Manufacturing of Interlocking Blocks in Compound Wall Using Construction and Demolition Waste

AKHILA E

M.E, Construction Engineering and Management
Shree Venkateshwara Hi-tech Engineering College
Othakuthirai, Gobi.

***Abstract*- Waste from construction and demolition projects is the most significant and harmful pollution that exists today. Indian construction and demolition (C&D) waste production is anticipated to be 150 million tons per year, according to the Building Material Promotion Council (BMPTC). At many landfill sites across the world, construction and demolition (C and D) debris frequently accounts up 10 to 30 percent of the waste received. This study involves creating compound walls out of leftover materials from building and demolition. goal is to evaluate how well construction and demolished (C&D) concrete debris is used in interlocking compound walls.**

***Index Terms*- C & D waste**

1.INTRODUCTION

The construction or demolition work such as building a bridge, a road, a flyover, a mall, or widening or construction of a road results in huge waste. Concrete, plaster, metal, plastics, and other inert and non-biodegradable materials make up the majority of C and D garbage. These wastes are large and bulky, taking up a lot of area along the sides of the road. Recent recognition of the potential for diversion of waste components from landfill has laid. C&D waste becoming a topic of interest for recycling. It can be used as recycle aggregate for concrete. The aim of this project is to construct an interlocking compound wall using construction and demolition waste.

1.1 NEED OF THE STUDY

- To comply with policy, legislation, and regulation on waste management such as disposal.
- To provide an economical alternative to the C&D industry for land-based disposal, as recycling is more sustainable, and the cost of landfilling is increasing.
- To eliminate illegal dumping and associated negative impacts on the landscape, especially in rural areas.
- To control waste disposal thereby reducing the transportation costs.
- To conserve natural resources and reduce our dependency on materials.
- To reduce the volumes of waste being diverted to landfill.

1.2 SCOPE OF THE STUDY

- To suggest an effective method for usage of construction and demolition waste.
- To evaluate effects of interlocking structures in

1.3 LITERATURE REVIEW

Wherever Times is specified, Times Roman or Times New Roman may be used. If neither is available on your word processor, please use the font closest in appearance to Times. Avoid using bit-mapped fonts. True Type 1 or Open Type fonts are required. Please embed all fonts, in particular symbol fonts, as well, for math, etc.

2. METHODOLOGY

Methodology consists of the following steps:

1. Mold Preparation: Prepare molds with specified dimensions for casting interlocking bricks.
2. Material Collection and Selection: Collect Construction and Demolition (C&D) waste and select normal aggregate, sand, and cement according to predefined criteria.
3. Laboratory Testing: Conduct laboratory tests on both C&D waste and the standard aggregate-sand-cement mixture to evaluate their properties.
4. Casting of Interlocking Bricks: Cast interlocking bricks using C&D waste and a conventional mix of aggregate, sand, and cement.
5. Brick Testing: Perform compression tests on the interlocking bricks from both sets.
6. Comparison of Both Blocks: Analyze and compare the test results between the bricks made from C&D waste and those made from traditional materials.
7. Benefit and Defect Analysis: Assess the benefits and drawbacks of using C&D waste in interlocking brick production, considering environmental and economic factors

3.TESTS CONDUCTED

3.1 TEST ON CEMENT

1. **Consistency Test**: The consistency test, also known as the Vicat test, is designed to determine the water content required to produce a cement paste of standard consistency. The test involves measuring the penetration of a Vicat plunger into a cement paste under specified conditions. The consistency of the cement paste is indicative of its workability and ability to form a cohesive mixture with aggregates. It influences factors such as the ease of handling and placement of concrete. A cement paste with the right consistency ensures uniform distribution of water and aggregates, leading to a strong and durable concrete mix.
2. **Setting Time Test**: The setting time of cement is a critical property that determines the time frame within which the cement paste changes from a plastic, workable state to a rigid, hardened state. This test is conducted using a Vicat apparatus or Gillmore needles and involves monitoring the time at which the initial and final setting occur. The initial setting time is the point at which the cement paste loses its plasticity, making it unsuitable for further manipulation. The final setting time marks the moment when the cement paste achieves its ultimate hardness and can support loads. Understanding the setting time of cement is crucial for ensuring that construction activities such as placing, finishing, and curing are performed within the appropriate time window.

3.2 TEST ON AGGREGATE

Specific Gravity Test: The specific gravity of an aggregate is a measure of its density relative to the density of water. It is determined by comparing the weight of a given volume of the aggregate to the weight of an equal volume of water. The specific gravity of fine and coarse aggregates is typically determined using the displacement method or the pycnometer method. The results of the test provide valuable information about the aggregate's porosity, permeability, and moisture absorption capacity.

