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Review of the Research on Multi-Blended Concrete using Fly Ash, M Sand, and Recycled Coarse Aggregate in Concrete

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ABSTRACT: The study looks at the characteristics and performance of multi-blended concrete with recycled coarse aggregate, manufactured sand (M sand), and fly ash. The goal is to understand how these elements influence the properties of coarse and fine aggregates, as well as cement in concrete compositions. Recycled Coarse Aggregate: This material comes from demolished concrete constructions. Its application helps reduce waste and the environmental impact of concrete production. Manufactured sand is created by crushing rocks and stones. It is used as a fine aggregate replacement for natural sand, which is becoming scarce in many areas. Fly ash, a byproduct of coal combustion in power plants, can improve the durability and workability of concrete while using less cement. To make diverse concrete blends, recycled coarse aggregate, M sand, and fly ash are combined with regular cement in varying quantities. The resulting concrete mixtures are evaluated for compressive strength, workability, durability, and other mechanical characteristics.

KEYWORDS: recycled coarse aggregate, M sand, and fly ash, compressive strength, split tensile strength, analysis.

I.INTRODUCTION

Concrete is used in the construction of the majority of buildings worldwide. Coarse aggregate makes up a large portion of concrete, and because natural aggregates are used so frequently, there may be a shortage of the aggregate. To combat these recycled aggregates are used, which is a problem. The majority of the structures are in a condition of deterioration as a result of environmental issues including earthquakes, floods, cyclones, etc., as well as poor upkeep. After that, the buildings are either renovated or demolished. This waste accumulates the majority of open spaces to address this difficulty aggregates are recovered from concrete debris and they are utilized as a replacement for the natural aggregates [1-5]. In concrete, recycled aggregates can be a good substitute for natural aggregates [8]. Because there is less connection between the cement matrix and aggregate particles extra materials are added to create a bond recycled aggregates have lower strength than traditional concrete. Fly ash-based concrete has a lower initial strength [10]. Many laboratory research employs fly ash, M sand, and recycled coarse aggregates individually [11].

II.LITERATURE REVIEW

Adeyemi Adesina, Paul O.Awoyera (2022)

Recycled aggregates have been increasingly considered for use in concrete, owing to the limited supply of natural aggregates coupled with the corresponding carbon footprint. However, despite the sustainability benefits of using recycled aggregates in concrete, its use in concrete is plagued with lower performance due to the physical properties of the recycled aggregates. One of the effective ways to improve the performance of concrete incorporating recycled aggregates is with the incorporation of fly ash (FA) which is also waste material. In this chapter the effect of FA on the mechanical properties of concrete incorporating recycled aggregates has been discussed. With the incorporation of FA in the recycled aggregate concrete mixture, various properties are enhanced, owing to the filler effects and pozzolanic reactivity of FA. Microspores in concrete are filled up with fine particles, and thus ensuring low permeability in the matrix as a result of the improved concrete microstructure.

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G. Amadi*, H. Beushausen and M.G. Alexander (2022)

"Multi-Technique Approach to Enhance the Properties of Fine Recycled Aggregate Concrete" This study investigated the properties of fine recycled aggregates (FRA), with a view to enhancing their properties for structural concrete applications. The study explored several approaches including mixing; curing; systematic screening of FRA particles below 1.18mm to reduce the adhered cement paste (ACP) content; and the use of fly ash as 30% cement replacement to modify the microstructure of FRA concrete. To test these approaches, two series of concrete mixes were prepared at 0.45 and 0.55 w/b ratio, with FRA replacing natural sand at 0, 25, and 50% by mass, and tests were carried out after 3, 28, and 180 days of curing. Results show that the combination of ACP reduction and fly ash treatment significantly enhanced the compressive strength and elastic modulus of FRA concrete, especially at 180 days, through microstructure modification and pozzolanic reactions.

