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Behavior of Recycled Aggregate Concrete with Hybrid Fiber and Micro Silica in Flexure

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Abstract - - *Mongrel fiber corroborated concrete is the use of two or further than two filaments in a single concrete matrix to ameliorate overall parcels of concrete. In well-designed mongrel mixes, there's positive commerce between the filaments and the performing mongrel performance exceeds the sum of individual fiber performances. Among all the used filaments presently, cold-blooded fibre has high elastic modulus and stiffness and therefore the addition of sword fibre is effective for perfecting the parcels. Cracking performance of shafts was plant to ameliorate the result of using mongrel filaments but there's no chance to increase the ultimate Cargo capacity. A good bond between the mongrel fibre convinced in the concrete showed better results in the parcels of concrete. In this design, the material used in concrete composites using sword fibre, coconut fibre and Micro Silica. The concrete composites were made with 0, 20, 40, 60 RA relief along with 10, 20, 30 Micro Silica and 1, 2, 3 Mongrel fibre. It was plant that increase of certain chance Micro Silica and mongrel fibre gave better compressive strength, resolve tensile strength, flexural strength and continuity tests compared to the conventional concrete.*

Key Words: *mongrel fibre, sword fibre*

1.INTRODUCTION

A fundamental task in civil engineering is related to the retrofitting of existing RC (reinforced concrete) structures. During the design life of reinforced concrete (RC) structures, local cracks that result from overloading or from the flaws of construction technology inevitably form. Cracks can reduce the loadcarrying capacity of structures, change the dynamic characteristics of structures, and even adversely aff ect the durability and security of structures. . A hybrid fibre reinforced concrete is a composite of two or more fibres in concrete,in this test hybrid fibre as basalt,steel ,steel fibre and coconut fibres. Since the pioneering attempts at the middle of the 80's, the use of fiber-reinforced composites for the rehabilitation/strengthening of beams and slabs exhibited promising and fascinating results, allowing to obtain a significant improvement in both strength (ultimate limit state) and stiffness (serviceability limit state) of the structure. Fibre reinforces polymer-based strengthening is mainly performed by applying unidirectional fibre reinforced sheets on the beam traction side. Moreover, many experimental and analytical models have been recently proposed for evaluating both the mechanical behavior of strengthened RC structural elements and the fibre reinforce debonding/failure features. Nevertheless, performance assessment of strengthened RC beams is usually restricted to the case of traditional carbon-based and glass-based fibre reinforce. In the last years, an increasing interest has been gained by a new class of fibre reinforced composites based on basalt fibers. They are produced by molten basalt rock and exhibit intriguing physico-chemical properties, especially if compared with traditional glass and carbon fibers. Moreover, fabrication process of basalt fibers,steel fibre fibre is generally characterized by good processability features and it may be significantly cheaper than the case of carbon and glass fibers. In this project include both natural and artificial fibre. natural fibre as coconut fibre.

2. AIM

Basalt fibreand steel fibre exhibit good physio-chemical properties compared with traditional glass and carbon fibers and it is significantly cheaper than the case of carbon and glass fibers. Investigations of the flexural behavior of RC beams of both controlled and wrapped specimen is needed as it is widely used in retrofitting and strengthening of bridges, high rise buidings and in an existing structure to increase its load carrying capacity. Coupled with its low price, excellent heat resistance and lower environmental impact, the use of basalt fibre and steel for flexural strengthening of RC structures is justifiable

3. SCOPE

Modeling and analysis of the innovative light weight concrete composite CFS integrated beam alternative to for conventional type beam. The work is focused sigma section and C section of CFS and Light weight concrete, embedded in CFS empty core portion, in different position, under flexural testing.

