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A Review on Flexural Behaviour of RCC Composite Beams with Light Weight and Normal Density Concretes

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Abstract-A form of concrete known as lightweight concrete can provide the same strength while weighing less than ordinary concrete.We are developing a lightweight steel-concrete composite beam. The flexural behavior of composite beams is examined in this research. In composite beams, which are comprised of steel sections, concrete slabs or beams, and shear connectors, the steel and concrete are joined together using shear connectors or epoxy adhesive bonding agents. Indian Standard Medium Beam (ISMB) section of steel was used in this work. Cold-formed steel hollow portions of lightweight concrete are filled with cement, fine aggregate, foundry sand and coarse aggregate.Utilizing all of these waste materials will help us make this composite section more affordable, environmentally friendly, light, and sturdy than ordinary standard concrete. The review predictsthe analysis of employing these waste components in composite steel beam concrete sections.This paper analyze the review on flexural behavior of RCC concrete beam in light weight concrete in different building structure.

Keywords- Composite beam, lightweight concrete, Normal Density,RCC.

I. INTRODUCTION

Currently, construction industry is the most important component of human civilization. It would be more correct to say that it started in the Stone Age, when man first learned how to construct his own shelter. Since then, people have combined numerous mathematical equations to create a variety of buildings, including pyramids. Civil engineering, whether well-known or obscure, has always aided in the evolution of mankind. We've come a long way in this area already, and we're still working to do so[1].To build and span members projects, concrete structural systems with composite steel beams are extensively used all over the world. A composite is produced when steel components, such as beam, are connected to concrete components, such as a floor or deck slab bridge.

Composite structures have become less costly than steel and RCC. Moreover, the building's fire-resistant components [2].

Composite beams are made of RC floor plates, steel beams, or bridge floors, shear connections, and epoxy adhesive. Composite development happens when two different materials are firmly fused together so that they appear to work as a single unit from the side [3]. The activity is considered to as composite activity when this happens. A typical design features steel radiates supporting solid floor parts. Composite beams are made of RC floor plates, steel beams, or bridge floors, shear connections, and epoxy adhesive. Composite development happens when two different materials are firmly fused together so that they appear to work as a single unit from the side.

The activity is referred to as composite activity when this happens.A typical design features steel radiates supporting solid floor parts [4].Cold formed steel includes lightweight solid solids with steel gaps. Each component alone determines how it will behave structurally. Because in-filled concrete does not require any additional reinforcing steel, formwork is not necessary for CFST beams.

1. Light Weight Concrete Materials:

Concrete is a composite engineering material. It consists of a combination of aggregate, water, occasionally admixtures, a binding material like cement or lime, and one or more of these. Concrete's unit weight is decreased when the word "lightweight" is added. It is made of lightweight aggregates, such as pumice, air-cooled blast furnace slag, clays, shales, slate, and plastic granules, as opposed to conventional aggregates. Concrete with a partial replacement of coarse aggregate with ceramic waste and fine aggregate with foundry sand improves tensile strength as well as shear, compaction, and flexural strength. As a durable, cost-effective, and resource-efficient material, concrete is currently employed more frequently [6].

Concrete made from waste resources can benefit the economy and the environment. Legally discarding trash on the planet could have negative environmental effects. So, the reuse of this waste material might be emphasized. The qualities of new, hardened floor are affected differently by each type of waste product.

- A mixture of minerals, primarily silica sand, along with a clay binder, some impurities, and up to 30% water results in ceramic waste, an inorganic, non-metallic, usually crystalline oxide.
- The best and most dependable silica sand for casting forms in foundries is called "foundry sand." Molds or patterns used for casting metal are created by binding sand. Sand from finished metal throwing shake-outs is typically recovered and used to make foundry sand.

II. LITERATURE REVIEW

The proposed methodology hasconsidered the flexural behavior of a cold-formed beam made of lightweight concrete [7]. It has been decided to use three cold-formed built-up parts that can be channel segment linked back to the lower back using welding. The beam will undergo experimental testing with two-factor loading so that the carrying capability of various regions may be compared. The researcher [8] have investigated the performance of hollow sections with and without infill under compression and flexure. The compressive and flexure strength of rectangular conventional concrete composite phase with mechanical bonding is at its highest when compared to the opposing types of square and square hollow sections and performed a trial and explanatory study of cement-filled steel cylindrical sections [9].

The findings of this investigation study show that relapse models that were produced utilizing the fewest number of investigations and Taguchi's technique will accurately and sensibly forecast the critical burden conveying limit at the extreme point. The researcher [10] performed an initial evaluation on M-25 evaluation concrete that comprised waste foundry sand in amounts of 0%, 10%, 20%, 30%, and 40% by weight as well as waste terminated tiles in amounts of 0%, 10%, 20%, 30%, and 40% by weight. Additionally, it has been established that part flexibility increases up to a replacement rate of 20% and then decreases when waste foundry sand and waste terminated tiles grow.

