International Conference on Latest Innovation in Engineering Science and Management
Buddha Institute of Technology, GIDA, Gorakhpur (UP)
30th - 31st March 2019 www.conferenceworld.in ISBN : 978-93-87793-80-4

A Review on Strengthening of R.C.C. Slab by Using CFRP

Vaibhav Jadhav[1] , Santosh Mohite[2]

1(Dept of civil Engineering ,Annasaheb Dange Collage of Engineering and Technology , Ashta, India)

2(Assistant Professor, Department of Civil Engineering, Annasaheb Dange College Of Engineering and Technology, Ashta, India)

ABSTRACT *This paper presents a review on strengthening of RCC slab by using CFRP. The use of composite materials is more in repairing and retrofitting of concrete structures in the last few years, so that many of concrete structures would be strengthened by these materials. One of these applications are Carbon Fibre Reinforced Polymer (CFRP).material used in strengthening and retrofitting of reinforced concrete structures. The main reason for this is that it is possible to obtain a good strengthening effect with a relatively less work effort. It is also possible to do a strengthening work without changing the appearance or dimensions of the structure***.**

Keyword- CFRP,Flexural strength, Reinforced concrete slab, Epoxy adhesive, Deflection, Prestressing.

1. INTRODUCTION.

The structure is designed for a specific period, and the design life varies depending on the nature of the structure. In domestic buildings, the lifetime of this design is about 25 years and in public or commercial buildings it will be 50 years.

The deterioration of the concrete structure is a major challenge faced by the infrastructure and bridge industry worldwide. Degradation is mainly caused by corrosion of steel, gradual decrease in resistance due to aging, repetition of high intensity load, temperature change, freezing and thawing cycle, contact chemicals, saline and exposure to ultraviolet light. Enhancement or modernization is an effective way to enhance it, as structure replacement or complete reconstruction will benefit.

The most common technique for strengthening RC slabs has been involved in the use of epoxy bonded external steel sheets. It has been experimentally proved that this technique can be used to increase the bending strength of structural members. Although the joining technique of steel is simple, cost effective and efficient, there is a serious problem of deterioration of the joint at the interface between steel and concrete due to steel corrosion. Another general strengthening technique is the construction of a very effective steel jacket for strength, rigidity and ductility reasons. However, it increases the overall dimensions of the cross section, resulting in an increase in the weight of the structure and requires a lot of labour. To solve these problems, we replaced the steel plate with a lightweight, corrosion resistant CFRP composite plate. CFRPC helps to increase strength and ductility without excessive increase in stiffness. In addition, such materials can be designed to meet specific requirements.

In order to consider the need to strengthen the CR slab, it is necessary to analyze the situation actually occurring when existing RC slabs are insufficient for various reasons and repairing and / or strengthening is considered necessary. The situation where the RC slab necessary for repair follows corrosion of steel improves the service life of the RC slab, changes the design parameters, restores the strength and rigidity of the slab.

2.LITERATURE REVIEW.

2.1 Hakan Nordin et al. (2003) (1), The most current research in the thesis focuses on the reinforcement of concrete structures with advanced CFRP bars together in the groove of the concrete cover, the PRE-STANDARD force is transferred to the concrete through the sticky band and only the anchor was used during a mechanical test .Three factor factors were changed during the test of the force of guarantee, joint length and stiffness of the bar; The result of the test shows an increase in the concrete breaking load and an increase in the steel yielding load.

2.2 Everaldo Bonaldo, Joaquim O. Barros, Paulo B. Lourenço et al.(2006) (2),

In this document, boosting the strategy together, one SFRC layer and NSM laminating CFRP strips have been implemented to significantly increase its flexural strength of current RC slabs. Experimental results of four-point bending tests, carried out in concrete slabs. strips unstrengthen and strengthened, are presented and analyzed.

2.3 H. M. Seliem, E. A. Sumner, R. Seracino & S. T. Smith et al. (2008) (3),

This paper reports field tests on the use of Carbon Fiber Reinforced Polymers (CFRP) strengthening alternatives to restore the flexural capacity of the RC slab after having large openings cut out in the positive moment region. The uniqueness of this study is that the test was performed on an existing multi-storey RCC building that was scheduled for demolition. Testing a real structure allowed incorporating factors and boundary conditions that typically cannot be simulated in the laboratory.Five tests on five different slabs were carried out to evaluate the ability of the CFRP strengthening alternatives to restore the flexural capacity of the slab after introducing the openings. Three types of strengthening techniques was investigated to find out the most effective system for strengthening. The three different types of strengthening techniques are use of externally bonded.(EB) CFRP laminates, EB CFRP laminates with CFRP anchors, and Near Surface Mounted (NSM) CFRP strips. Test results showed that the three strengthening techniques enhanced the Load carrying capacities of the slabs with openings with the NSM technique more effective than the EB technique. The use of CFRP anchors using EB laminates the total detachment and therefore the slab allows its full bending capacity to return.

