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Effective Reuse of Material from Demolished Structures

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ABSTRACT: In recent years, the management of construction and demolition waste (C&D waste) has become a major challenge for the construction industry due to the increasing volume of waste produced and its associated environmental impact. This article aims to assess the effect of fine-grained fractions (<0.125 mm–0.6–0.125 mm) of construction and demolition waste, obtained by industrial sorting in a C&D waste processing plant, on the technological behaviour and technical performance of clay bricks. Simulating the brickmaking process on a laboratory scale, it was appraised whether the CDR additions determined any change in the main properties of bricks, taking a CDR-free brick body as a reference. The results indicated that the use of CDR is technologically feasible. It is possible to obtain, through proper crushing and sorting operations, grain-sized fractions with quite a homogenous chemical and mineralogical composition. The residues did affect the compositional properties, compressive strength, and water absorption of the clay bricks. Nevertheless, the characterization of the residual-added semi-finished and fired products highlighted their good technological and mechanical properties, which allowed them to provide performances similar to those of standard bricks manufactured with raw natural materials.

KEYWORDS: construction and demolition waste; clay bricks; technological properties

I. INTRODUCTION

With the growth of society on all fronts, a lot of construction activities are seen everywhere. The infrastructure development activities are increasing exponentially in India. Also, the demolition of existing structures, which have outlined their service life, is going on simultaneously. It is not essential that the structures need to be demolished only after their service life span is over, but also due to the ongoing trend of reconstruction of even healthy structures just for creating more space to meet the present requirement. All such activities are generating a huge amount of waste, called the Construction and Demolition (C & D) waste. Disposal of such debris in a sustainable manner is a big challenge for the builders, developers, and owners. On the other hand, there is an acute shortage of naturally available aggregates for the construction of buildings. Reduction of this demand in a small way is possible with the Reusing or Recycling of construction and demolition waste generated from the construction activities. Hence, the construction sector must accept the use of C & D waste wherever feasible. C & D activities generate huge quantities of waste and more accumulation of waste is creating harmful effects on both environment and human life. Researchers around the world have reported that C & D waste constitutes around 20 to 30% of total solid waste and about 70 to 80 % of C & D is concrete and masonry. As C & D waste forms a significant portion, the appropriate management of C & D waste is vital for a sustainable environment. Besides population increase, the boost in the fiscal growth after several advancements and re-development projects in India and subsequent rise in the urbanization and industrialization have made the construction sector boost remarkably, but the adverse environmental effects from the C & D waste are progressively becoming challenging tasks in urban solid waste management. This study assesses the impacts of construction and other civil engineering-related activities on the environment and investigates the utmost serious challenges and hopeful measures for the management of C & D waste, particularly in India.

II. AIM & OBJECTIVES

The main aim is, “To reuse the materials obtained from Construction and Demolition structure effectively”.

And the objectives are,

1. To utilize construction and demolition waste materials.
2. To reduce environmental pollution, space reclamation, and improve environmental aesthetics.

- To reduce environmental footprint.

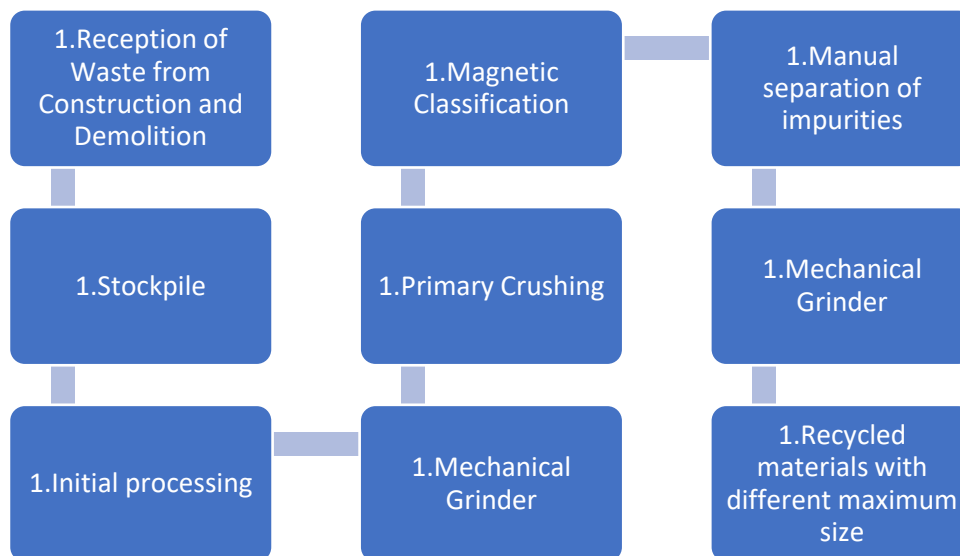
III. AREA OF STUDY

To achieve the above aim and objective, the scope of work generated as follows:

- To utilize construction and demolition waste materials by manufacturing recycled bricks.
- To reduce environmental pollution, and space reclamation and improve environmental aesthetics by suggesting methods of recycling/reuse of demolition waste.
- To reduce environmental footprint by reducing the usage of natural bricks and suggesting to use of Recycled bricks.

