"UTILIZATION OF DEMOLISHED BUILDING WASTE IN PAVING BLOCK WITH COIR FIBRE"

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ABSTRACT

In India, total quantum of waste from construction industry is estimated to be between12 to 14 million tons per annum, out of which 7 to 8 million tonnes are concrete and brick waste. Construction, demolition, renovation generates large amount of concrete waste. This waste is either dumped or it is diverted towards landfill. This concrete waste can be qualitatively reused for manufacturing of various concrete blocks. In this report, we represent the concept of sustainable use of concrete waste in concrete which can be used in manufacturing of interlocking paver blocks with coir fiber. After crushing, this concrete waste can be used as a replacement of coarse and fine aggregates in two stages as complete and half replacement in paver blocks by considering IS specification. In this project, by considering suitable materials, size, shape, mix design etc. and by accepting specific casting methodology and by performing various specific tests, we are going to cast interlocking paver blocks.

Keyword : - *Reuse, Recycling, C&D waste, building materials, coir fibre, paving block ….*

1. INTRODUCTION

In India there is large amount of use of concrete which is made from natural material like river sand, course aggregate` from demolition of mountains by stone crusher and artificial material like cement. Indian buildings in 2013 have generated more than 626 million tons of solid waste which is 52 times more than official estimate. A great part of this waste is being used illegally for dumping and filling up urban water bodies. From the large amount of solid waste generated from various industries, construction and demolition waste contributes in large amount.

Construction and demolition waste is the waste which is generated from various activities like residential construction work, road work, renovation work demolition, etc.

Recycled coarse aggregates are obtained by crushing of concrete waste from demolition of structural components in many structures such as old buildings, bridges, concrete pavements etc. Concrete paving block is versatile, aesthetically attractive, functional and cost effective and requires little or no maintenance if correctly manufactured and laid. Paver block is solid, unreinforced precast cement concrete paving units used in the surface course of pavements. Interlocking concrete paving block technology has been introduced in India in construction, a decade ago, for specific requirement like footpaths, parking areas, gardens, etc.

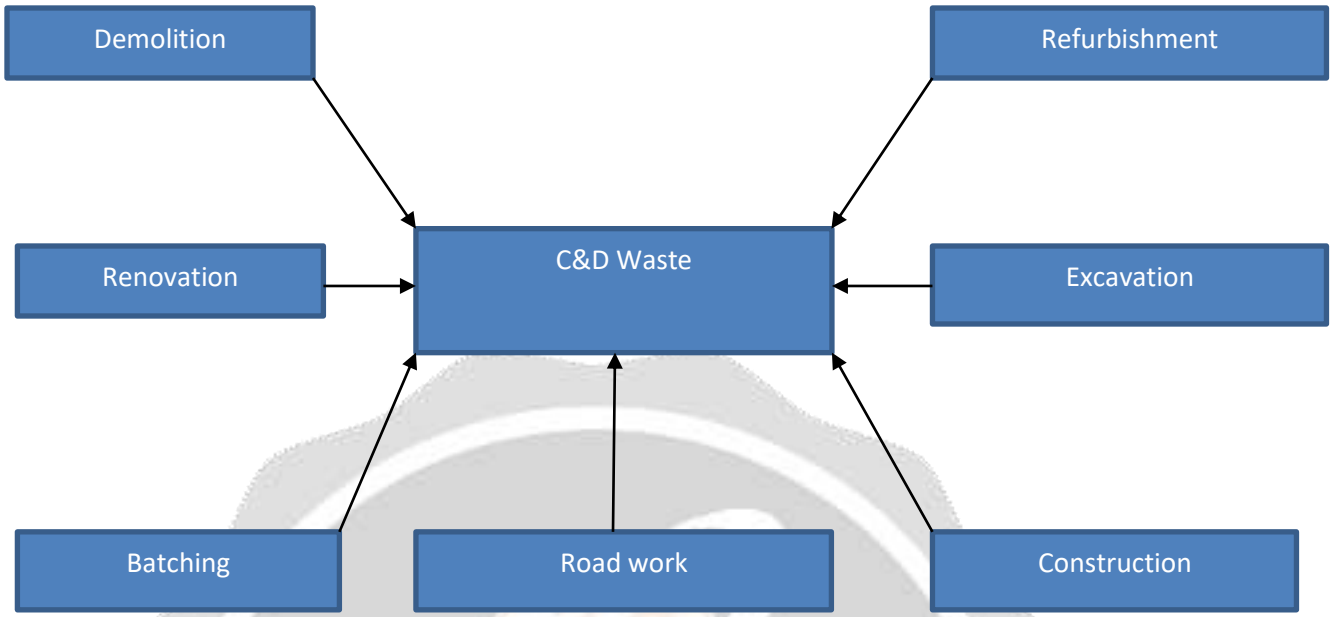

Fig No 1.1: Generation of construction and demolition waste.

