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Literature review on Retrofitting of RC Beam by using different FRP'S

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ABSTRACT:

This paper present gives an insight of the various works which is carried on strengthening of reinforced concrete beams and columns. The Fiber Reinforced Polymer (FRP's) is broadly used in the structural elements like beams and columns. Retrofitting of these products like glass, steel, polypropylene, carbon, nylon, polyester, basalt have been used in the study. The literature review helps to presumption of flexural strength and shear strength of the beam and column is extended by using FRP's.and it introduced by new material of High Performance Fiber Reinforced Concrete (HPFRC)i.e. SIFON.

Keywords: *Composite beams and columns, FRP, Retrofitting, Strengthening*

I. INTRODUCTION

The civil infrastructure constituents of a major portion of the national wealth .These essential need of strengthening of reinforced concrete structure. The aging and depreciation of reinforced concrete structure are not only reasons of strengthening of beams and columns but also reasons including for improper design standards, improper constructional works and unpredicted loads. Therefore the improvement and modification of their performance of RC beam and columns .The reinforced concrete structure of beam of circumstances there are two possible solutions: replacement or retrofitting. Full structure of the replacement might have determinate disadvantages such as high costs for material and labour, a stronger environmental impact and inconvenience due to interruption of the function of the structure. When possible, it is often better to repair or upgrade the structure by retrofitting. In the last decade, Retrofitting of concrete structures with externally bonded reinforcement is generally done by using either steel plates or fiber reinforced polymer (FRP) laminates. FRP can be convenient compared to steel for a number of reasons. They are lighter than the equivalent the development of strong epoxy glue has led to a technique which has great potential in the field of upgrading structures. Basically the technique involves gluing steel plates or fibre reinforced polymer (FRP) plates to the surface of the concrete. The plates then act compositely with the concrete and help to carry the loads. Fiber reinforced polymers are majorly used for the strengthening of the reinforced concrete beams and columns.. It has been a lot of study on the fibers these days due to the advantages they bring with them.

II.LITERATURE REVIEW

1. A Obaidat, Y.T., Heyden, S., Dahlblom, O., Abu-Farsakh.:" Retrofitting of reinforced concrete beams using composite laminates". Submitted to Construction & Building Materials, 2010.

Summary: This paper presents the results of an experimental study to investigate the behavior of structurally damaged full-scale reinforced concrete beams retrofitted with CFRP laminates in shear or in flexure. The main variables considered were the internal reinforcement ratio, position of retrofitting and the length of CFRP. The experimental results, generally, indicate that beams retrofitted in shear and flexure by using CFRP laminates are structurally efficient and are restored to stiffness and strength values nearly equal to or greater than those of the control beams. It was found that the efficiency of the strengthening technique by CFRP in flexure varied depending on the length. The main failure mode in the experimental work was plate deboning in retrofitted beams.

2. N. F. Grace, G. A. Sayed, A. K. Soliman and K. R. Saleh : "Strengthening Reinforced Beam Using Fiber Reinforced polymer (FRP) Laminates" ACI Structural journal/ September- 1999.

Summary: This paper present in the various types of fiber reinforced polymer laminates are tested with the 14 simply supported cross section beams. In each beam was strengthened with FRP laminates of initially loaded above its cracking load and tested until failure. The carbon/ glass fiber reinforced polymer (CFRP/GFRP) of strengthening materials were used in externally bonded with beams. The different layers of frp sheet, types of epoxy and strengthening pattern which are examined and to calculate the absorbed energy to total energy, or energy ratio .The proper combination of vertical and horizontal sheets are provided; proper epoxy can lead to a doubling of the ultimate load carrying of the beam. To conclude the behavior of strengthening of beams are exhibits in higher factor of safety in design.

3. **Tarek H. Almusallam and Yousef A. Al-Salloum."Retrofitting of RC beam and Column joints using FRP Laminates":2007** presented a procedure for analytical prediction of joint shear strength of interior beam-column joints, strengthened with externally bonded fiber-reinforced polymer sheets. To implement the available formulation for shear capacity prediction, a program was developed. Using this program, shear capacity of the joint and joint shear stress variation at various stages of loading were predicted and compared with experimental observations. It was observed that even a low quantity of FRP can enhance shear capacity of the joint significantly.

4. Ramakrishnan. V. "Strengthening of Rc Beam by using BFRP" 2003

Summary**:** The researched and find out the basalt fiber may use in concrete. After investigations, the basalt fiber used in concrete for the first time in world. And also they are find out the beams reinforced with plain basalt bars failed in flexure due to inadequate bond between the steel and concrete. All the actual ultimate

moments were much less than the calculated ultimate moments to the steel pullout failure. The beam with fibers exhibited a primary failure in flexure and shear followed by a secondary failure on splitting and also ductile, micro cracks resist bond between all the modified basalt rebar and concrete was extremely good. Ultimate moment good compare with normal concrete. In general the basalt fibers are suitable for use in reinforced concrete section.

