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Investigation on Sandwiched Wall Panel with Lightweight Concrete Using Bloated Clay

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Abstract: This research focuses on the development of lightweight sandwich wall panels using Bloated Clay Aggregate (BCA) as a partial replacement for coarse aggregate in M30 grade concrete. The study evaluates mechanical properties such as compressive strength, split tensile strength, and flexural behavior. The use of BCA reduced the weight of concrete, improved workability, and enhanced ductility. The optimum performance was observed at 35% BCA replacement, proving it suitable for prefabricated and sustainable wall systems.

Keywords: *Bloated Clay, Lightweight Concrete, Sandwich Panel, Structural Performance, Flexural Strength.*

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I. INTRODUCTION

Concrete remains the most widely used construction material due to its durability and strength. However, its high self-weight limits its application in modular and lightweight construction. Lightweight concrete using alternative aggregates such as Bloated Clay helps in reducing dead load while maintaining necessary strength. Sandwich wall panels combine structural and thermal insulation functions, making them ideal for modern construction systems.

II. LITERATURE REVIEW

Swathi Arivalagan et al. (2018) reported that LECA improved thermal insulation and structural performance. A.M. Rashad (2018) described LECA as an effective lightweight aggregate, improving workability, ductility, and energy efficiency. Studies suggest that optimal replacement of coarse aggregate with BCA ranges between 30% and 40%.

III. OBJECTIVES

- To develop lightweight concrete panels using BCA
- To determine the optimum BCA replacement percentage
- To evaluate mechanical behavior through experimental investigation
- To propose BCA panels for prefabricated and seismic-resistant structures

IV. MATERIALS AND METHODS

Materials used include Ordinary Portland Cement (53 grade), river sand, granite aggregate, and Bloated Clay. Water-cement ratio was kept at 0.5. Specimens were prepared in cube, prism, and sandwich panel forms. Tests were conducted as per IS 10262:2019 and IS 456:2000 guidelines.

V. MIX DESIGN

The mix was designed for M30 grade concrete with fixed cement content of 394 kg/m³. BCA replaced coarse aggregates at 0%, 30%, 35%, 40%, and 45% levels.

Water-cement ratio was maintained at 0.5.

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Table 1: Mix Proportions for Different BCA Replacement Levels

% BCA	Cement (kg/ m³)	Fine Agg. (kg/ m³)	Coarse Agg. (kg/ m³)	BCA (kg/ m³)	Water(kg/ m³)
0%	394	615	1135.3	0	197
30%	394	615	794.7	340.6	197
35%	394	615	738	398	197
40%	394	615	681.2	454	197
45%	394	615	625	511	197

VI. EXPERIMENTAL INVESTIGATION

The experimental program consisted of casting and testing cubes, cylinders, beams, and full-scale sandwich panels. Tests included slump test, compressive strength (cube test), split tensile (cylinder), and flexural strength (prism). Panel behavior was studied using load– deflection setup as per IS standards. Maximum performance was observed at 35% BCA replacement.

VII. RESULTS AND DISCUSSION

Slump Test: Increased with higher BCA content (62 mm at 0% to 79 mm at45%) Compressive Strength: Peak strength observed at 35% BCA (39.48 MPa). Split Tensile Strength: Maximum 5.39 MPa at 45%, though 35% provided the best overall performance.

Flexural Strength: Increased with BCA content; 35% showed balanced workability and strength.

Panel Test: Load-deflection behavior improved with BCA due to lower density and better energy absorption.

VIII. CONCLUSION

Bloated Clay Aggregate proved to be a beneficial lightweight material in sandwich wall panels. At 35% replacement, the panels exhibited optimum mechanical behavior and ductility. This mix design is suitable for prefabricated, energy-efficient, and seismic-resistant structural applications.

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