We all know that the basic requirement of paver blocks is high compressive strength and low water absorption, so in order to achieve the same conventional results we are trying to replace the course aggregate and fine aggregate completely and partially (50%) in bottom layer because of environmental considerations and growing trend in reusing waste products.

1.1 Construction and demolition waste:

Presence of C & D waste and other inert material like drain silt, dust and grit is significant. Non inert construction waste is directly put to use for land filling Recycled aggregates are obtained by crushing of concrete from demolition of structure such as old building, concrete pavement, structural components in many structures such as bridges and structures at the end of their service life. C & D waste needs to be focus upon in view of the (i) potential to save natural resources stone, river sand, soil etc and energy. (ii) Its bulk which is carried over long distance for just dumping. (iii) its occupying significant space at land fill sites.

So far no organ utilization of C & D waste is quite common in industrialized countries but in India sized effort has been made. The utilization of the C & D is necessary in upcoming years in growing industries.

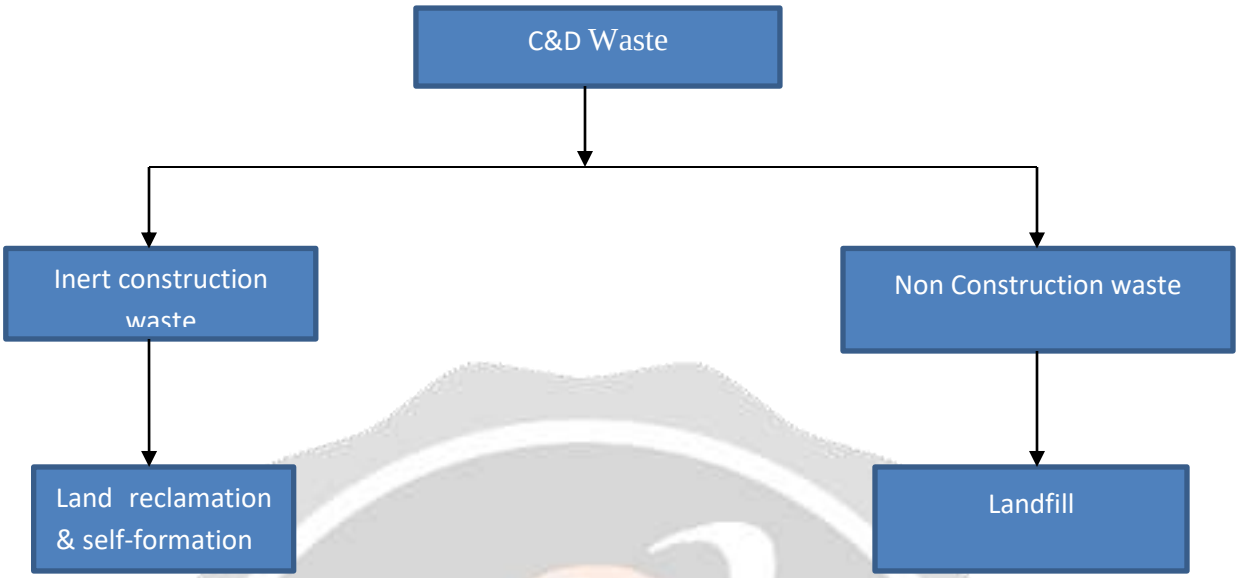

Fig No 1.2: Tree diagram of construction and demolition waste.

1.2 Small steps to make reuse from C & D waste:

- C & D waste can be recycled and reused in construction and minimize environmental degradation and pressure on land. Small steps in Delhi have been taken to reuse the recycled aggregates in RMC, pavement blocks, kerb stones and concrete bricks,
- Processed C & D waste can be used for road and embankment construction.
- Finer grade can be moulded into blocks and slabs with appropriate binder.

1.3. Coir Fibre:

Coir fiber is a natural fiber which is obtained from the husk of coconut. It is the fibrous material found between the hard, internal shell and the outer coat of coconut. The word coir is obtained from Tamil word "kayiru" and its scientific name is "cocoas".

The individual cellular structure is narrow and hollow, with thick walls of cellulose. It is pale in color at immature stage but with age becomes hardened and yellow with deposition of lignin layer. Each cell is about 1mm long with diameter 10-20 µm. Generally length of fiber is found between 10 to 30 cm. Coconut coir has about 48% of lignin which adds strength and elasticity to the cellulose based fiber walls. Since lignin resists bio-degradation, high lignin content also imparts longevity to outdoor applications. Coir fiber nearly takes more than 20 years to decompose.

