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Literature Review of combined Ultra-Light weight Concrete CFS Composite Beams

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Abstract - - *Abstract-This paper presents the results of experimental study on the behavior of emulsion shafts of cold-formed steel and Ultra- lightweight cement concrete (ULCC) in a Structure. Cold- formed brand (CFS) sections are truly feathery paraphernalia where their high structural performance is suitable for erecting construction. Conventionally, they are used as purlins and siderails in the structure envelopes of the artificial structures. The results of various researchers indicated that the capability to repel or overcome adverse conditions or rigorous testing of the product (cold-ordered brand concrete) was significantly bettered for both the shear resistance and the flexural resistance. In order to satisfy different engineering construction demands, four types new brand fiber corroborated ultra-featherlight cement emulsion (ULCC) with different viscosity ranging from 1250 kg/ m3 to 1550 kg/ m3 were proposed. Extensive standard compressive and tensile tests were performed to gain the mechanical parcels of these ULCCs with different viscosity, which will offer useful information for the developments of design on engineering constructions with analogous types of ULCC. Predicated on these test results, native laws were established to describe the compressive and tensile stress – strain conduct of ULCC with varying viscosity.*

Key Words: *(CFS)* Cold-formed steel, (ULCC) Ultra-lightweight cement composite, (FE) Finite element analysis, cement concrete.

1.INTRODUCTION *(Size 11, Times New roman)*

Ultralightweight cement compound (ULCC)Ultra-light weight cement compound (ULCC) has attracted expansive exploration interests in both civil and coastal engineering constructions due to its high specific strengths. In order to satisfy different engineering construction demands, four types new sword fiber corroborated ultra-lightweight cement compound (ULCC) with different consistence ranging from 1250 kg/m3 to 1550 kg/ m3 were proposed. Expansive standard compressive and tensile tests were performed to gain the mechanical parcels of these ULCCs with different consistence, which will offer useful information for the developments of design on engineering constructions with similar types of ULCC. Grounded on these test results, native laws were established to describe the compressive and tensile stress – strain behaviors of ULCC with varying consistence. Regarding the operations of the ULCC in engineering constructions, a ULCC flat arbor with viscosity of 1550 kg/ m3 under concentrated lading was tested. The failure mechanisms and ultimate strength behaviors of this ULCC flat arbor were reported. 3D FE model was also developed to pretend the structural behaviors of the new ULCC flat arbor, and its delicacy was verified by the reported test results. With the validated FE model and reported mechanical parcels of ULCC with different consistence, structural behaviors of ULCC flat crossbeams with these ULCCs were delved. Analytical model grounded on the system of bending resistance in Hosts-EPFL was proposed to prognosticate the ultimate resistance of ULCC flat arbor. Erected-up box sections of cold-formed sword (CFS) construction are getting decreasingly popular for column members in cold- formed sword (CFS) construction; uses of similar sections include CFS trusses, space frames, and portal frames. the erected-up box sections are formed through two identical lipped channels connected at their flanges with tone-drilling screws. In such an arrangement, independent buckling of the individual channels is averted by the screws. This paper presents an experimental disquisition on axial capacity of erected-up CFS box sections. Tests were conducted for different values of slenderness from ray. In total, the results from 16 experimental tests are reported. Of these, 8 tests were conducted on erected-up CFS box sections and the remaining 8 tests were conducted on Two Sigma channel sections. Two- Refocused cargo and two support, Cargo-axial relationship, and failure modes are bandied for erected-up ray. Nonlinear finite element (FE) models were developed for erected-up CFS box sections and double single channels. FE models considered material nonlinearities, original defects and modeling of intermediate fasteners. FE results showed good agreement against the test results. A parametric study was conducted which comprises 148 models to probe the effect of fastener distance on axial capacity of erected-up CFS box sections. Both FE and test results were compared against the design strengths calculated in agreement with the American Iron and Steel Institute (AISI) and Australian and New Zealand Norms (AS/ NZS). From the comparison, it was observed that the AISI & AS/ NZS are conservative by around 17 while determining the axial capacity of similar erected-up CFS box ray.

