Application of Demolished Construction Waste For Manufacturing of Green Construction

Mr Gaurav Rajput [1] Prof .Dr R.P Singh Kushwah [2]

1 PG scholar Construction Technology & Management ,Chhatrapati Shivaji Maharaj University

2 Professor Dept of Civil Engg Chhatrapati Shivaji Maharaj University

Abstract

Rapid population growth and fast urbanization, the construction activity also increased. In India, with fast growing constructions, the natural resources are Becoming inadequate to fulfill the needs of construction. Materials like natural sand, coarse aggregate natural available goo clay for bricks have become scarce, resulting in increase in masonry work, concrete work, and overall construction cost. Also, prices of cement, the main binding material, is going in increasing day by day. Interlocking concrete paver blocks by using demolished concrete waste are the new approach for paver construction work with advantageous like good appearance, less motor , no need of finishing and more effective bond they can be more advantageous than conventional paver blocks. In this report, an attempt is made to study the various aspects of interlocking concrete paver blocks by using demolished concrete waste or material. Also, emphasis Is given on the eco-friendly of greenery approach for interlocking concrete paver block.

Keywords; *Construction, Demolish, Waste, Implementation, Paver Block*

I) Introduction:

Construction and Demolition Waste :

Nearness of C and D waste and other idle material like channel residue, residue and coarseness is huge. Non-idle development waste is straightforwardly use for land filling. Reused totals are acquired by smashing of cements from destruction of auxiliary parts in numerous structures, for example, old structures, solid asphalts, extensions, and structures toward the finish of their administration life. C and D waste should be engaged upon considering (1) the possibility to spare normal assets (stone, stream sand, soil, and so on.) and vitality (2) its mass which is extended significant distances for simply

dumping, (3) its consuming huge space at landfill destinations. Usage of C and D waste is very regular in industrialized nations however in India so for, no sorted out exertion has been made. The use of the C and D is important in forthcoming years in developing businesses.

Little steps to make reuse from C and D waste:-

i. C and D waste can be reused and reused in development and limit natural debasement and weight ashore.
ii. Small steps in Delhi have been taken to reuse the reused totals in RMC, asphalt squares, kerb stones and solid blocks.
iii. Processed C and D waste can be utilized for street and dike development. Better evaluation can be formed into squares and sections with fitting cover.

Paver Block:

Concrete paver square was first presented in Holland in the fifties as substitution of paver blocks. This square was rectangular and had a similar size as the blocks. During recent decades, the square shape has consistently advanced from non-interlocking to mostly interlocking to completely interlocking to increase interlocking shapes. Interlocking solid square asphalt (ICBP) comprises of a surface layer of little component, strong unreinforced precast cement paver squares laid on a meager, compacted bedding material which is built over appropriately profile base coarse. Solid clearing square is flexible, stylishly alluring, utilitarian and financially savvy and requires next to zero support if effectively produced and laid. Interlocking solid clearing square innovation has been

presented in India in development, 10 years back, for explicit necessity like pathways, stopping zones, gardens, and so on. An appropriately structure ICBP gives great execution when applied at area where traditional frameworks have lower administration life because of number of land, traffic, natural and operational limitations. Many number of such applications for light, medium, overwhelming , and substantial traffic conditions are presently by and by around the world.

Significance: Construction wastes have become squeezing issue in many creating nations and affect condition, economy, and social viewpoints. In creating urban communities, there is age of value C and D waste from fixes and restoration of structures and from material utilized for giving tasteful view for structures. There is have to reuse this immense measure of waste created. Illegal dumping is basic issue made from physical development waste which needs genuine consideration. we have received one of the powerful approaches to reuse development solid waste

II) Literature Review :

V.A. Dakwale Construction and demolition waste eco bricks of size 230mm*90mm*90mm are developed for six different compositions Amongst the various trials carried out the brick with ratio of binder, fine aggregate and coarse aggregate as1:2.75:2.25exhibitcompressivestrengthand water absorption within the limit so with minimum self-weight. Compressive strength of bricks reduced with increased percentage of fine aggregate Increase in both fine and coarse waste aggregates resulted in reduction in compressive strength by30%.

M.C. Nataraja & Lelin Das " Study on strength properties of paver blocks made from unconventional Material" In this investigation, various properties such as compressive split tensile, bending strength and water absorption of paver blocks consisting of crushed granite, unconventional materials such as Kadapa and broken paver for various percentage replacement of coarse aggregate are studied as per IS 15658:2006.Kadapa aggregates are better than granite aggregates in terms of water absorption limits. Broken paver aggregate is not suitable in making paver blocks as water absorption is more than 7%. However, 50% replacement of paver aggregate with natural aggregate can be used.