To accomplish this particular work, define is explained in the detailed methodology.

IV. METHODOLOGY



- 1. Reception of Waste from Construction and Demolition** - In this, waste from construction and demolition is taken out from the demolished building on a loaded truck to the site of the recycling plant. In this waste, all types of waste are found like concrete structures, metals, glass, bricks, plastic, plaster, and wood. This waste is then separated on-site which is recyclable and non-recyclable.
- 2. Stockpile** - A stockpile is a pile or storage location for bulk materials, forming part of the bulk material handling process.
- 3. Initial processing** - Construction waste refers to the collective name of the muck, waste concrete, waste bricks, and other wastes produced in the production activities of people engaged in the demolition, construction, decoration, repair, and other construction industries.
- 4. Mechanical Grinder** - After initial processing, the material is taken into the mechanical grinder. Mechanical grinding is a method used to produce coarse and fine aggregate by separating a drum into small sections with partitions, loading the drum with iron balls for grinding, and rotating the partitions.
- 5. Primary Crushing** - Upon arrival at the recycling plant, Construction and Demolition Waste may either enter directly into the processing operation or need to be broken down to obtain materials with workable particle sizes, in which case hydraulic breakers are mounted on tracked or wheeled excavators are used.
- 6. Magnetic Classification** - Magnetic Separation is the process, in which the “magnetically caused material is detached easily” by using a magnetic force. Magnetic separation technology is one of the best methods for sorting recyclable materials. It uses the power of magnetic devices to sort ferrous products from non-magnetic debris.



7. **Manual separation of impurities** -Typically, mixed C&D debris is tipped at a central facility, and the materials with a high market value, such as large pieces of sawn lumber, are removed. The remaining mixed C&D materials are then processed using one of two primary methods. The manual labour method relies on human sorters to pick out materials and place them in specific containers.
8. **Mechanical Grinder** - In the above step grinder material is kept compact for separation but now in this step materials are ground in small quantities. This material gets the needed shape for further process.
9. **Recycled materials with different maximum sizes** - In this step, we get material in which type we needed, like coarse, fine, and medium.

V. LITERATURE REVIEW

Bansal, G. Mishra.^{1} have suggested after studying different technologies, various research work on utilization of C&D waste it is concluded that the C&D waste reuse and recycling have great business potential. Its success depends on the incentive by the government and the formation of standards, strict compliance with regulations, and better state of an art technology for recycling these wastes. Given international developments and experiences, as well as a shortage of aggregate from natural sources being experienced in many parts of the country, it is time that recycled aggregate is permitted for use in concrete constructions.

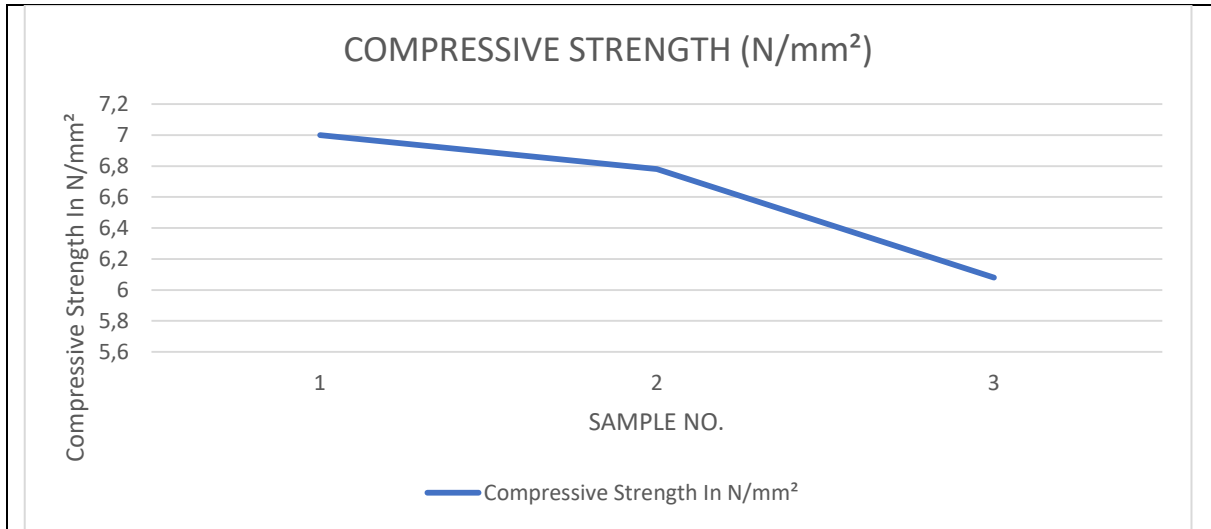
Yadhu et al.^{2}From the above study, it is concluded that the crushed C&D wastes can be used as a replacement for conventional sand as fine aggregate. Further studies should be done to know how extensively we can use the crashed C&D wastes in construction. Using crushed C&D wastes in fresh concrete not only decreases the C&D waste in the country, but also will decrease the use of river sand, which is both becoming hard to come by, and also it will make the construction much cheaper. Even though more research is to be pilot study towards the preparation of such a manual. It also suggested an improved method of recycling/reuse/disposal of demolition waste.

