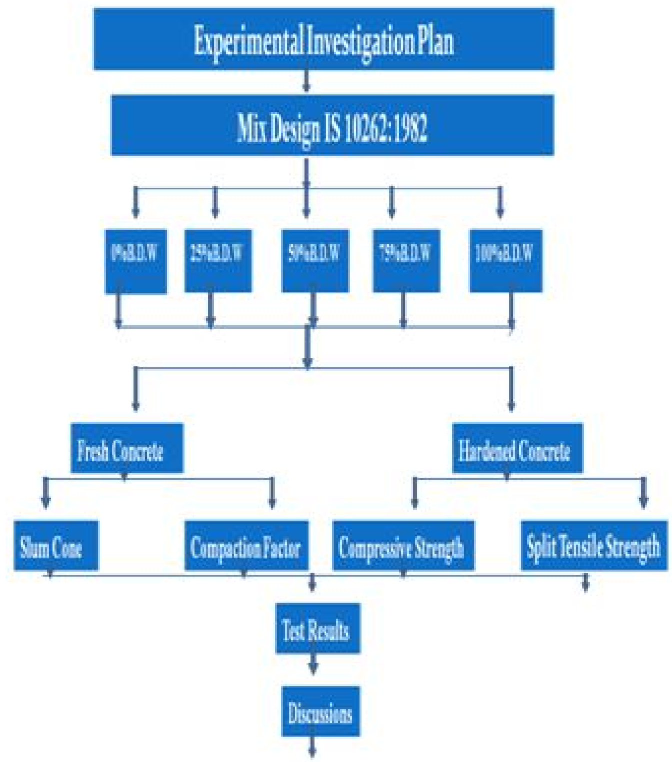
Should be free of excessive impurities which might effect:

- Setting time
- Concrete strength
- Volume stability
- Surface discoloration
- Corrosion of steel

Drinking water generally is suitable for mixing with concrete

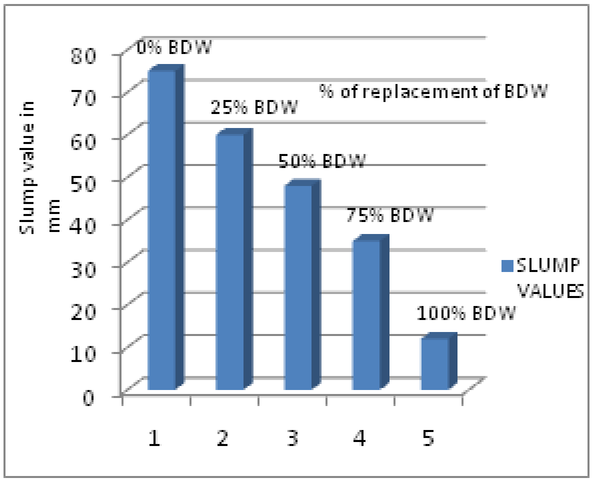
## II. EXPERIMENTAL INVESTIGATION

In this experimentation, an attempt has been made to find out the properties of concrete produced by replacing the coarse aggregate with building demolishing waste in various percentages ranging (0%, 25%, 50%, 75% and 100%).The experimental program plan is as shown in the figure.




**Test results of fresh concrete:**

| S.No | % Replacement of CA by BDW | Slump Values (mm) |
|---|---|---|
| 1 | 0 | 75 |
| 2 | 25 | 60 |
| 3 | 50 | 48 |
| 4 | 75 | 35 |
| 5 | 100 | 12 |




**Curing**

Curing is a procedure that is adopted to promote the hardening of concrete under conditions of humidity and temperature which are conducive to the progressive and proper setting of the constituent cement.