Joel Santhosh & Ravikant Talluri "Manufacture of concrete paving blocks With fly ash and glass powder" Different mix proportion is prepared using cement replaced by equal quality of fly ash and waste glass powder. The study indicated that fly ash and waste glass powder can effectively be used as cement replacement without substantial change in strength. Mix design is carried out to form M40 grade of concrete by using IS specification. Tensile splitting strength and abrasion resistance seems to be satisfactory. There is saving in cost of cement and it also reduces burden of dumping fly ash and west glass on earth which is eco-friendly.

Osman gencel, "Marble industry produces large amounts of waste marble. In paving blocks, they have partly replaced aggregate with waste marble. Abrasive resistance of the blocks is strongly influence by their marble aggregate content. Although compressive strength decreases with increasing marble content in concrete, 28 days' strength obtained was satisfactory.

III) Objectives :

i. To study the need of effective utilization of Construction and Demolish Waste
ii. To analysis the physical properties of Ingredients of concrete
iii) To study demolish based concrete and conventional concrete with following test:
    i. Compressive Strength Test
    ii. Water Absorption Test
    iii. Flexural Strength Test
iii. Comparative Study of Conventional concrete paving block and demolish based concrete paying block
iv. To study the cost analysis of new manufactured concrete paying block

IV) Problem Statement: Construction wastes have become squeezing issue in many creating nations and affect condition, economy, and social viewpoints. In creating urban communities, there is age of value C and D waste from fixes and restoration of structures and from material utilized for giving tasteful view for structures. There is have to

reuse this immense measure of waste created. Illegal dumping is basic issue made from physical development waste which needs genuine consideration. We have received one of the powerful approaches to reuse development solid waste

V) Data Collection:

Test Results of Concrete Ingredients

Table1.1 Result of cement tests:

Sr. No.	Test Performed	Results
1	Fineness of cement.	2.86%
2	Standard consistency of cement .	26%
3	Initial setting time.	32 minutes
4	Final setting time.	600 minutes

Result of cement aggregate :

Table 1.2 : Test results of aggregate

Sr. no	Test Performed	Results
1.	Specific gravity of coarse aggregate.	2.13
2.	Water absorption test.	5.21%
3.	Impact value test.	14.6%
4.	Aggregate crushing test	13.25%
5.	Specific gravity of Fine aggregate	2.63

Table No.1.3 : The physical Requirement of 53 Grade Portland concrete IS 12269-2013.

Fineness; specific surface	Should not be less than 225m2/kg
Soundness by Le-ChatelierMethod	Should not exceed 10mm
Setting time Initial set Final set	Should not be less than 30 mts Should not exceed 600 mts

Compressive strength : 3 days 7days 28 days	Should not be less than 27 Mpa Should not be less than 37 Mpa Should not be less than 53 Mpa

Aggregates :

Table No. 1.4 : Size of coarse total for mass cement.

Class and size	IS sieve designation	Percentage
Very large, 150 to 80mm	160mm 80mm	90 to 100 0 to 10
Large , 80 to 40mm	80mm 40mm	90 to 100 0 to 10
Medium, 40 to 20mm	40mm 20mm	90 to 100 0 to 10
Small, 20 to 4.75	20 mm 4.75mm 2.36mm	90 to 100 0 to 10 0 to 2

Table No. 1.5 : Fine Aggregate

IS sieve Designation	Percentage Passing for			
	Grading Zone 1	Grading Zone 2	Grading Zone 3	Grading Zone 4
10 mm	100	100	100	100
4.75 mm	90-100	90-100	90-100	95-100
2.36 mm	60-95	75-100	85-100	95-100
1.18 mm	30-70	55-90	75-100	90-100
600 micron	15-34	35-59	60-79	80-100
300 micron	5-20	8-30	12-40	15-50
150 micron	0-10	0-10	0-10	0-15

Mix Design: Final Mix Proportion **(M 35)** **1: 3.10 :3.71**

- Cement: 261.9 kg
- Water: 157.14 kg

- Fine aggregate : 966.52 kg
- Water-cement ratio: 0.55
- Coarse aggregate : 810.9kg

VI) Data Analysis: Tests on Concrete

Test 1-Compression Test

Table No. 1.6 Compressive Strength Test Results Of Conventional Paver block And Demolished Concrete Waste paver block.