3.3 TEST ON C & D WASTES

Specific Gravity Test: The specific gravity of an aggregate is determined by comparing the weight of a given volume of the aggregate to the weight of an equal volume of water. This test can be performed using the displacement method or the pycnometer method. For C&D waste aggregates, understanding their specific gravity is crucial for assessing their suitability as replacements for conventional aggregates in concrete and other construction materials.

3.4 TEST ON NORMAL CONCRETE MIX AND CONCRETE MIX WITH C & D WASTE

Slump test

The slump test involves assessing the "slump" or deformation of a freshly mixed concrete sample when subjected to controlled conditions. A standard conical mold is filled with freshly mixed concrete in layers and compacted using a specific rod. After removing the mold, the concrete naturally slumps, and the reduction in height from the original mold is measured. This value, known as the "slump," quantifies the workability and consistency of the concrete mix.

3.5 TEST ON INTERLOCKING BRICKS

Compression testing involves subjecting a C&D waste brick to an increasing axial load until it fails. This test is typically performed using a hydraulic testing machine. The results of the test provide crucial information about the brick's compressive strength, which is the maximum load the brick can withstand before failure. The test also reveals the brick's load-deformation behavior, helping to assess its structural performance under load.

RESULTS AND DISCUSSIONS

1. CONSISTENCY TEST

Table 1. Consistency Values

TRIAL	CEMENT (gm)	WATER%	PENETRATION IN mm
1	250	28 (70ml)	32
2	250	30 (75ml)	11
3	250	32 (80ml)	6
4	250	34 (85ml)	5

2. SETTING TIME TEST

Initial setting time = 35 minutes
Final setting time = 452 minutes

3.SPECIFIC GRAVITY TEST ON FINE AGGREGATE

Apparent specific gravity = (Weight of dry sample/Weight of equal volume of water)
=D/C-(A-B)
=2.64

Water absorption of Aggregate =C-D/D *100
=0.80%

4.SPECIFIC GRAVITY TEST ON COARSE AGGREGATE

Apparent specific gravity = (Weight of dry sample/Weight of equal volume of water)
=D/C-(A-B)
= 2.64

Water absorption of Aggregate = C-D/D *100
= 0.81%

5. SPECIFIC GRAVITY TEST ON C& D WASTE FINE AGGREGATE

Apparent specific gravity = (Weight of dry sample/Weight of equal volume of water)
= D/C-(A-B)
= 2.660

Water absorption of Aggregate = C-D/D *100
= 0.80%

6. SPECIFIC GRAVITY TEST ON C& D WASTE COARSE AGGREGATE

Apparent specific gravity = (Weight of dry sample/Weight of equal volume of water)
= D/C-(A-B)
= 2.4

Water absorption of Coarse Aggregate = C-D/D *100
= 0.89%

7. SIEVE ANALYISIS

Table 2. particle distribution of c and d

SIEVE SIZE mm	**WEIGHT RETAINED gm**	**PERCENTAGE WEIGHT RETAINED**	**CUMILATIVE PERCENTAGE WEIGHT**	**PERCENTAGE FINER**
4.75	4	0.4	0.4	99.6
2.36	55	5.5	5.9	94.1
1.18	112	11.2	17.1	82.9
0.6	190	19	36.1	63.9
0.3	325	32.5	68.6	31.4
0.15	174	17.4	86	14
0.075	131	13.1	99.1	0.9
Residue	9	0.9	100	0

8. COMPRESSION TEST ON INTERLOCKING BRICKS

Table 3. compression test value

BRICK WITH C AND D	**7 DAY (N/mm^2)**	**28 DAY (N/mm^2)**
SAMPLE 1	13.88	16.40
SAMPLE 2	13.86	16.5
SAMPLE 3	13.9	16.41

CONCLUSION

In conclusion, this study underscores the potential of repurposing C&D waste into interlocking blocks as a sustainable and economically viable construction solution. It not only contributes to the reduction of landfill space consumption but also offers a practical way to address the environmental challenges posed by the ever-increasing volume of C&D waste. Further research and development in this field can pave the way for more extensive adoption of C&D waste-based building materials, facilitating sustainable construction practices and promoting responsible resource utilization in the construction industry.