2. AIM

In construction sedulity the cold- formed sections are now used as columns, shafts, super studs, nethermost decking, etc., in structures, islets, grain lockers, transmission halls, and others. Cold- formed brand (CFS) is generally distributed as a slender section which tends to buckle and distort. The strength of this section is generally reduced significantly as the section is truly thin. When hollow sections are used as structural element original bucking occurs and to help this thin cold-ordered brand sections are in- filled with concrete. The concrete and the thin cold formed brand give confinement to each other

continuously. This is the main end and attraction of the disquisition.

2.1 Experimental Study of Cold-Formed Steel Built-Up Beams

Experimental Study of Cold- Formed Sword Erected-Up Shafts The work aimed to experimentally probe the commerce between the individual factors under adding loading and to quantify the effect of the connector distance on the cross-sectional moment capacity and the behavior of the shafts.

2.2 Developments and mechanical behaviors of steel fiber reinforced ultra-lightweight cement composite with different densities

Developments and mechanical conduct of brand fiber corroborated ultra-featherlight cement emulsion with different viscosity Mix proportions of ULCC with four different viscosities in a range from 1250 kg/ m3 to1550kg/ m3. The compressive strength and direct tensile strength of ULCC all increased with the increase of their viscosity within a range of 1250 kg/ m3-1550 kg/ m3. As the density of the ULCC increase by 24 from 1250 kg/ m3 to 1550 kg/ m3, the compressive strength and tensile strength of the ULCC were increased by45.87 and49.26, singly. The ULCC beams failed in flexure mode under concentrated loading, which indicate the superior severity of ULCC.

2.3 Compression test and analysis of multi-limbs built-up cold-formed steel stub columns

Axial compression bearing capacity tests and finite element analysis of nine multi-limbs built–up cold–formed steel stub columns with three different section forms were conducted in this paper. The results show that the failure modes of all specimens are local buckling and distortional buckling. Multi-limbs built–up cold–formed steel stub columns consisting of a few basic components can work in harmony, the integral behavior is desirable. The axial load bearing capacity of the multi-limbs built-up section stub column increases when the maximum width–thickness ratio of the plates decreases; the screw spacing has a little impact on the ultimate axial compressive capacity and the buckling capacity of the multi-limbs built-up cold-formed steel stub columns.

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 A.Ananthakumara AND T.N.Manju shree

Based on the results obtained from this study, the following conclusions are made. Concrete/CFS composite beams can be designed for flexural failure. The use of shear connectors is feasible for providing composite action. When adequate number and spacing of shear connectors are furnished, the CFS track acts as tension reinforcement and the concrete/CFS composite beams can increase their flexural capacity.

4.2 Umesh N G, & Anilkumar

It is possible to obtain the structural LWC by blending of different light weight aggregates. For every mix the cubes were cast and an average 28day compressive strength was 30.084 N/mm2 and 35.61 N/mm2, which were more than the target mean strength for both M20 and M30 LWC respectively. The ultimate load for LWC beams are more than that of NCC beams of M20 and M30 grades. The ultimate deflections of M20 grade LWC beams are less than the ultimate deflections of NCC beams of same grade. The ultimate deflections of M30 grade LWC beams are slightly higher than the ultimate deflections of NCC beams of same grade.

4.3 Lulu K Makkar

Dual layer RCC elements have higher load carrying capacity when compared to the conventional concrete. Comparing ULCC 1250, 1350, 1450 and ULCC 1550, ULCC 1550 has higher load carrying capacity. Ductile nature can be improved by using ECC along with ULCC as dual layer. In column, there is an increase of 6.10% in ultimate load. In dual layer slab, there is2.73% increase in ultimate load. While in case of dual zone slab, there is 44.86 % increase in load carrying capacity.

