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UTILIZATION OF HYBRID FIBER REINFORCED CONCRETE CONSTRUCTION- REVIEW

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Abstract— The brittle nature of concrete results in sudden unpredictable failure. By using special hybrid fiber combination of steel and polypropylene fibber whose aspect ratio are 50 and 33 respectively. Concrete is one of the most resourceful and environmental friendly building material. The main objective of this study is taking weight fraction of the FIBERs used in this study varied from 0 to 0.50% with an increment of 0.25%. Concrete cubes will tested under positive static loading, and the results were evaluated with respect to strength and ductility. Test results indicate that the provision of HFRC in concrete enhances the strength, ductility, and is one of the possible alternative solutions for reducing the congestion of reinforcement in concrete. The hybrid combination of 0.50% steel fibber and 0.50% polypropylene fiber has best performance considering the strength, energy dissipation capacity.

Keywords- *polypropylene fiber, Concrete, steel fiber, HFRC*

1. INTRODUCTION

Ductility is an essential property of structures responding in elastically during severe earthquakes. Concrete is one of the most durable building materials. It provides superior fire resistance, compared with wooden construction, and can gain strength over time. It is more important for India to develop technologies involving fly ash consumption in concrete. Ductility is defined as the ability of sections, members and structures to deform in elastically without excessive degradation in strength or stiffness. Filling ability: The property that determines how fast SCC flows under its own weight and completely fills intricate spaces with obstacles, such as reinforcement, without losing its stability. Passing ability: The ability of SCC to pass through congested reinforcement and adhere to it without application of external energy. Stability**:** The ability of SCC to remain homogenous by resisting segregation bleeding and air popping during transport, placing and after placement. Advantages of self-compacting concrete:-there are many advantages of using SCC.in volume fraction according to classification (1) Low volume fraction (%1),(2)Moderate volume fraction(between 1 and 2%),(3)High volume fraction(greater than 2).(1)Low volume fraction:-The fibers are used to reduce cracking. These are used in slabs and pavements that have large exposed leading to high shrinkage crack. The fibers are uniformly distributed in three-dimensions making an efficient load distribution. The fibers are less sensitive to corrosion than the reinforcing steel bars.(2)Moderate volume fraction:-These composite are used in construction methods such as Shotcrete and in structures that require energy absorption capability, improved capacity againstdelaminating,spalling,and fatigue.(3)High volume fraction:-The fibers used at this level lead to strain hardening of the composites. Steel fiber:-Steel fibers have been used in concrete since the early 1900s.However, addition of fibers to fresh concrete results in a loss of workability. Hooked end or are crimped or undulated through their length. Typically steel fiber have equivalent diameters of from 0.15

mm to 2 mm and lengths from 7 to 75mm.carbon steels are most commonly used to produce fibers but fibers made from corrosion-resistant alloys are available.tensil strength (0.5 -2 GPa) and modulus of elasticity (200 GPa),a ductile/plastic stress-strain characteristic and low creep. Polypropylene:- Polypropylene fiber was first used to reinforce concrete in the1960s. Polypropylene is a synthetic hydrocarbon polymer, the fiber of which is made using extrusion processes by hot-drawing the material through a die. Fibrillated polypropylene fibers are slit and expanded into an open network thus offering a larger specific surface area with improved bond characteristics.Polypropylenefiber contents of up to 12% by volume are claimed to have been used successfully with hand-packing fabrication techniques, but volumes of 0,1% of 50-mm fibrin concrete have been reported to have caused a slump loss of 75 mm.Polypropylene fibers are hydrophobic and therefore have the disadvantages of poor bond characteristics with cement matrix point melting point, high.

LITERATURE REVIEW

A. SELF-COMPACTING HIGH PERFORMANCE FIBER REINFORCED CONCRETE- BY:WEN-CHENG LIAO,SHIH-HO CHAO,SANG-YEOL PARK,ANTOINE E.NAAMAN(JAN 2006)

In this paper, the authors provide a brief summary of findings based on an extensive review of existing literature and numerous laboratory trials, several SCHPFRC mixtures taken from previous studies were modified using the available local materials leading to recommended mixtures with compressive strengths ranging from 35 to 65 MPa.these mixtures contain coarse aggregates having a 12 mm maximum size and 30 mm long steel fiber in volume fractions of 1.5% and 2%. The recommended SCHPFRC mixtures were achieved by adjusting the coarse to fine aggregate ratios, increasing paste volume, mixing in steps according to a pre-set procedure, and adding relevant admixtures.Spread diameter of the fresh SCHPFRC mixtures measured by using the standard slump flow test was approximately 600 mm.Results obtained from direct tensile tests showed that the strain-hardening response of the hardened composites were maintained up to large composite strains.