SnehalAnilkumarKumbhar, Anil Kumar Gupta.^{3} have suggested concepts for the reutilization of construction materials, including waste debris, using recycling into other components that are useful in construction. Primary opportunities identified in this study to divert Construction and Demolition Debris from the solid waste stream exist in the form of demolition operations to salvage or recycle building materials and systems. This work is expected to be a pilot study toward the preparation of such a manual. It also suggested an improved method of recycling/reuse/disposal of demolition waste.

VI. RESULT

Compressive strength test (Bricks)

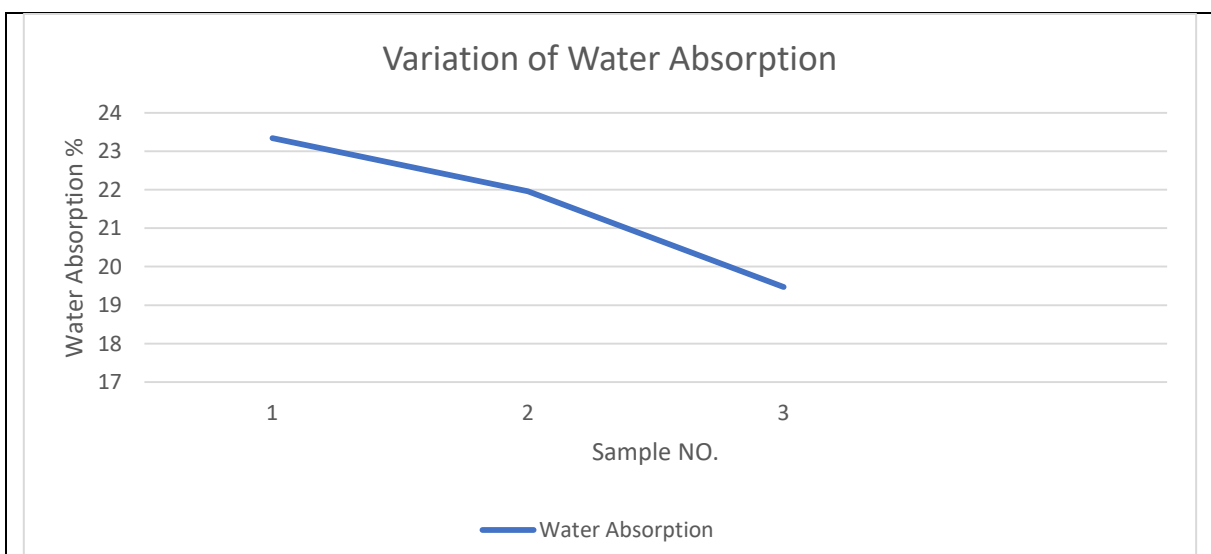
| Sample No. | Compressive Strength In N/mm ² | Remark |
|------------|--|----------------------|
| 1 | 6.99 | Standard Brick |
| 2 | 6.78 | 10% Demolished Waste |
| 3 | 6.08 | 20% Demolished Waste |



Graph No. 4.1: Compressive Strength Test (Bricks)

Water Absorption test

| Sample No. | Water Absorption | Remark |
|------------|------------------|----------------------|
| 1 | 23.34 | STD. BRICK |
| 2 | 21.96 | 10% Demolished Waste |
| 3 | 19.47 | 20% Demolished Waste |



Graph No. 4.2: Water Absorption Test



After the test performed in previous chapter, the analysis and discussions are to be done in this chapter. Some of the important observations are discussed below.

1. By studying the compression test performed on bricks and graph no. 4.1 compressive Strength is Maximum for a Standard Brick which is 6.99 N/mm^2 and closest of which is brick with 10% demolished waste replacement which is 6.78 N/mm^2 and Lowest for a Brick with 20% Demolished Waste replacement which is 6.08 N/mm^2
2. By studying the water absorption test performed on bricks and graph no. 4.2 the water absorption was found to be 23.34% for std. brick and after replacing 10% demolished waste it is found to be 21.96% and after replacing 20% demolished waste it is found to be 19.47%

After studying various tests and graphs on recycled bricks we concluded that 20% of replacement of demolished waste is found to be the better suitable percentage in manufacturing brick made of demolition waste along with fly ash and also has a potential to be used as instead of normal bricks.

VII. CONCLUSION

Based on the information collected on this project, the following conclusions can be drawn:

1. After this study we can conclude that the demolished waste can be utilized for different construction materials like the manufacturing of bricks and it can minimize the negative environmental impact.
 2. After reuse/recycle methods used to manage C & D waste we promote the reduction in environmental land pollution, space reclamation and improve environment aesthetics.
 3. And reduction in environment footprints and promote sustainable development of natural resources.
 4. When increased in the demolished waste in recycled bricks the water absorption reduced.
- 10% demolished waste:
- $\frac{(23.34-21.96) 100}{23.34} = 5.91\%$
- 20% demolished waste:
- $\frac{(23.34-19.47) 100}{23.34} = 16.58\%$
5. The colour, shape, size and texture of the bricks were found to be satisfactory.

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