Effect of Adequate Curing on Hardened Concrete Increased

- Strength
- Water tightness
- Abrasion resistance
- Freeze-thaw resistance
- Volume stability

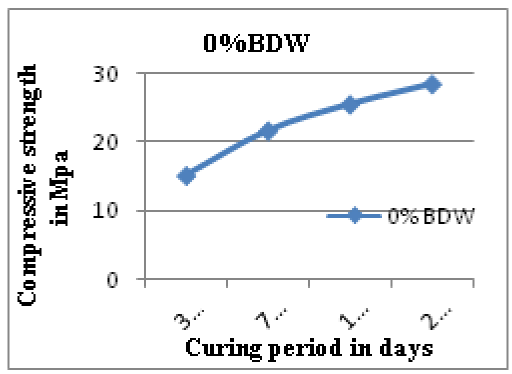
**Test and test specimens**

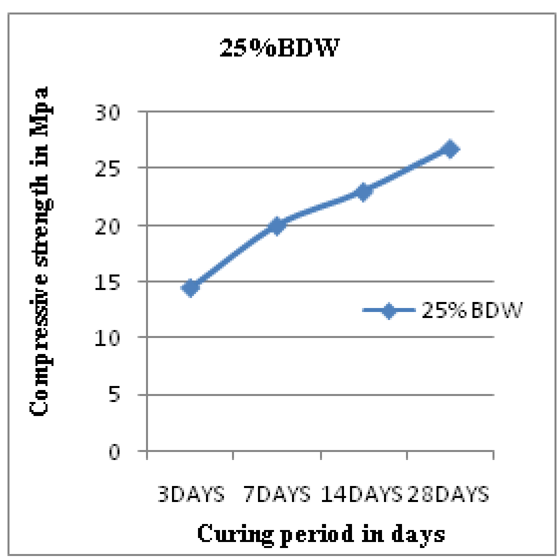
- Compressive Strength Test: Compressive strength test was conducted as per IS 516: 1959. Cubes of standard dimensions 150x150x150mm were cast and tested on compressive testing machine. Three cubes were tested for every percentage of replacement with recycled aggregate at the ages of 3, 7, 14, 28 days to establish the average compressive strength. The cubes were well cured till the day of test.
- Split Tensile Strength: The splitting tensile strength is well known indirect test used for determining the tensile strength of concrete. Tensile strength is one of the most important fundamental properties of concrete. An accurate prediction of tensile strength of concrete will help in mitigating cracking problems, improve shear strength prediction and minimize the failure of concrete in tension due to inadequate methods of tensile strength prediction. The splitting tensile strength was determined after curing at 3, 7, 14, 28 days on cylinders 150 mm x 300 mm as per Indian standard specifications BIS: 516-1959

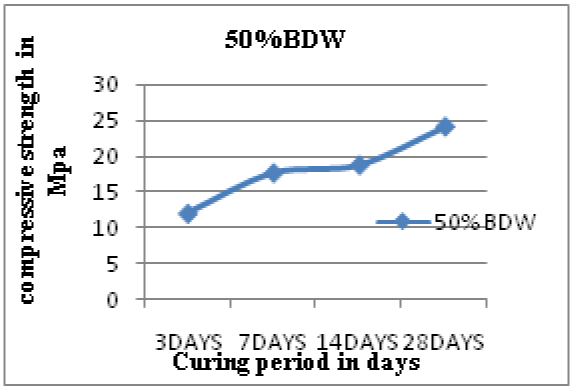
## III. RESULTS AND DISCUSSION

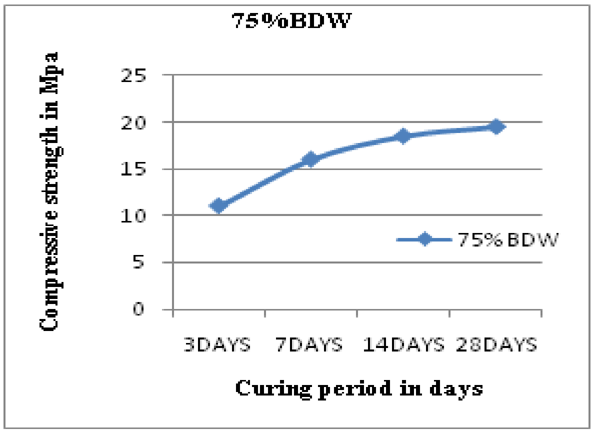
The interpretation made during the examination of cubes are summarized as mixed proportion and compressive strength are represented. Three specimens each having 100:0, 75:25, 50:50, 25:75, and 0:100 in the ratio of demolished waste as coarse aggregate and tested after3, 7, 14, and 28 days in order to have a comparative study. Cubical and Cylinder specimens were cast for the determination of compressive strength and split tensile strength and these observations are presented as compressive strength and split tensile strength values.