Specimen	Specimen No.	Load (KN)	Apparent Compressive Strength (N/mm^2)	Corrected Compressive Strength (N/mm^2)	Avg. Compressive Strength (N/mm^2)
Conventional Paver block	SC 1	860	23.6	27.848	29.024
	SC 2	880	24.1	28.438	
	SC 3	950	26.09	30.786	
demolished concrete waste paver block	SD 1	690	18.95	22.361	27.766
	SD 2	840	23.07	27.223	
	SD 3	1040	28.57	33.713	

Test 2-Water Absorption Test

Table no.1.7. Water Absorption Test Results Of Conventional Paver Block and Demolished Concrete Waste paver block.

Specimen	Specimen No:	Dry Weight (W_d)	Wet Weight (W_w)	Water Absorption (%)	AverageWater Absorption(%)
Conventional Paver Interlock	SC 1	5.637	5.724	1.54	1.47
	SC 2	5.669	5.756	1.53	
	SC 3	5.716	5.793	1.34	
Paver blockwith demolished concrete waste	SD 1	5.759	5.884	2.17	2.00
	SD 2	5.531	5.635	1.84	
	SD 3	5.557	5.669	2.01	

Test 3- Flexural Strength Test

Table no.1.8 - Flexural Strength Test Results Of Conventional Paver Block Demolished Concrete Waste paver block

Specimen	Specimen No.	Breaking Load (KN)	Flexural Strength (N/mm^2)	Avg. Flexural Strength (N/mm^2)
Conventional Paver block	SC 1	26.8	9.423	9.727
	SC 2	28.2	9.914	
	SC 3	28.0	9.844	
Paver block with demolished concrete waste	SD 1	22.2	7.805	7.594
	SD 2	21.6	7.594	
	SD 3	21.0	7.383	

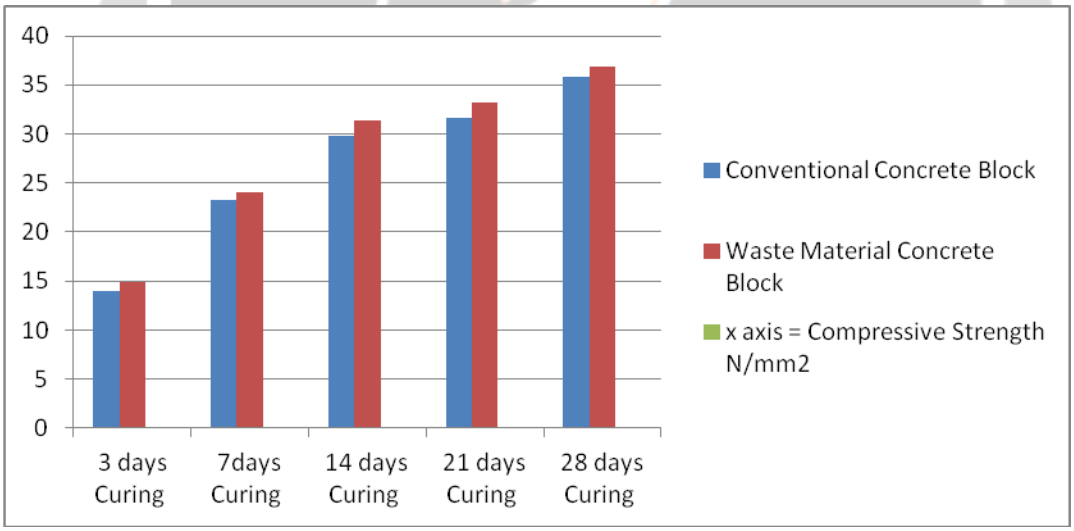
VII) Implementation of Paver Block:

- **Testing of Concrete Paving block:** The paving block tested under CTM with standard conditions the results as follows:

- **Comparison between the Compressive Strength of Conventional Paving Concrete Block and Waste material Concrete Paving block :**Following comparison shows that replacement and addition of waste material fly ash, glass powder, sisal fibers, tends to help to maintain and significant increase in the compressive strength of concrete paving block, which can save the significant amount of natural material like sand and cement also it is prove that use of Waste Materials can leads to increase the compressive strength of concrete paving block.

Table No 1.9 Comparison between Conventional Paving Concrete Block and Waste material Concrete Paving block

SrNo.	Days	Comp.Strength (N/mm^2)	
		Conventional Paving Blocks	Waste material paving Blocks
1.	3 Days	14.01	14.89
2.	7Days	23.32	24.01
3.	14 Days	29.81	31.39
4.	21 Days	31.68	33.23
5.	28 Days	35.83	36.91



(GRAPH No 1.1 : Comparative study)

ABRASION RESISTANCE TEST (IS 15658:2006)

The objective of the abrasion test is to screen out products that might cause excessive wear to the pumps at air tanker bases due to their abrasiveness. The abrasion resistance of concrete pavements is a surface property that is mainly dependent on the quality of the surface layer characteristics. The top 3-5 mm is the most important part of the abrasion resistance of the concrete product. Sample size with 70.6 x 70.6 mm surface properly dries in oven at temperature of 1100C was placed on disc rotating at 30 rpm with constant load of 300N and 20 gram abrasive powder uniformly spread over disc at end of predefined constant revolution 22 and repeated for total 220 revolutions with 9 breaks. The wear shall be determined from the difference in readings obtained by the measuring instrument

before and after the abrasion of the specimen. The value shall be checked up with the average loss in thickness of the specimen obtained by the following formula.