Fig No 1.3: coir fiber

1.4 Paver block:

Concrete paver block were first introduced in Holland in the fifties as replacement of paver bricks. These blocks were rectangular in shape and had more or less size as the bricks during past five decades, the block shape has steadily Evolved from non-interlocking to partially interlocking to fully interlocking to, multiply interlocking shapes.

Interlocking concrete blocks pavement consist of a surface layer of small element, solid unreinforced precast concrete paver blocks laid on a thin ,compacted bedding material which is constructed over properly profile base coarse. Concrete paving block is versatile, aesthetically attractive, functional and cost effective and requires little or no maintenance if correctly manufactured and laid. Interlocking concrete paving block technology has been introduced in India in construction, a decade ago, for specific requirement like footpaths, parking areas.

Fig No.1.4 Interlocking Concrete Paver Block

A properly design ICBP gives excellent performance when applied at location where conventional systems have lower service life due to number of, geological, traffic, environmental and operational constraints. Many number of such applications for light, medium, heavy and very heavy traffic conditions are currently in practice around the world.

1.5 Introduction to project work:

In this project, we have presented the concept of sustainable use of concrete waste in which can be reused in manufacturing of an Interlocking paver block with coir fibre. Manufacture of paver block is made of two layers. One is top layer having specified thickness and other is at bottom layer. In our project we have decided the thickness of paver block as 75 mm having 10mm top layer thickness and 65mm bottom layer thickness. Shape of paver block plays an important role in interlocking so paver block Zigzag shape is manufactured our project.

Recommended grader of paver block to be used in construction having different traffic categories are given in table below.

Table No 1.1: IS 15658:2006 Recommended grades of paver block for different categories

Sr no	Grade designation of paver block	Specified compressive strength of paver block of 28 days	Traffic category	Recommended min. paver block thickness	Traffic example of application
1	M-30	30	Non Traffic	50	Public Gardens.
2	M-35	35	Light Traffic	60	Pedestrian Plazas, Shopping Complex, Car Parks
3	M-40	40	Median Traffic	80	City Streets ,Small And Median Market Roads
4	M-50	50	Heavy Traffic	100	Bus Terminals,, Industrial Complex, Factory Floors
5	M-55	55	Very Heavy Traffic	120	Container Terminals, Ports, Dock Yards

Concrete waste collected from the nearby demolished site and was crushed through machinery and manually. After crushing of the concrete waste which was collected aggregates obtained were used as a replacement of coarse and fine aggregates as partial (50%) replacement in top and bottom layer of paver blocks by considering IS specification. Selected grade of concrete for paver block casting was M-35.

1.6 Problem statement:

- Construction waste has become a pressing issue in many developing countries and has adverse effects on environment, economy and social aspects.
- In developing cities, there is generation of quality C & D waste from repairs and rehabilitation of structures and from materials used for giving aesthetic view for structures. There is need to reuse this huge amount of waste generated.

- Illegal dumping is common issue created from physical construction waste which needs serious attention. So we have adopted one of the effective ways to reuse construction concrete waste.

1.7 Objectives of project:

- To develop low cost interlocking paver blocks with coir fibers.
- To study the effect on compressive, water absorption and flexural strength, tensile splitting test on paver blocks with partial replacement of aggregates.
- To study the strength properties of paver blocks made by utilizing demolished building waste with coir fiber.
- To minimize the burden of construction and demolished waste on environment and dumping issue.
- Sustainable approach towards production of greener concrete.

1.8 Advantages:

1] Sustainable use of construction concrete waste.

2] Avoiding dumping problems of concrete waste.

3] Results obtained are comparatively similar to standard blocks as studied in various research papers.

4] Use of paver blocks gives good aesthetic view.

5] Economy can be achieved for large scale use.

1.9 Disadvantages:

1] Transportation cost of concrete waste will be more if site is at far distance.

2] Heavy machinery is required for proper crushing of concrete waste.

3] There is no standard mix design, hence require proper proportion' of ingredients.

1.10 Scope of the project work:

As in project we replaced partial amount of material (coarse and fine aggregate) obtained from construction and demolition waste in interlocking concrete paver blocks. We tried to achieve adequate compressive strength, flexural strength, water absorption. The leading scope of our project is as follow:

- Utilization of construction wastes.
- To conquer illegal dumping issue of construction waste in an area.
- Application of obtained paver blocks in light weight traffic areas.
- To promote use of debris in various products and research works.

