# Integrated Approach to Construction and Demolition Waste Management.

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***Abstract:*** *Management of construction and demolition waste is a major problem in Bhilai Charoda city due to the growing urban population, urbanization and lack of awareness of the people and carelessness of the governing bodies. This article highlights the actions taken for renewable construction and demolition waste management in Bhilai-Charoda city by analyzing the waste generation, collection, disposal scenario and steps taken to improve the condition of Bhilai-Charoda city along with the integrated frame work. It advocates an integrated approach for the proper disposal and usage of construction and demolished waste.*

***Keywords- Integrated, Construction, demolition, Waste management, Renewable, Disposal.***

## 1. Introduction

Demolished and construction waste obtained from a structure mainly made up of concrete has several foreign matter such as various type of finishes, cladding materials, lumber, dirt, steel, hardware's, woods, plastics etc. attached to them directly or indirectly. Construction waste may also contain many types of hazardous substances. This type of construction waste is a concerned issue for public health, economics, and aesthetics and also for environmental considerations of city. Some of the construction wastes like waste wood, stones, demolished concrete, steel frame work have the potential to recycle or reuse while certain components of construction waste are hazardous when land filled releases toxic gases. The conventional way of disposing construction waste is to transport them from the site to the open ground and either dumping or land filling them. But, by dumping or land filling them in to the earth often leads to many problems in the long duration.

- Natural resources of dumped area is affected
- Transportation of debris increases the construction cost
- Dumped debris occupies large area which is not aesthetically good
- Soil below debris get affected by the toxic waste in long period of time, becomes less fertile and quality of soil reduces
- Causes air as well as water pollution

This approach would incorporate some appropriate ways to recycle and reuse the construction and demolition waste. It is a difficult task to plan and execute this although this paper presents an overview of the current scenario of Construction waste management in city Bhilai-Charoda and suggests the necessary actions to make construction wastes sustainable.

## 2. Integrated Approach

Any schemes or programs in Indian cities depend on the structural and functional integration of education and society participation. Some of the major recommendation includes:

- Ensuring the participation of school children and college students in educating the public on construction waste management.
- Separate collection and disposal of the construction and demolition wastes.
- Use of appropriate equipment for collection, transport and processing of wastes.
- Rehabilitation of the open dumps to sustainable landfills.
- Setting up collection and transportation facilities for construction and demolishing wastes.

- Recycled aggregate use.

## 3. Construction Waste Management Approach in Bhilai-Charoda

**Bhilai** is a twin city with Durg city in Durg district of the Indian state of Chhattisgarh, in eastern central India. With a population of 1,064,077, Bhilai is the second-largest urban area in Chhattisgarh after Raipur. Bhilai is a major industrial city in India as well as an education hub of central India. The Bhilai metropolis contains three municipal corporations: Bhilai Municipal Corporation, Bhilai-Charoda Municipal Corporation and Risali Municipal Corporation.

Bhilai-Charoda is a municipal corporation and a part of Bhilai city in the state of Chhattisgarh, India. Charoda is an industrial area of Bhilai city. Asia's longest railway marshaling yard is present in Charoda, Bhilai. Total quantity of Construction & Demolished waste generated from Municipal Corporation Bhilai - Charoda has been estimated as 2200 MT./Day while Municipal Corporation has installed a recycling plant but that is not enough to tackle the construction and demolished waste of buildings in this area. This area is having a huge potential for future mass construction and the current methodology for their disposal is not well enough.

So one of the possible solutions to these problems is to use concrete made from recycled aggregate in construction. Recycled aggregate concrete is produced by crushing of demolished and construction waste which contains pozzolanic properties then screening and after that removal of contaminants such as reinforcement, metals, paper, wood, organic wastes, plastics and gypsum. Concrete made with such recycled concrete aggregate is called recycled aggregate concrete.

## 4. Materials and Methodology

Recycled waste: Demolished waste was collected from areas of Bhilai-3 Durg Chhattisgarh, India. On being tested the demolished waste in laboratory shows pozzolanic properties. First demolished waste is collected, crushed in desirable size using appropriate mechanical devices passed through 4.75mm sieve and then used as a partially replacement of sand in concrete. Properties of recycled aggregates are given in Table 1 below.