According to [11] composite frame systems have been extremely popular for high rise buildings over the past few decades. RCC and steel frames have long been the most used frame systems. Due to their numerous advantages and superior structural performance, concrete-filled steel tubes have seen an increase in use in building construction in recent years. This results in the standard composite frame structure.The conducted experimental studies on steel-composite concrete beams subjected to negative bending [12]. A test using composite beams that were bent negatively).

The behavior of the composite cross sections varies greatly depending on the type of loading. When the composite cross - sectional area is pressured by a negative moment, the concrete is in compression and the steel is in tensions in the sagging moment zone while the composite cross section is under compression. The establishment of slab cracking and localized bending of the steel profile as a result has an impact on the beam's strength and ductility.For production of high-strength lightweight concrete, it is urgent to provide information on the characteristics of the aggregate [13].

The present paper reports an in vestigation of some high-strength lightweight aggregates available on the European market.This paper reports limited experimental data on the flexural behavior of high-strength lightweight concrete beams. Flexural tests were conducted on six singly reinforced beams [14]. The variables were strength of concrete and the ratio of tensile steel content r as a ratio of the balanced steel content.

Compression or lateralreinforcement was used in this study. It is concluded that to achieve a ductility index of 3, pip, should not exceed 0.40 for beams with concrete strengths of 8000 psi or 0.20 for beams with concrete strength of 11,000 psi. Resistance of high-strength lightweight concrete 50 to 100 MPa to water penetration and accelerated chloride penetration is presented [15].The permeability of high-strength-lightweight concrete appears to be very low, but it may be higher than that of normal weight concrete at a similar strength level. Too-high cement content may increase the permeability.

The proposed work [16] to study the effect of condensed silica fume (CSF) on the mechanical properties of high strength concrete made with lightweight aggregate (L WA), and compare these properties to concretes with similar strength properties.The tensile strength (modulus of rupture R), modulus of elasticity (E), stress-strain properties, and bond slip of reinforcing bars were studied for jour concrete mixes of similar high strength [10,000 psi (69 MPa)j achieved through varying contents of CSF (0 and 13 to 15Percent by weight of cement) and low water-cement ratios (0.25 to 0.34).

The method [17] proposes Aerated concrete is relatively homogeneous when compared to normal concrete. The properties of aerated concrete depend on its microstructure (void ± paste system) and composition. Aerated concrete as a good insulation material. Investigations on the properties of aerated concrete in terms of physical (microstructure, density), chemical, mechanical (compressive and tensile strengths, modulus of elasticity, drying shrinkage) and functional.

Themethodology[18] investigated the fatigue behavior of steel concrete composite beam sections taking into account fatigue life, stress strain curves, ductility, and slip in order to construct an expression to predict the serviceability of the composite beam by taking into consideration various design codes. Casing will be used less frequently as a result of rising stiffness in comparison to open steel sections and declining construction costs.The proposedmethod [19] carried out a series of tests in beams for flexure and tension to clarify the fatigue strength of the tension plates with the welded stud shear connector of SCS sandwich beams. The results of many pushes out shear tests for beams were compared to the S-N curve for Eurocode 3 detail category 80 fatigue strength.

The results of theoretical calculations that were carried out on the basis that the beam was entirely made of composite material were found to be exaggerated. It was found that the S-N curve of EC3 gives satisfying performance for fatigue life in SCS since the experimental results are moderately higher than that of the push out test results and EC3 codal requirements.Four reinforced concrete beams totaling 1500 mm in length, 200 mm in width, and 250 mm in height were cast, two of which were made of lightweight foamed concrete and the other two were made of ordinary weight concrete, according to the author's analysis. For thin foamed concrete beams, 1800 kg/m3 is the ideal density. Beams with steel reinforcement bars have a load capacity of 11.54% [20].

It was discovered that the improvement in load capacity for lightweight foamed concrete is 3.6% of the load capacity for normal concrete beams by comparing it to normal concrete beams reinforced with GFRP bars. The increase in the load capacity for beam reinforced with GFRP bars was discovered by comparing lightweight foamed concrete beams.Lightweight foamed mortar beams may sustain ultimate loads that are between 8 and 34% lower than heavier reinforced concrete with the same reinforcing arrangement, according to experiment results on the flexural behavior of beams and reinforced concrete slabs built of this material [21]. The suggested approach tested three beams of regular weight concrete and seven beams of lightly foamed mortar as control samples.

III. CONCLUSION

The analysis of light weight concreter suggest that it is successful to substitute fine aggregate and coarse aggregate for wasted foundry sand and ceramic waste in the concrete mix. By utilizing thin materials,

we can lighten the concrete weighted and able to carry larger weights. The concrete's compressive strength, split tensile strength, and flexure strength all increase when compared to standard concrete. A further inference that can be made from the results is that steel composite beams reinforced with lightweight concrete have a high capacity for carrying loads.

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