REFERENCES:

1. Abdul Latif Hamid, Amit D. Raval, Dr.Jayeshkumar R. Pitroda -A Review Paper on Construction and Demolition Waste Management (2019).
2. Adriano Frutuoso da Silva Gilvan de Jesus Santos, Joel Carlos Moizinho,Yanna Carla Frutuoso de Araujo- Recycling of construction and demolition waste as aggregate for pavement block production(2018).
3. Akaninyene A. Umoh- Recycling demolition waste sandcrete blocks as aggregate in concrete (2012).
4. Akash Kumar, Vishal V Panchal, Vinayak B Kulkarni, Avadhut Kulkarni - Use of Construction Demolition Waste in Pavement (2017).
5. Alejandra Vidales Barriguete, Carolina Piña Ramírez, veronica Vitiello, Mercedes del Río Merino, Paola Villoria Sáez- Construction and demolition waste as drainage in landscaped roofs. (2020)
6. Amin Al-Fakih, Bashar S Mohammed1, Fadhil Nuruddin, and Ehsan Nikbakht Department of Civil and Environmental Engineering, University Technology PETRONAS(UTP), Tronoh,Perak- Malayasia Development of Interlocking Masonry Bricks and its Structural Behaviour:ReviewPaper
7. Amit Krishan, Mohit Agarwal -Reusability of Construction & Demolition waste in bricks (2017)
8. Andrea Campioli, Serena Giorgi, Monica Lavagna - Guidelines for Effective and Sustainable Recycling of Construction and Demolition Waste (2018).
9. Ashish Patil Dr. Ajay Dhake-Design and Analysis of Structural precast Interlocking Blocks for Retaining Wall
10. Avindana John, Dr.Suhil Kumar Mittal, N.K Dhapekar - Applicability of Construction and Demolition Waste Concrete in Construction Sector – Review
11. Bhadangr P M, Bhosale N M, Kokare D R, Yeotikar V U, Kulkarni G A, and Sayeed Nadeem - Experimental study on bricks by using Demolished construction materials. (2018)
12. Carlos Hoffmann Sampaio, Weslei Monteiro Ambrós , Bogdan Grigore Cazacliu, Josep Oliva Moncunill , Moacir Medeiros Veras , Gérson Luis Miltzarek , Luis F. O. Silva , Ariane Salvador Kuerten and Maria Alejandra Liendo - Construction and Demolition Waste Recycling through Conventional Jig, Air Jig, and Sensor-Based Sorting: A Comparison.(2021)
13. Dinesh Kumar Malviya, Madan Chandra Maurya- Recycled C&D waste- An energy efficient and sustainable construction material (2021)
14. Gasingwa Noel, Mbereyaho Leopold,Ntitanguranwa Jeanpaual, Kabano James - Reuse of construction and demolished concrete waste in producing strong and affordable concrete blocks (2018)
15. Itad Shiboub -A System Dynamic Model for Sustainable Construction and Demolition Waste Recycling in Libya (2019)
16. Jose Kurian, Shishir Bansal, S K Singh- Construction & demolition (C&D) waste recycling in New Delhi (2014)
17. Juan A. Ferriz - Papi, Simon Thomas -Recycled aggregates from construction and demolition waste in the production of concrete blocks
18. Kamlesh V. Madavi, Ramesh D. Dod- Management of Construction & Demolition Waste in Pune City (2019).
19. Merhan M. Shahda1, Nancy M. Badawy- Recycling Concept Starts from the Design Stage: Five Architectural Applications based on the Reuse of Construction and Demolition Waste (2019)
20. Patrick J. Dolan, Richard G. Lampo, and Jacqueline C. Dearborn- Concepts for Reuse and Recycling of Construction and Demolition Waste (1999)
21. Salman Shooshtarian, Savindi Caldera, Tayyab Maqsood and Tim Ryley- Using Recycled Construction and Demolition Waste Products: A Review of Stakeholders' Perceptions, Decisions, and Motivations (2020).
22. Shahiron Shahidana, Mohamad Azim Mohammad Azmib, Kumanan Kupusamyc Sharifah Salwa Mohd Zukid , Noorwirdawati Alie- Utilizing Construction and Demolition (C&D) Waste as Recycled Aggregates (RA) in Concrete(2017).
23. Shivam Gupta and Rachit Khandelwal -Utilization of Construction & Demolition Waste in Road Sector (2015).
24. Stefania Butera, Thomas H. Christensen, Thomas F. Astrup - Life cycle assessment of construction and demolition waste management (2015).
25. Tomas U. Ganiron Jr- Recycling Concrete Debris from Construction and Demolition Waste (2015).