4. LITERATURE REVEW

4.1 Yildirima et al

have investigated the steel, glass and polypropylene fiber reinforced concrete structures under repeated impact loads in this study. Twelve different concrete series prepared fiberless the one of all and the others reinforced polypropylene, glass, steel and hybrid fiber were produced. The polypropylene fibers in diameter of 50 mm, l/d ratio of 400, glass fibers in diameter of 14 mm, l/d ratio of 857 and steel fibers in diameter of 0.75 mm, l/d ratio of 80 were used in concrete mixtures. The volumetric contents were 0.5, 0.75 and 1% in fiber reinforced concrete. The volumetric content was 0.1% in polypropylene and glass fiber reinforced concrete. Dropweight test similar the method pre sented ACI 544.2R89 was conducted using 28 days cured samples having dimensions of 100 × 100 × 100 mm and reduction of strength were determined by ultrasonic pulse velocity (UPV) test. Furthermore, initial crack formation and fracture numbers variation in samples were detected. In the present study, it was aimed to develop performance under repeated impact loads using fibers in concrete. As a result, especially impact performance was rather increased in steel

fiber reinforced concrete, and hybrid fibers had also positive effect on the performance of concrete.

4.2 Li

This paper presents an extensive overview of the achievements in the study on the mechanical behaviour of elements and structures made of recycled aggregate concrete (RAC) in China. Experimental findings on the flexural and shear properties of RAC beams, the compressive behaviour of RAC columns, the seismic performance of RAC column-beam joints and frame structures are summarized and discussed. The related design recommendations given in the first Chinese code on RAC—Technical Code for Application of Recycled Aggregate Concrete, are also briefly introduced. The design formulas are evaluated using the test data available. Furthermore, some successful practical applications of RAC in the pavements and building structures are also presented.

4.3 Jiang et al

Have studied the effects of the volume fraction and length of basalt fibre (BF) on the mechanical properties of FRC were analyzed. Coupling with the scanning electron microscope (SEM) and mercury intrusion porosimeter (MIP), the microstructure of BF concrete was studied also. The results show that adding BF significantly improves the tensile strength, flexural strength and toughness index, whereas the compressive strength shows no obvious increase. Furthermore, the length of BF presents an influence on the mechanical properties. Compared with the plain concrete, the compressive, splitting tensile and flexural strength of concrete reinforced with 12 mm BF increase by 0.18–4.68%, 14.08– 24.34% and 6.30–9.58% respectively. As the BF length increasing to 22 mm, corresponding strengths increase by 0.55–5.72%, 14.96–25.51% and 7.35– 10.37%, separately. A good bond between the BF and the matrix interface is observed in the early age. However, this bond shows degradation to a certain extent at 28 days. Moreover, the MIP results indicate that the concrete containing BF presents higher porosity.

4.4 Poorsaheli et al

Have investigate the Addition of fibers into concrete mixture has been an attractive subject for researchers to determine how various forms of fibers change the performance of concrete. This paper reports the findings of a study on the impact of using steel fibers and polyolefin fibers at three volume ratios on the long-term performance of concrete when subjected to a high chloride medium. The concrete properties that were measured include compressive strength, flexural strength, water permeability under pressure, electrical resistivity, half cell test, and water absorption. Results showed that fibers have no considerable impact on compressive strength while they can improve the flexural strength by up to 28%. Electrical resistivity and half-cell test results showed that polyolefin fibers improve the concrete performance against corrosion while steel fibers reduce the corrosion resistance of concrete. Moreover, steel fibers in hybrid mixtures attenuate the positive impact of polyolefin fibers on the corrosion performance of concrete.

4.5 J. Vishaul et al

Have studied the tensile strength of concrete certain fibers are added into the concrete. Fiber reinforced concrete (FRC) contains fibrous material, which increases the structural stability and integrity. Fiber reinforcement in concrete, mortar, and cement paste can enhance many engineering properties of the basic materials, such as frac- ture toughness, deflection under lateral loading and resistance to fatigue, impact, thermal shock spalling, and durability. Hybrid fiber reinforced concrete, which is the combination of various fibers into the conventional concrete makes it subtle and enhances the mechanical behavior of the concrete. In the present study, experimental procedures were carried out to decode the compressive strength, tensile strength, and the durability of M40 grade hybrid Alkali Resistant (AR) glass and Coir fiber reinforced concrete. The addition of a combination of fibers into conventional concrete had proportional effects in increasing the ductility and impact resistance.