4.4 Xiao-Long Gao

(1) The compressive strength and direct tensile strength of ULCC all increased with the increase of their densities within a range of 1250 kg/m3 1550 kg/m3. As the density of the ULCC increase by 24% from 1250 kg/m3 to 1550 kg/m3, the compressive strength and tensile strength of the ULCC were increased by 45.87% and 49.26%, respectively.
(2) The load–deflection curves of the ULCC slab exhibited three working stages, i.e., elastic stage, cracks developing stage, and recession stage. The ultimate resistances, P, of ULCC slabs was increased by 17.74%, 21.38% and 70.03% as the density of ULCC increased from 1250 kg/m3, 1350 kg/m3 and 1450 kg/m3 and 1550 kg/m3, respectively. The ULCC slabs failed in flexure mode under concentrated loading, which indicate the superior ductility of ULCC. This suggest that the ULCC are structurally more safety in engineering application.
(3) A three-dimensional finite element model of ULCC flat slab without reinforcement was presented in this paper. The concrete model with adjusted damage parameters has been proposed to model ULCC. The load–deflection curve obtained from FE analysis shows reasonably agreement with the test result, which shows the reasonable of finite element model and constitutive laws of ULCC proposed in this paper.
(4) The modified height of tension zone, 0.7(h-x), which is based on the MCS-EPFL method for bending resistance was developed to consider the scope of tension zone. The yield line model based on the modified equation for bending resistance in MCS-EPFL was developed to predict the flexural bending resistance of ULCC flat slab without reinforcement under concentrate load. The validation against the test and FE results showed the reasonable and conservative of the developed mode.

4.5 J. Rondal

The last decade has shown large and important progresses in the knowledge of the behavior of cold-formed steel members and structures. All the main ingredients are now brought

together—scientific knowledge, high strength steels, modern methods of fabrication, modern design specifications, etc.—and the industry of the light gauge construction seems to be ready to enter, with confidence, in the new millennium.

4.6 AL-Hasnawi Yasser Sami Ghareb

It has observed the bond between CFS and cellular concrete obviously when using perforated CFS. Turn out to be the bearing capacity for beams that consist of perforated CFS and cellular concrete it is bigger than non-perforated beams although the reinforced area for two groups are the same. Local buckling which is one of the main drawbacks of CFS is prevent due to confinement provided by encasing concrete. Flexural load carrying capacity of CFS encased concrete beam is increased as the effective area of steel acting in bending is increased as local bucking is prevented. In encased section the failure was typically in the form of flexural cracks originating from the bottom of the specimen and extends towards the top of the specimen. The majority of cracks were formed between the zones of two-point loading and also some cracking was also observed near the supports end.

4.7 Bindhu K.R et al (2009)

Compared the behavior of exterior beam-column joint sub assemblages with transverse reinforcements detailed as per IS 456 and IS 13920.One of the outside beam-column joints at an intermediate storey is intended for a six-story RC structure in Zone III. The columns were 3 meters long and had a cross section of 450300 mm, while the beams had a cross section of 300450 mm. The analysis was carried out with a live load of 3 kN/m2 and a floor finish of 1 kN/m2. The thicknesses of the external and internal walls were 250 and 150 mm, respectively. He came to the conclusion that all of the specimens failed due to the formation of tensile cracks at the beam-column interface, ensuring that the strong-column weak-beam requirements were met. With the exception of a few hairline cracks in the joint region, the joints were in good condition. IRJET sample template format, define abbreviations and acronyms the first time they are used in the text, even after they have been defined in the abstract. Abbreviations such as IEEE, SI, MKS, CGS, sc, dc, and rms do not have to be defined. Do not use abbreviations in the title or heads unless they are unavoidable.

4.8 Muthuswamy K.R and Thirugnanam G.S (2014)

Identify the potential of hybrid fiber reinforced concrete (HFRC) as a ductile material which can be used for the construction of beam-column joints. The test specimen for this experimental investigation was a fifth-scale model of an exterior beam-column joint made of conventional concrete and fiber reinforced concrete. Cyclic loading was used on the specimens. The load-bearing capacity, load-deflection behavior, ductility, energy absorption, stiffness, and failure patterns of joints have all been investigated. When hybrid fiber is used in the RCC beam-column joint, the first crack load is increased by 61% and the ultimate load is increased by 33%. When compared to the traditional RCC beamcolumn joint, the cumulative ductility of the HFRC beamcolumn joint has been enhanced by 1.5 times. The HFRC beam-column joint's cumulative energy absorption capability was 1.8 times that of a traditional RCC beamcolumn joint.

