To Evaluate Effect of Fine Aggregate Replacement by Combining Steel Slag & Fly Ash in Brick

Saurabh Doke [*1], Yash Gomase [*2], Aakash Jadhav[*3] ,Prof.Y.P.Pawar[*4]

[*1]Student, Department of Civil Engineering, SKN Sinhgad College of Engineering Korti, Pandharpur, Maharashtra, India

[*2]Student, Department of Civil Engineering, SKN Sinhgad College of Engineering Korti, Pandharpur, Maharashtra, India

[*3]Student, Department of Civil Engineering, SKN Sinhgad College of Engineering Korti, Pandharpur, Maharashtra, India

[*4]Assistant Professor, Department of Civil Engineering, SKN Sinhgad College of Engineering Korti, Pandharpur, Maharashtra, India

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Abstract - This research explores the potential of using steel slag and fly ash as partial substitutes for natural fine aggregates in the manufacturing of bricks. The study focuses on assessing how this substitution affects key brick characteristics, including compressive strength, water absorption, and overall durability. Steel slag and fly ash, recognized for their cementitious and pozzolanic behavior, were integrated in different ratios to identify the most effective blend. The findings reveal that incorporating these industrial by-products can improve certain performance aspects of the bricks while also supporting environmental sustainability by lowering the consumption of natural raw materials and reducing industrial waste.

Keywords: Sustainable construction, Eco-friendly materials, Industrial waste utilization.

1. INTRODUCTION

The construction industry heavily relies on natural resources, particularly materials like clay and sand, which are widely used in the production of bricks and concrete. This extensive extraction not only exhausts non-renewable resources but also contributes to significant environmental harm. As the demand for sustainable and eco-conscious building solutions grows, there is increasing interest in the use of industrial waste products as partial replacements for conventional materials.

Steel slag, a residual product from steelmaking, and fly ash, produced from coal combustion in thermal power stations, have demonstrated promising potential in this regard due to their pozzolanic and binding properties. Typically classified as industrial waste, these materials pose environmental disposal issues. However, repurposing them in construction offers a dual advantage: reducing environmental pollution and supporting the development of sustainable building practices.

2. Body of Paper

Table -1: Sample Table format

Compressive strength 7 (N/mm²)			
Sr.No	7th day	14th day	28th day
1	5.6	6.9	9.5
2	4.5	5.8	8.6
3	4.3	5.5	8.4
4	4.4	5.5	8.3

The compressive strength increased with moderate replacement levels. Mix B (30% steel slag + 15% fly ash) exhibited the highest strength, surpassing the control mix. This improvement is attributed to the of fly ash and the angular particle shape of steel slag, which enhances bonding and densifies the matrix. However, beyond 60% replacement (Mix C and D), strength declined slightly due to excess unreacted material and reduced bonding effectiveness.

Fig -1: Figure

3. CONCLUSIONS

This study demonstrates that partially replacing natural fine aggregate with steel slag and fly ash in brick production can significantly enhance the material's properties while contributing to environmental sustainability. Among the various mix designs tested, the combination of 30% steel slag and 15% fly ash yielded the most favorable results in terms of compressive strength, reduced water absorption, and improved resistance to acid attack.

ACKNOWLEDGEMENT

Water Absorption:-

Water absorption decreased in mixes with up to 45% replacement, indicating better compactness and lower porosity. Mix B again demonstrated optimal results. Higher replacement levels (Mix C and D) showed a marginal increase in water absorption, likely due to the higher surface area and porosity of the by-products used.

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BIOGRAPHIES (Optional not mandatory)

1'st Author Photo

Description about the author1 (in 5-6 lines)