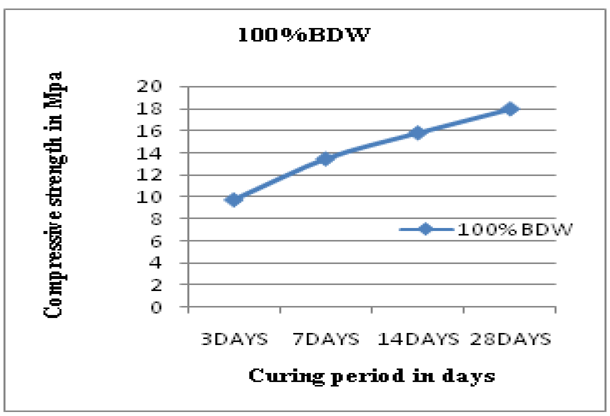
| trail no | % | compressive strength for cubes in n/mm$^2$ (days) | | | | split tensile strength for cylinders in n/mm$^2$ (days | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 3 | 7 | 14 | 28 | 3 | 7 | 14 | 28 |
| 1. | 0 | 15 | 21.6 | 25.5 | 28.5 | 1.8 | 2.8 | 3.18 | 3.5 |
| 2. | 25 | 14.5 | 20 | 23 | 26.8 | 1.65 | 2.28 | 2.64 | 3 |
| 3. | 50 | 12 | 17.6 | 18.7 | 24 | 1.24 | 2.07 | 2.45 | 2.7 |
| 4. | 75 | 11 | 16 | 18.5 | 19.5 | 1.21 | 1.73 | 1.98 | 2.2 |
| 5. | 100 | 9.8 | 13.5 | 15.84 | 18 | 1.12 | 1.62 | 1.85 | 2 |