4.6 Kazmia et al

Have investigated the axial stress-strain behavior of macro-synthetic fiber reinforced recycled aggregate concrete. Concrete cylinders reinforced with macro-synthetic fibers were tested under axial compression, with the variation of three different replacement ratios of recycled aggregates (i.e., 0, 50 and 100%) and three different dosages of macro polypropylene fibers (i.e., 0, 0.5 and 1% of volume of recycled aggregate concrete). A comparative study of the existing stress-strain models for steel fiber reinforced normal and recycled aggregate concrete with the test results indicates that the stress-strain behavior of steel fiber reinforced normal and recycled aggregate concrete can be well predicted by these existing models. No stress- strain model for macro synthetic fiber reinforced normal and recycled aggregate concrete has been developed. Based on the test results, a stress-strain model is developed in this work by modifying the parameters of best performing stress- strain model for steel fiber reinforced normal aggregate concrete. The proposed model can effectively predict the stress-strain behavior of both steel and macro-synthetic fiber reinforced normal and recycled aggregate concrete. Test results show that the peak stress, peak strain and ultimate strain of concrete specimens increase with the increase in fiber dosage and the addition of fibers has a better effect on recycled aggregate concrete and as compared to normal aggregate concrete

4.7 Ramesh et al

Have investigated the flexural behavior of externally bonded glass fibre reinforced polymer (GFRP) reinforced concrete (RC) beams incorporating both ‘basalt’ and ‘polyolefn’ fbres at a constant ratio of 70:30 and in several combinations of fbre volume fractions (Vf) ranging from 0–2% (at a constant increment of 0.5%) were investigated, to highlight to role of strengthening and the hybrid fbres in beams. Three diferent types of beams, namely: a control beam (1 No.); GFRP laminated RC beam (1 No.) and laminated and hybrid fbre reinforced (HFRC) beams (4 Nos.) were cast, and tested under a four-point bending. The load-defection response at: frst crack, yield point, at initiation of debonding lamination and at ultimate stages were recorded by appropriate instrumentation. The results indicate that there is a ‘combined efect’ of lamination and incorporation of the above hybrid fbres in contributing to the very high load-carrying capacity and enhanced ductility of laminated HFRC beam, especially at a fbre volume content of 1.5%. Further, the maximum yield and ultimate loadcarrying capacity of laminated HFRC beam is found to be 59% and 49% higher than the laminated RC beam

and 125% and 98% higher than the control beam. However, the defections are higher, and their permissibility have to be ascertained with respect to relevant codal provisions. All the laminated HFRC beams exhibited 'gradual debonding' and 'ductile' failure, whereas, the control beam exhibited 'fexural mode' of failure. The 'combined efect' can be used advantageously in structural applications, where both 'strength' and 'ductility' are important.

4.8 Hanumesh et al (2018)

have presented the behavior of Recycle Aggregate Concrete (RAC) with and without addition of Polypropylene (PP) fibers. The natural coarse aggregate was replaced by recycle aggregate in the proportion of 0, 25, 50, 75 and 100%. The Polypropylene fibres (PP) were used in the recycle aggregate concrete by 1 and 2% by volume. In the present experimental study compressive, split and shear strengths were evaluated. The results showed that, the incorporation of PP fibers increases the strengths in RAC. Few Regression Models were deduced to estimate the strengths for RAC with respect to compressive strength.

4.9 Mohammed et al. (2020)

have described material properties of high strength concrete containing different PET waste fiber in terms of fiber volume and length. Structural behavior of reinforced concrete beams made of this newly developed concrete has been fairly investigated. Cracking performance of beams was found to improve as a result of using PET waste fiber, but there is no chance to increase the ultimate load capacity. There is some strength loss of the beam mainly attributed to the degradation take place in compressive strength of concrete, but mode of failure of tested concrete beams was almost identical to that of control beam without PET waste fiber. Ultimate moment capacity of concrete section with PET fiber can be calculated accurately following the recommendation of the ACI 318 code. The results are interested and can encourage researchers to work on this kind of recycled high strength concrete for structural applications in future