Katarzyna Kalinowska-Wichrowska (2022)

"The Performance of Concrete Made with Secondary Products—Recycled Coarse Aggregates, Recycled Cement Mortar, and Fly Ash–Slag Mix" The properties of cement concrete using waste materials—namely, recycled cement mortar, fly ash–slag, and recycled concrete aggregate—are presented. A treatment process for waste materials is proposed. Two research experiments were conducted. In the first, concretes were made with fly ash–slag mix (FAS) and recycled cement mortar (RCM) as additions. The most favorable content of the concrete additive in the form of RCM and FAS was determined experimentally, and their influence on the physical and mechanical properties of concrete was established. For this purpose, 10 test series were carried out according to the experimental plan. In the second study, concretes containing FAS–RCM and recycled concrete aggregate (RCA) as a 30% replacement of natural aggregate (NA) were prepared. The compressive strength, frost resistance, water absorption, volume density, thermal conductivity, and microstructure were researched. The test results show that the addition of FAS–RCM and RCA can produce composites with better physical and mechanical properties compared with concrete made only of natural raw materials and cement. The detailed results show that FAS–RCM can be a valuable substitute for cement and RCA as a replacement for natural aggregates. Compared with traditional cement concretes, concretes made of FAS, RCM, and RCA are characterized by a higher compressive strength: 7% higher in the case of 30% replacement of NA by RCA with the additional use of the innovative FAS–RCM additive as 30% of the cement mass.

Peem Nuaklonga Et al. (September 2021)

In this study, the micro carbon fiber (CF) was used to enhance the mechanical properties of fly ash geopolymer containing fine recycled concrete aggregate (RCA). Natural river sand was replaced with RCA at 0, 50, and 100% by volume. The CF was used as additive material by incorporating into the mixture at 0, 0.1, 0.2, and 0.3% by weight of fly ash. The results showed that the CF enhanced the mechanical properties of geopolymer containing RCA through the increased nucleation sites for geopolymerization reaction and the bridging effect of the fiber. For the mix with 100% RCA, the incorporation of 0.2% CF resulted geopolymer mortar with higher compressive and splitting tensile strengths. For the flexural strength and surface abrasion resistance, best results were obtained with the use of 50%RCA with significant improvement in both flexural strength and surface abrasion resistance. The incorporation of CF thus increases the use of recycled fine aggregate without resort to natural fine aggregate.

Ripunjoy Gogoi, Divyah Nagarajan (june 2021)

The main purpose of this study was to evaluate fresh properties and mechanical characteristics of Glass fiber reinforced concrete (GR) containing Recycled aggregate and Fly Ash. It was utilized to replace Ordinary Portland Cement material at different percentages of 5, 10, 15, 20, and 25%. Glass fibers (6 mm length) have been incorporated in two different volume fractions of 0.5 and 1%. Experimental results proved that the addition of fly ash in concrete mixes decreased compressive strength test results at early ages; on the other hand, strength increased at later ages with reference mixes. The replacement of fly ash also showed decreased sorptivity, water absorption value, and increased acid resistance compared to control mixes. incorporation of glass fiber improved compressive strength test results of GR; however, fiber inclusion decreased fresh properties of GR mixes. Besides, Scanning Electronic Microscopic analysis studies of GR with optimum fiber content and fly ash recommended development of C-S-H gel and cementitious compounds as an effect of reaction between flyash, recycled aggregate, and cement. experimental results showed that utilization of concrete prepared with fly ash and recycled aggregate is more suitable for sustainable construction & green concrete block production industry beyond economic benefits.