T= ((W1-W2)*V1)/(W1*A)

Where, t = average loss in thickness in mm,

W1 = initial mass of the specimen in gm.

W2 = final mass of the abraded specimen in gm.

V1 = initial volume of the specimen in mm3

A = surface area of the specimen in mm2

(Table No 1.10: Abrasion Resistance Tests Results)

Type of Paving Block	Loss in Thickness (mm)	Mean (mm)
28 days Curing (Conventional Concrete)	1.32	1.32
	1.30	
	1.34	
28 days Curing (Modified Concrete)	1.29	1.31
	1.31	
	1.33	

The value of abrasion resistance is very minimum which is limit of IS 15658-2

Materials required & their rates

Water required for manufacturing of paving blocks, will be available at site in sufficient amount.

1) Cement : Rs 350 / Bag (50Kg)
2) Crushed Sand : Rs 3100 / Brass
3) Coarse Aggregate : Rs 3200 / Brass
4) Fly Ash : Rs 1 / Kg
5) Waste Glass: Free of cost.
6) Waste Materials Free of cost (Except cost required for extraction of Fibers.)

Normal Concrete Paving Block

(Table No 4.12: Cost Analysis of Conventional Concrete Paving Block)

Materials	Cost of Materials	Materials required for each paving block	Cost
Cement	Rs 350 / Bag	780.12 gm	2.50/-
Crushed Sand	Rs 3100 / Brass	1830 gm	0.78/-
Coarse Aggregate	Rs 3200 / Brass	1470 gm	0.63/-
Labour Charges	Rs 1 / Block	5 Labours	5.0/-
Equipment Charges	Rs 1 / Block	-	1.0/-
TOTAL			**10/-**

Manufacturing cost of single conventional paving block is Rs 10/-

Paving Blocks By Using Waste

(Table No 4.14 Cost Analysis of Modify Concrete Paving Block)

Materials	Cost of Materials	Materials required for each paving block	Cost
Cement	Rs 350 / Bag	664.07gm	2.10/-
Waste Material Expenses	0.80	NA	0.80
Labour Charges	Rs 1 / Block	5 labours	5.0/-
Equipment Charges	Rs 1 / Block	-	1.0/-
TOTAL			**9/-**

Manufacturing cost of single conventional paving block is Rs 9/-

VIII) Conclusion:

Proper management and recycling of construction and demolition waste contribute to public health and safety. It minimizes the risks associated with hazardous materials, like asbestos or lead-based paint, by ensuring their proper removal and disposal. By controlling the disposal of waste materials, we can reduce the potential for pollution and protect the well-being of communities. In conclusion, construction and demolition waste recycling offers a wide range of benefits. It helps preserve natural resources, reduces waste, conserves energy, supports the economy,

promotes sustainability, and enhances public health and safety. Embracing recycling practices in the construction industry is crucial for a more sustainable and resilient future.

Experimental Analysis Conclude that

i. Construction waste management is the aspect which is going to help the country to develop in a sustainable manner.
ii. Applying waste management theories will reduce issues related to the environment, social and also gives economic benefits.
iii. Finally we can conclude that the paver blocks prepared using M35 grade of concrete and 10% replacement of coarse Aggregate can be used for pedestrian plazas, car parks, office complexes, rural roads with low volume traffic, residential roads, housing colonized.
iv. Compressive Strength Of Conventional Paver block compare with With Demolished Concrete Waste paver block is 29.024 N/mm^2
v. Water Absorption Of Conventional Paver block compare with With Demolished Concrete Waste paver block is 1.47 %.
vi. Flexural Strength Of Conventional Paver block compare with With Demolished Concrete Waste paver block is 9.727 N/mm^2

vii. . Research conclude that up to 10% of cost can be reduces by using the waste materials.

It has been concluded that by effective utilization of construction and demolition waste for manufacturing paver blocks which is sustainable and cost effective. This way the C&D waste can be utilization effectively helps in reducing the exploitation of the natural resources which will help in achieving the sustainable development goals in construction industry

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