5. Priti A. Patel, Dr. Atul K. Desai, and Dr. Jatin A. Desai, "Evaluation of Engineering Properties for Polypropylene Fiber Reinforced Concrete", 2012

Has studied on the performance of polypropylene fiber reinforced concrete. From the experimental studies properties such as compressive strength, flexural strength, split tensile strength and shear strength of polypropylene fiber reinforced concrete was studied. The fiber volume fraction Vf ranges from 0 to 2%. Conclusions drawn are like the failure modes when fibers are present in concrete are spelling of mortar or bulging in transverse direction. With the increasing fiber content compressive strength was increased. Strength increase ranges from 8 to 16%. PFRP has better crack control. There is increase in the shear strength by 23 to 47% .

III. SLURRY INFILTRATED FIBER CONCRETE (SIFON)

SIFCON is a special type of high performance (steel) fiber reinforced concrete (HPFRC). It is a new construction material possessing high strength as well as large ductility and potential for structural applications. When accidental and abnormal loads are encountered during service loads .SIFCON also exhibit new behavioral phenomenon, that of Fiber lock" which believed to be responsible for its outstanding stress-strain properties. The matrix in SIFCON has no coarse aggregates, but high cementations content. However, it may contain fine and coarse sand and additives such as fly ash, micro silica and latex emulsions. The matrix fineness must be designed so as to properly infiltrate the fiber network placed in molds, since otherwise, large pores may form leading to substantial reduction in properties. A controlled quantity of high range water reducing admixtures .It may be used for improving flowing characteristics of SIFCON. All steel fiber types namely straight, hooked and crimped can be used. The fibers are subjected to frictional and mechanical interlock in addition to the bond with the matrix. The matrix plays the role of transferring the forces between fibers by shear, but also acts as bearing to keep fibers interlock. Normally, fiber reinforced concrete contained 1to 3% by volume, SIFCON contains 4-12% of fibers.

IV.CONCLUSION

Fiber reinforced polymer (FRP) is widely accepted as materials for structural and non-structural application in the field. Interest in FRP for structural applications is due to specific modulus and strength of the reinforcing fibers. It is well suited for development of novel repair, retrofit and new construction solution that lead to

economical and improved the structural performance.FRP as strengthening and retrofitting material has several advantages over conventional materials. Its thickness is small and hence its application does not add weight to existing structures. It helps to preserve the cultural heritage of monumental structures. GFRP, CFRP, BFRP, are most desirable in repair/retrofit if structural elements such as beam column and slabs, which requires a high increase in strength, toughness, energy absorption, fatigue and ductility ratio, etc.

REFERENCE

[1] Priti A. Patel, Dr. Atul K. Desai, and Dr. Jatin A. Desai "Evaluation of Engineering Properties for PolypropylenFibre Reinforced Concrete", (2012)

[2] Gonzalo Martinez-Barrera, Fernando Urena-Nunez, and Osman Gencel, Witold Brostow," Mechanical properties of polypropylene-fiber reinforced concrete after gamma irradiation", Composites: Part A 42 (2011) 567–572

[3] Ha¸sim Pıhtılı, and Nihat Tosun, "Effect of load and speed on the wear behavior of woven glass fabrics and aramid fiber reinforced composites", Wear 252 (2002) 979–984.

[4] Hedong Niu, Alvaro Vasquez, and Vistasp M. Karbhari,"Effect of material configuration on strengthening of concrete slabs by CFRP composites", Composites: Part B 37 (2006) 213–226.

[5] Lelli Van Den Einde, Lei Zhao, and Frieder Seible, "Use of FRP composites in civil structural applications", Construction and Building Materials 17 (2003) 389–403.

[6] Ľuba Horbanová, Anna Ujhelyiová, Jozef Ryba, Ján Lokaj, and Peter Michlík, "Properties of composite polypropylene fibers for technical application", Acta Chimica Slovaca, Vol.3, No.2, 2010, 84 – 92.

[7] Antonopoulos, C.P. and Triantafillou, T.C -Strengthened R.C. Beam-Column Joints Journal of Composites and Construction, ASCE, Vol. 7, February (2003)

[8] Ramakrishnan. V. "Strengthening of RC Beam by using BFRP" 2003

[9] Tarek H. Almusallam and Yousef A. Al-Salloum."Retrofitting of RC beam and Column joints using FRP Laminates":2007

[10] JCI. Technical report on continuous fiber reinforced concrete. JCI TC952 on Continuous Reinforced Concrete 1998; 116-124.

[11] JCI. Technical report on retrofit technology for concrete structures. Technical Committee on Retrofitting Technology for Concrete Structures 2003; 79-97.