4.9 Kaliluthin.A.K and Kothandaraman.Setal(2014)

Investigated the seismic performance of RC beam column joint designed as per IS 456 as reference joint, IS 13920 as ductile joint and core reinforcement as core joints. The column had a cross section of 200mm by 150mm and a length of 800mm. The beam measured 150mm x 200mm (depth) and 6000mm in length from the face of the column. The basic conclusion is that the proposed core joint outperformed the other two types of joints investigated. The core joint's initial fracture load was 15.29 percent higher than the reference and ductile joints. For reference and ductile joints, however, the load at first crack remained constant. The ultimate load carrying capability of the core joint was found to be 25.5 percent higher than that of the reference joint and 6% higher than that of the ductile joint. The load deflection behavior of the reference joint and core joint was found to be similar, with the ultimate deflection in the reference joint being 19mm, 18mm in the ductile joint, and 16mm in the core joint. When compared to the Reference joint, the stiffness factor of the core joint increased by 38 percent, and by 17 percent when compared to the ductile joint. The ductility factor of the core joint was 50% higher than the reference joint and 25% higher than the ductile joint.

4.10 Mustafa Gencoglu and Ilhan Eren (2002)

Evaluated the behavior of a Steel Fiber Reinforced Concrete beam-column joint (SFRC). Under displacement-controlled stress, four specimens exhibiting an exterior beam column joint exposed to reverse cyclic loading were examined in this investigation. The application of SFRC in crucial parts of beam-column joints increased the strength capacity for bending moment and shear forces, according to the experiments. Steel fibers prevent cross bending or shear cracks and reduce crack breadth by bridging between two sides of cracks; also, SFRC raises the concrete section's shear capability. It is suggested that SFRC be used in conjunction with regularly spaced stirrups in order to prevent shear cracks in beam-column joints under reverse cycle stress. The use of SFRC in beam-column joint specimens subjected to reversed cyclic loads can raise the total energy quantities in the specimens.

4.11 Tamil Selvi.M and Thandavamoorthy T.S, (2013)

Studied the compressive strength, split tensile strength of steel, polypropylene fiber and hybrid polypropylene and steel (crimped) fiber reinforced concrete. Casting is used to make cubes and cylinders. Tensile strength tests are performed, both compressive and split. When compared to ordinary concrete of M30 grade, SFRC (Steel Fiber Reinforced Concrete) cubes exhibit a 41 percent increase in compressive strength after 7 days, with 14th and 21st days equal strengths and 14 percent increase at 28 days. 2. When comparing PPFRC (Polypropylene Fiber Reinforced Concrete) to conventional concrete for M30 grade, the compressive strength of PPFRC (Polypropylene Fiber Reinforced Concrete) increases by percentages of 11, 10, 18 and 11, respectively, at 7, 14, 21, and 28 days. 3. Compressive strength data for Hybrid Polypropylene and Steel (crimped) Fibers 7, 14, 21, and 28 days demonstrate a decrease in compressive strength for percentages of 22, 10, 3, and 9 when compared to conventional concrete for M30 grade. PPFRC split tensile strength measurements for 30 grade concrete indicate increases of 21, 10, 27, and 25% at 7, 14, 21, and 28 days, respectively, when compared to conventional concrete. Split tensile strength data for concrete reinforced with Hybrid Polypropylene and steel

(crimped) fibers show a 7% increase in 7 days, a 15% decrease in 14 days, equal strength in 21 days, and a 5% rise in 28 days when compared to conventional concrete for M30 grade

5. CONCLUSIONS

In this article, an experimental investigation on the capacity of built-up CFS box beam sections in double channels of two different section, C channel and Sigma channel, both are placed different positions i.e., face to face and back-to-back then test conducted with and without filling of ULCC, is presented. Material properties and initial imperfections were measured for all test specimens. Bi Axial load versus displacement, load versus axial strain relationships and buckling modes at failure, deflections etc. are discussed. The effect of fastener spacing on compression capacity of built-up CFS box sections is also investigated. A nonlinear FE model is developed, which includes nonlinear material properties, initial imperfections and modeling of intermediate fasteners. FE results are validated against the test results, which showed good agreement. The validated FE model was then used to conduct a parametric study comprising several FE models, to study the effect of fastener spacing on compression capacity of such beam and columns. The axial capacity of the built-up CFS box columns, determined from the test and FE analysis are compared against the design strengths determined from the AISI & AS/NZS design guidelines. It was found that the AISI & AS/NZS are over-conservative to both test and FE results by around 17% for all front-to-front built-up box beam while predicting the flexural property of such beam.

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