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Zhuo Tanga,Wengui Lia Vivian,W.Y.Tamb and Zhiyu Luoa March (2020)

By harnessing the benefits from both construction and demolition waste recycling and geopolymer binders, geopolymeric recycled aggregate concrete (GRAC) can contribute to the green and eco-friendly construction material products. In this study, the compressive behavior of GRAC based on fly ash and slag was experimentally investigated under both quasi-static and dynamic loadings. Quasi-static compressive tests were performed by using a high-force servo-hydraulic test system, while dynamic compressive tests were carried out by using a Ø80-mm split Hopkinson pressure bar (SHPB) apparatus. The compressive properties of GRAC under dynamic loading, including stress-strain curves, energy absorption capability, and failure modes were obtained and compared with those under quasi-static loading. The results show that the compressive properties of GRAC exhibit a strong strain rate dependency.

III.METHODOLOGY OF PROPOSED SURVEY

The proposed survey aims to investigate the properties and performance of multi-blended concrete incorporating recycled coarse aggregate, manufactured sand (M sand), and fly ash. This methodology outlines the steps necessary to conduct a comprehensive study, focusing on the effects of these materials on concrete's mechanical and durability characteristics.

1. Literature Review

   Before conducting the survey, a thorough literature review will be performed to gather existing knowledge on:

2. Material Selection

   Recycled Coarse Aggregate
   Source recycled aggregates from construction and demolition waste.
   Ensure that the aggregates meet relevant standards (e.g., ASTM C33).
   Manufactured Sand (M Sand) Obtain M sand from local suppliers, ensuring it meets specifications for fine aggregates (e.g., IS 383).
   Fly Ash

3. Mix Design

   Develop various concrete mix designs incorporating different proportions of:

4. Experimental Setup

   Sample Preparation
   Prepare concrete samples using standard mixing methods.
   Cast specimens in molds for various tests (cylinders for compressive strength, beams for flexural strength).
   Curing ;Cure samples under controlled conditions (temperature, humidity) for specified durations (7, 14, and 28 days).

5. Testing Procedures ;Conduct a series of tests to evaluate the properties of the multi-blended concrete:
   Mechanical Properties
   Compressive Strength: Test using a universal testing machine according to ASTM C39.
   Flexural Strength: Perform tests following ASTM C78 standards.
   Tensile Strength: Use split-cylinder tests per ASTM C496.
   Durability Tests Water Absorption: Measure absorption rates following ASTM C642.

6. Data Analysis ; Analyze collected data using statistical methods.

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Figure 1: Mix concrete

IV.CONCLUSION AND FUTURE WORK

1. In this paper, The effectiveness of recycled coarse aggregate in improving or compromising mechanical properties.
2. The impact of M sand on workability and strength characteristics compared to natural sand.
3. The role of fly ash in enhancing durability while reducing environmental impact through lower cement usage.
4. Optimal mix designs that achieve desired performance criteria.
5. Recommendations for practical applications in construction practices involving sustainable materials.

REFERENCES

[1] Manik Goyal, Hinoni Goyal, 2018, International Journal of Engineering Research & Technology (IJERT), Volume 6, Issue 11,.
[2] Ashraf M.Wagih et al, 2013, Housing and Building National Research Center (HBRC) journal, 9, 193-200.
[3] Khan A. R et al, 2017, Fifth International Conference on Sustainable Construction Materials and Technologies.
[4] Er. Rajdeep Singh and Er. Gurtej Singh, 2013, International Journal of Engineering Research & Technology (IJERT), ISSN: 2278-0181, Volume 2, Issue 11.
[5] Katrina McNeil and Thomas H.K. Kang, 2013, International Journal of Concrete Structures and Materials, Volume 7, No.1, pp.61-69.
[6] Ashish Sherimali et al., 2017, International Journal of Engineering Research and Application ISSN: 2248-9622, Vol. 7, Issue 1, (part-5), pp.72-79.
[7]BLN Sai Srinath et al, 2021, International Journal of Mechanical Engineering, ISSN: 0974-5823, Vol.6 No.3.
[8] Vivek K. Viswanath et al, 2020, International Journal of Engineering and Advanced Technology (IJEAT), ISSN: 2249-8958 (online), Vol-9 Issue-6.

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