**Table – 1 Physical Properties of recycled aggregate**

| **Properties** | **Observed Value** |
|---|---|
| Colour | Grayish brown |
| Specific gravity | 2.44 |
| Water absorption (%) | 3.13-4.3 |

Cement: The cement used in this work is ordinary Portland cement of Ultratech (43 grade) brand. The cement contains mainly two basic ingredients namely argillaceous and calcareous compounds. The physical properties of OPC cement are given in Table 2. This cement confirms IS: 8112-1989.

| Table – 2 Physical Properties of OPC cement | | |
|---|---|---|
| Properties | Requirement as per IS 8112-1989 | Observed Values |
| Normal consistency | 25-35% | 29% |
| Initial setting time | 30 minutes | 50 minutes |
| Final setting time | 600 minutes | 605 minutes |
| 7 d compressive strength | 33 $N/mm^2$ | 34.6 $N/mm^2$ |
| 28 d compressive strength | 43 $N/mm^2$ | 43.33 N/mm |
| Soundness test | Up to 10 mm | 2.7 mm |
| Fineness test (90 µ sieve) | Up to 10% | 1.2% |

Fine aggregate: The fine aggregate used is river sand which is available locally, which is passed through 4.75 mm sieve.

Coarse aggregate: The coarse aggregate used is locally available, 20 mm size maximum crushed stone aggregate has been used in this experiment whose specific gravity was found to 2.7

Water: Water used is Potable water for mixing and curing. Requirement of water increases on increasing demolished aggregate percentage for same workability as of standard M-20 concrete. So, the water-cement ratio is taken as 0.5 for all the mixes.

Concrete: In order to achieve the aim of the study laboratory tests is done in 7 days and 28 days and results are obtained of compressive strength of concrete (M-20) with partially replacing fine aggregate in concrete in proportions 20%, 25% and 30% along with coconut coir mixed in concrete 1% by weight in each samples. Cube testing is done on the concrete made from recycled aggregates which is made from crushed demolished and construction waste collected from different location of Bhilai-Charoda then using it as an alternative to the fine aggregate along with coconut coir in conventional concrete. Compressive strength of this recycled concrete were obtained and compared with those of natural aggregate standard M-20 concrete.

## 5. Result and Discussion

The observations made during the test of cubes are summarized below. Compressive strength test results are presented in tabular form (Table 3). Four specimens 1, 2, 3, 4 having 0%, 20%, 25% and 30% demolished waste with coconut coir 1% respectively as fine aggregate along by weigh replacement for mix of M-20 were cast and tested after 7 days and 28 d in order to have a comparative study.

| Table - 3 | | | |
|---|---|---|---|
| **S.No.** | **Specimen** | **Compressive Strength at 7 days in N/mm2** | **Compressive Strength at 28 days in N/mm2** |
| 1 | Specimen-1 | 13.6 | 20.1 |
| 2 | Specimen-2 | 12.2 | 18.8 |
| 3 | Specimen-3 | 9.5 | 15.4 |
| 4 | Specimen-4 | 7.5 | 13.2 |

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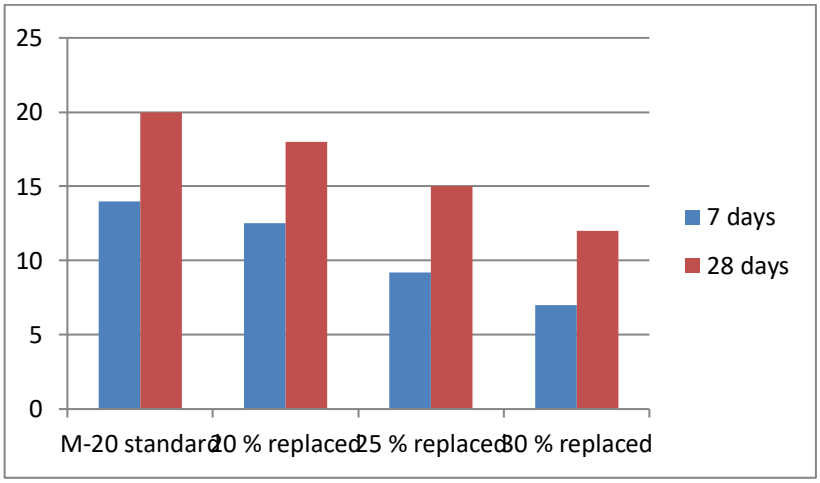


## 6. Conclusion and Future Scope

The concrete mixed with 20% recycled aggregate along with coconut coir can be used in Construction of Embankment Slope Drains Bed, Dowel walls PCC and in the construction of House Hold Drains of small size in Municipal Corporation area of Bhilai-Charoda and the 25% variant can be used in nominal PCC works. So in-order to be a developed as well as a smart city, Bhilai-Charoda has not only to be active in the part of new constructions but also it has to deal with the construction and demolishing waste actively. The construction and demolition waste of various ongoing projects and future projects shall be dumped in such an arranged manner that it should not cost harm to the nearby localities and ecosystem. The construction waste which can be recycled should be recycled and reuse again and the hazardous and non biodegradable wastes which are unfit for recycling must bury or dumped far away from the city. Degradable construction waste if capable then must be used as manure or fertilizers for the soil to increase its capacity. As today and also in near future there will always a need of a system to deal with the construction and demolition waste in Bhilai-Charoda.

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