4.10 Patel and Chandra (2015)

Researched currently being conducted concerning the use of fiber reinforced plastic wraps, laminates and sheets in the repair and strengthening of reinforced concrete members. in this paper to investigate the effect of replacing cement with Micro Silica and adding basalt fiber and study its mechanical properties and durability. to characterized mechanical properties and durability.110 specimens with different fiber proportion 0.7%,0.8%,0.9% ,1.2% with the replacing cement with 10% Micro Silica. the mechanical and durability properties of concrete, apart from different curing regimes only normal water curing has been chosen. Performance of the various mixes is tested by the compressive strength, split tensile strength and flexure strength. A cube specimen of size 150mmX150mm X150mm, cylindrical specimen of size 100 mm dia X 200 high mm and beam specimen of size 150mm × 150 mm × 700mm were cast and demoulded after 24 hours then they allowed for normal water curing also performed SEM analysis. The results show improvement in compressive strength, split tensile strength and flexural strength in cement replaced mixes with adding basalt fiber. The maximum compressive strength, split tensile strength and flexural strength value that can be achieved in this study with the Micro Silica content of 10% cement replacement and adding 0.9% basalt fiber.

4.11 Alnahhal and Aljidda (2018)

Investigated the effect of using recycled concrete aggregates (RCA) from construction and demolition (C&D) waste combined with basalt macro-fibers (BMF) on the flexural behavior and ultimate capacity of reinforced concrete (RC) beams experimentally and analytically. A total of 16 RC beam specimens were flexural tested to failure. The investigated parameters include the RCA replacement ratio and the volume fraction of the BMF. Furthermore, the experimental results were also compared against the existing analytical models and code-based equations for conventional concrete. The test results show that the flexural capacity of beams with the addition of BMF was improved. On the other hand, the use of RCA has no remarkable impact on the flexural strength of the tested beam.

4.12 Ralegaonkar et al (2018)

Have designed with suitable fiber reinforced mortar shall significantly help to enhance the fresh, mechanical, durability and dynamic properties. In view of the significance of chopped basalt fibers (CBF) for mortar strengthening, the present study elaborates the application of CBF for mortar design. The CBF manufacturing, the engineering properties and relevant advantages of its application are elaborated in the study. The study is extended further with relevant literature indicating the challenges of mix design of appropriate CBF reinforced mortar, various test methods and standards used to evaluate its performance and possible applications in civil engineering. The improved performance of the CBF reinforced mortar not only signifies its potential use for the application, but also is helpful to standardize the process of reinforced mortar design.

4.13 Chaboki et al (2018)

Have researched the flexural behavior and ductility ratio of reinforced concrete beams made with steel fibers and coarse recycled aggregate are studied. 27 reinforced concrete beams with a cross-section 150 mm wide, 200 mm high, and a length of 1500 mm, with various transverse reinforcement spacing, were manufactured and tested. Recycled aggregate from building demolition was used at 0%, 50% and 100% mass replacement of natural aggregate. Furthermore, steel fibers were added to improve the flexural behavior of the beams at 0%, 1% and 2% (in terms of volume). A four-point bending test was performed. In these tests, the flexural capacity, maximum displacement at the mid-span of the specimens and ductility were measured. The effects of the steel fibers and the transverse reinforcement spacing on the flexural behavior of recycled aggregate concrete beams were the main aims of this study. The results were also compared with ACI, CSA and Eurocode 2 requirements. It was found that the individual effects on the ductility ratio and maximum loading capacity depend on the other parameters

5. CONCLUSIONS

The experiment was successfully carried out, to the establishment of recycled aggregate as an alternative coarse aggregate replacement material in concrete. After the detailed investigation, the compressive, spilt tensile and flexural strength were increases up to 20% replacement of coarse aggregate by recycled aggregate and 10%Micro Silica, so it is advisable to replace coarse aggregate by recycled aggregate in hybrid fibre reinforced concrete up to 20% for structural purpose with an addition of dosage of 2% of hybrid

fibres.Water absorption property is acceptable only up to 20% replacement of recycled aggregate and 10% Micro Silica. The effect of sulphate attack on HFRC that is weight loss and strength loss are very less and negligible. Further researches are needed to enhance the strength property of HFRC while replacing coarse aggregate by recycled aggregate and Micro Silica in structural elements.

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