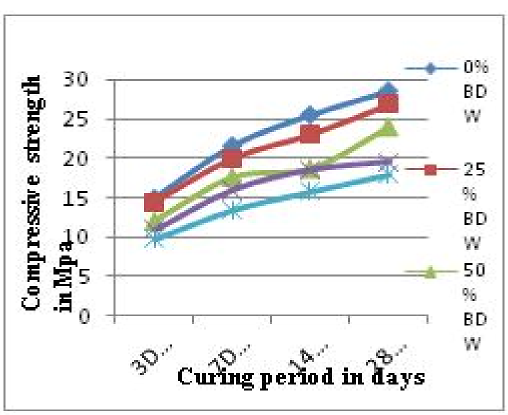



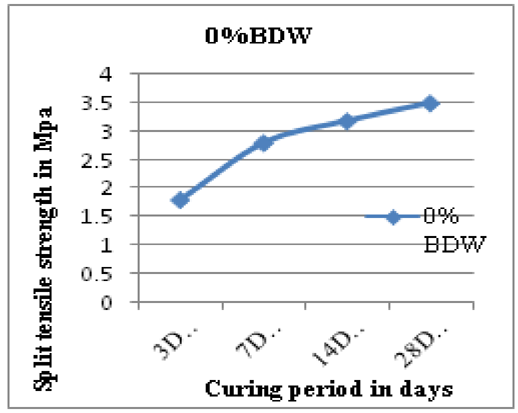


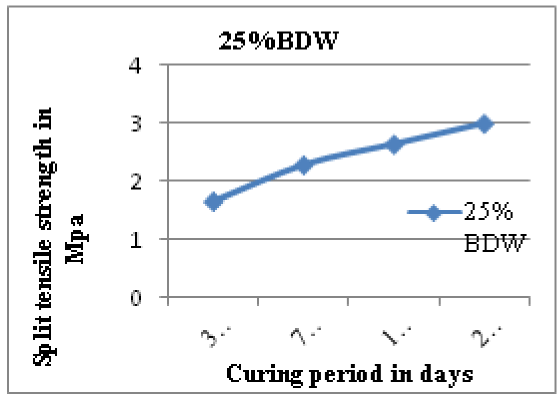



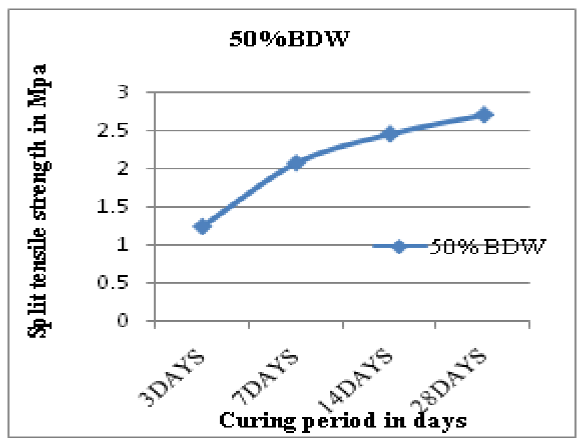



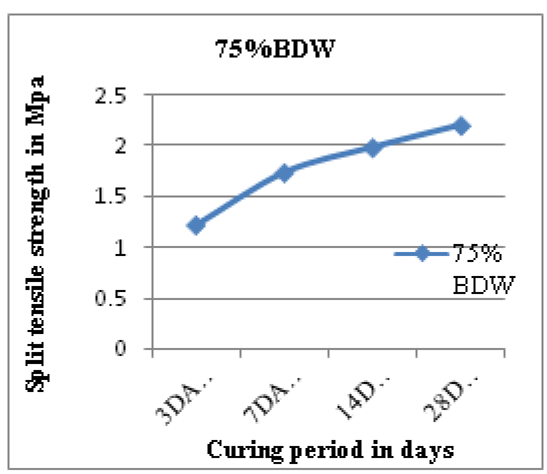

**Comparison of compressive strength obtained from different proportions replacements of CA by BDW**

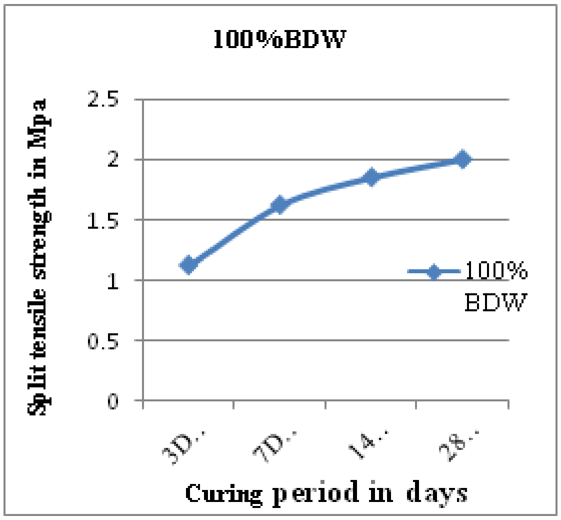


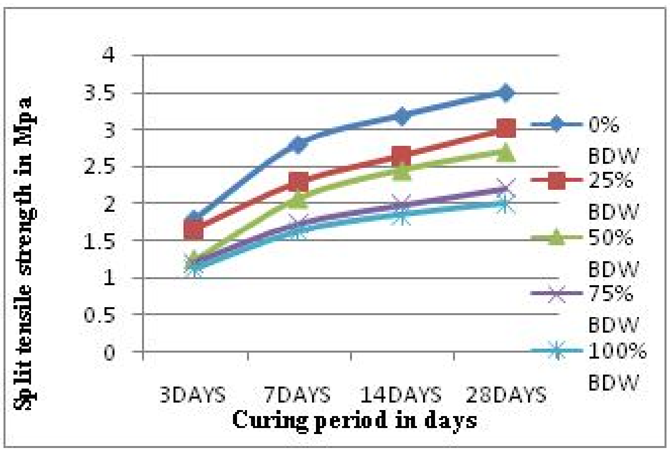






Comparison of split tensile strength obtained from various proportions replacements of CA by BDW




## IV. CONCLUSION

1. Compressive strength value decreases as the percentage replacement of CA with BDW increases.
2. Compressive strength value up to 50% replacement of CA by BDW is higher than design mix (M20) value.
3. Compressive strength value is decrease by 36.4 % for 100% replacement of CA by BDW.
4. Split tensile strength value decreases as the percentage replacement of CA with BDW increases.
5. Split tensile strength value is decrease by 42.86 % for 100% replacement of CA by BDW.
6. Slump value decreases with increase in percentage replacement of BDW with CA.
7. Work ability is decreases as the increase in replacement of CA by BDW.
8. From the above, it was concluded that up to 50% replacement of BDW with CA is preferable in construction works.

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