2. METHODOLOGY

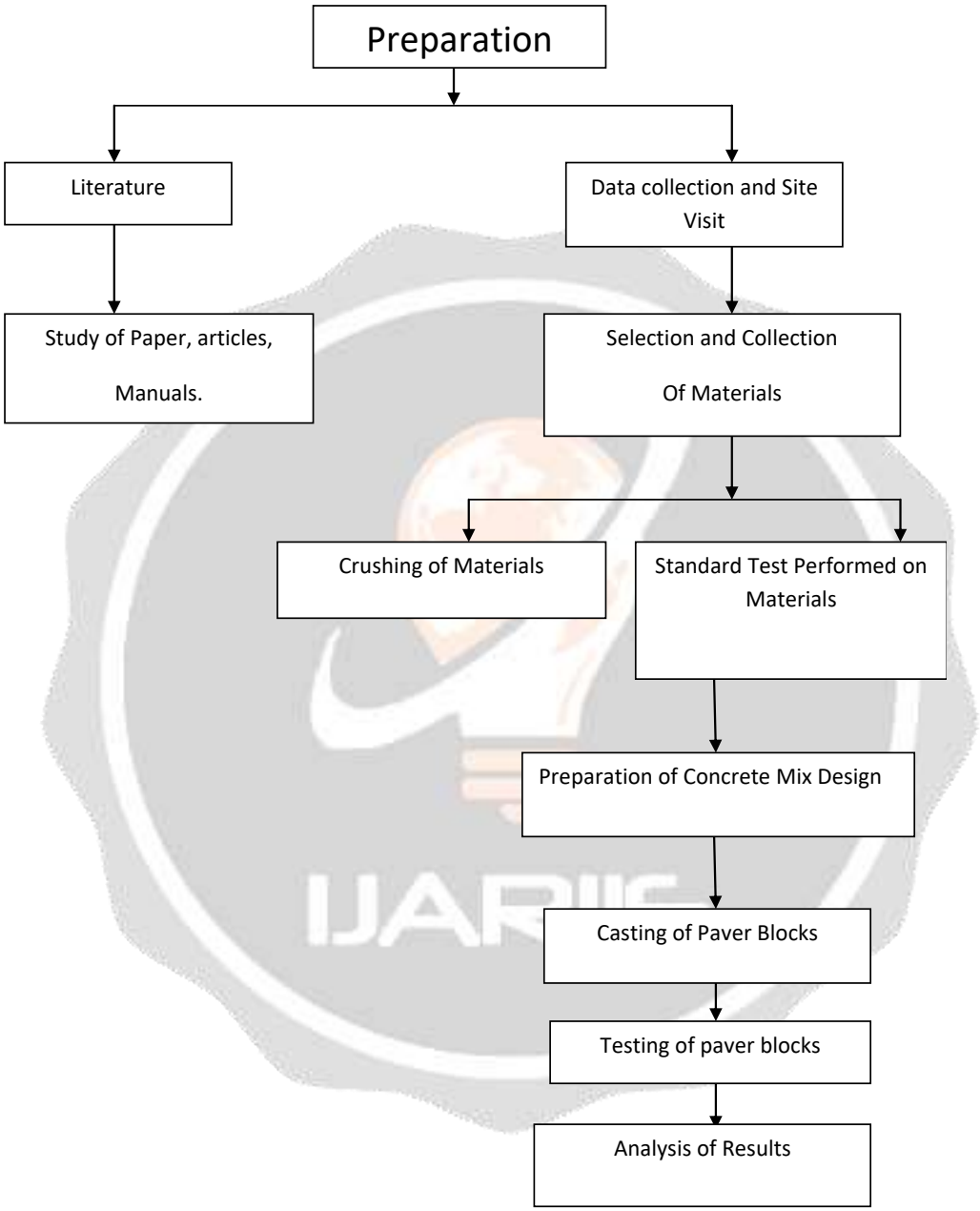

Fig no 2.1 flow diagram

2.1 Methodology:

Paver blocks of suitable dimensions, thickness, and shape and mix design using rubber moulds will be casted. For proper mixing and compacting table vibrator will be used. Concrete paver block contains cement, coarse and fine aggregate in bottom layer and in the top layer a mixture of cement, crush sand and color pigment. In first stage, partial (50%) replacement of coarse and fine aggregates by aggregates obtained from crushed concrete waste and in second stage, complete replacement of aggregates by crushed concrete waste in the bottom layer will be made with the addition of Coir Fiber 0.1%, 0.3%, 0.5% of Volume of concrete. For compression test blocks will be casted and test will be conducted after 14 days and 28 days on the set of three blocks as per IS 15658:2006). Similarly for tensile splitting and flexural strength each of 3 blocks will be casted and test will be conducted.

3. Conclusion:

- Impact value and crushing value obtained for aggregates obtained from concrete waste were 14.6% and 13.25% which are way better than requirements as per IS recommendations.
- Maximum compression strength of interlocking paver blocks obtained was 30.33MPa after 28 days with 40% debris.
- Maximum flexure strength of interlocking paver blocks obtained was 4.57MPa after 28 days with 50% debris.

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