They had concluded that only the slump flow test was used in this study to observe workability. Flow diameter about 600 mm was achieved in most cases. While the flow ability of SCHPFRC's was not as high as for conventional self-compacting concrete without fibers. Segregation of fiber was greatly reduced by using viscosity modifying agent, VMA. The mixtures become viscous enough to bring fibers to the edge of the slump base plate during flow test. The SCHPF have compressive strengths ranging from about 35 to 65 MPa and a tensile strengths ranging from 3.5 to 6.5 MPa. They also showed strain-hardening response in tension, accompanied by multiple cracking. The peak strain capacity after first cracking in tension ranged from 0.25 % to 0.45 %.

B. ‘’FLEXURAL BEHAVIOUR OF HYBRID (STEEL-POLYPROPYLENE) FIBER REINFORCED CONCRETE BEAMS’’ BY: K. RAMADEVI, D. L. VENKATESHBABU (2012)

In this paper the behavior of RC beam structures strengthened by using hybrid fiber reinforced concrete (HFRC) is analyzed. The concrete beams are casted for a grade of M25 as per IS 10262:2009. The fibers used are polyolefin and steel (crimped) fibers in various volume fractions The main reasons for adding steel fibers to concrete matrix is to improve the post-cracking response of the concrete i,e., to improve its energy absorption capacity and apparent ductility, and to provide crack resistance and crack control. The hybrid fibers of various proportions from 0.5%, 1%, 1.5% and 2% of volume of

concrete were used in the concrete mixes. The workability of hybrid fiber reinforced concrete mix was increased by addition of super plasticizer Complots SP 337.Totally five beams were casted and tested including control beam specimen. The test results shows that use of Hybrid Fiber reinforced concrete improves flexural performance of the beams during loading.

They had concluded that percentage of fibers used was 0.5%, 1%, 1.5% and 2% and the results were compared with the control beam specimen. The ultimate deflection for the HFRC beams was found to be increasing when compared to the control specimen, which is due to the increase in ductility of the beams by the introduction of fibers. The deflection of the mid-span was 20.18 mm for control beam and gradually decreased up to 2.0% HFRC beams which indicate the decrease in mid-span deflection with an increase in hybrid fiber proportion.

‘‘SEISMIC PERFORMANCE OF HYBRID FIBER REINFORCED BEAM-COLUMN JOINNT
‘’BY:PERUMAL,THANUKUMARI.(2010)

The main objective of this study is to investigate the effect of different proportions of hybrid fiber combinations (1.5% of steel fiber and 0 to 0.4% of polypropylene fiber) at the joint of exterior beam-column connections subjected to earthquake loading using M60 concrete. The hybrid fiber combinations of 1.5% of steel fiber and 0.2% of polypropylene fiber have best performance considering the strength, energy dissipation capacity and ductility factor. An attempt has been made to develop a new model by slightly modifying the previous models available in the literature for the joint shear strength. The proposed model was found to compare satisfactorily with the test results.The brittle nature of this High Strength Concrete results in sudden unpredictable failure. By using special hybrid fiber combinations of steel and polypropylene fibers, the explosive failure behaviour of High Strength Concrete (HSC) may be avoided.

They had concluded that hybridfiber reinforced concrete joints undergo large displacements without developing wider cracks when compared to SFRHPC and HPC joints. The fibers are effective in resisting deformation at all stages of loading from first crack to failure. The addition of polypropylene fiber increases the energy dissipation capacity, ultimate load, when the dosage of polypropylene fiber is 0.2 %.

It is possible to reduce the congestion of steel reinforcement in beam-column joint by replacing part of ties in columns by steel and synthetic fibers and thereby reducing the cost of construction. The specimen with 1.5% of steel fiber +0.4% of polypropylene fiber has the maximum curvature ductility factor. The excess polypropylene fiber increases the ductility but at this % the ultimate load and energy dissipation capacity is also reduced. The specimen which was formed by using hybrid fiber reinforced concrete in the joint region, consisting of 1.5% of steel fiber and 0.2% of polypropylene fiber exhibited excellent strength, deformation capacity, energy dissipation capacity and damage tolerance. It also has minor joint damage.

CONCLUSION

The hybrid fiber reinforced concrete joints undergo large displacements without developing wider cracks when compared to SFRHPC and HPC joints. All the above reviews conclude that It is possible to reduce the congestion of steel reinforcement in beam-column joint by certain amount of steel reinforcement by steel and synthetic fibers and thereby reducing the cost of construction.. Hybrid combination of steel and polypropylene by 1.5% of steel and 0.2% of polypropylene are better combination from strength , deformation capacity and energy dissipation point of view . In order to retain high level workability or fluidity with fiber reinforcement, the amount of paste in the mix should be increased to provide better dispersion of fibers in self compacting concrete. Sufficient ductile behavior could be achieved even after

replacing the certain amount of steel rebar with 1.5% of steel fibers. Polypropylene fiber increases the energy dissipation capacity, ultimate load, when the dosage of polypropylene fiber is 0.2 %.

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