2.4 Dragos Banu and N. Țaranu et al. (2010)(4),

In this document, several reinforcing techniques have been developed for reinforced concrete slabs with or without cuttings. The development of these methods is a necessity for different causes such as inadequate maintenance, overload of the reinforced concrete element, corrosion of the reinforcements and other different situations that have appeared over time. Each of the techniques presented in this document is more appropriate for a given situation and has its advantages and disadvantages. These techniques are believed to be traditional due to their prolonged use over time and which involve only traditional construction materials such as cement

and steel. The five techniques in this document have been and are the most used in the past and present throughout the world and this paper presents a brief presentation of the methods and the way in which they are applied. The selection of one of these methods is imposed by a sum of technological and economic factors.

2.5 M. Hosseini, S. Dias, J. Barros et al. (2013) (5),

In this paper they have studied the effect of the prestressed NSM CFRP laminates on the behaviour of RC slabs, an experimental program has been carried out. A total four nos. of RC slabs was tested, a reference slab (withoutCFRP), and three slabs flexural strengthened using NSM CFRP laminates with different prestress level: 0%, 20% and 40% of the ultimate tensile strength of the CFRP material. The experimental program is described and the main results are presented and analyzed in terms of the structural behaviour of the RC slabs failure modes and performance of the NSM technique with prestressed CFRP laminates.

2.6 G. I. Khaleel, I. G. Shaaban, K. M. Elsayedand, and M. H. Makhlouf et al.(2013)(6),

This study aims to determine the efficiency of using Fiber Reinforced Polymers (FRP) systems to strengthen the slab–column connections subjected to punching shear .The reinforcement systems used consisted of external FRP brackets made of glass and carbon fibers. The brackets have been installed around the column. Furthermore, external steel links were used as a conventional reinforcement method for comparison. In recent years, the use of FRP for strengthening concrete structures has been studied by many researchers, who are linked to the strengthening of reinforced concrete slabs, beams and columns. The use of FRP in the reinforcement of flexural concrete slabs is carried out by joining the sheet tension face. The use of FRP to reinforce the flat slab against the shear can be considered as a new application. This research shows the results obtained from an experimental investigation of 4 internal connections of slabs es of two half-scale levels, which were built and tested under the shear drilling caused by a centric vertical load. The research included a reinforced sample was considered as a control sample, a sample reinforced with steel connecting rods, reinforced with external stumps in glass fiber reinforced polymers (PRFV) and a reinforced sample sample external brackets made from fiber reinforced polymer carbon (CFRP). Therefore, the type of reinforcing material is the basic parameter in this study. The experimental results showed a significant increase in puncture resistance and flexural rigidity of the reinforced samples compared to the control samples. Furthermore, the reinforced tested plates showed an improvement in relative ductility. Finally, the equations to predict resistance applied to the plate cut-column connections perforated with different materials (steel, GFRP and CFRP) and compared with the experimental results.

2.7 Jiho Moon, Mahmoud M. Reda Taha, and Jung J. Kim et al. (2017)(7),

In this paper, a hybrid polymer composite system composed of UHPC and CFRP has been proposed as an adaptation system to improve the flexural strength and ductility of RC slab. Although the effectiveness of the proposed system has previously been confirmed through the testing of three full-size unidirectional slab having two continuous sections, the plates reconstructed with the hybrid system have not succeeded in cutting. This sudden yielding of the cut would result from the excessive improvement of bending strength compared to shear strength. In this study, shear connectors were installed between the hybrid system and an RC plate. Using a simple radius, only the positive moment section was examined. Two large-scale RC slab were launched and

tested in case of failure: the first as a control and the second with this new reinforcement technique. The proposed reinforcement system has increased the load capacity of the final slab by 70%, the rigidity of 60% and the resistance of 128%. The efficiency of the shear connectors in the ductile behavior of the retrofitted slab was also confirmed. After separating the upper part of the UHPC from the slab, the shear load of the shear connector transfer and the slab system were balanced by compression in UHPC and tension in CFRP.

3.CONCLUSION.

From above literature it is conclude that

Experimental program has shown that the hybrid reinforcement technique has great potential. Application to strengthen the bending of the RC slab, not only in terms of increasing the final load of the slab.

1) Strengthening of RC slab using CFRP laminated strips or the use of NSMR is an effective technique. The use of these techniques increases the initial stiffness of the original samples by about one and a half times and maintains the ductile behavior of the original samples.

The hybrid strengthening system also led to an increase of about 350% in the RC slab maximum load carrying capacity with respect to that of the reference slabs, and an increase of about 80% in comparison to that of the slabs only strengthened with NSM technique. When compared to the reference slabs, an increase of about 150% was obtained for the load carrying capacity when applying the NSM strengthening techniques.

REFFERENCES

Hakan Nordin (2003). *Flexural strengthening of concrete structure with prestressed near surface mounted CFRP rods.* 2003: 25.ISSN:1402-1757.ISRN: LTU-LIC- -03/25- - ISBN: 91-89580-80-7.

Everaldo Bonaldo, Joaquim O.Barros, Paulo B. Lourenço (2006*). Efficient strengthening technique to increase the flexural resistance of existing RC slabs: NSM CFRP laminates and compressive thin bonded SFRC overlay. Report* 09-DEC/E-06.

H. M. Seliem,E. A.Sumner,R. Seracino & S. T. Smith (2008). *Field testing of RC slabs with openings strengthened with CFRP.Fourth International Conference on FRP Composites in Civil Engineering (CICE2008)22-24July 2008, Zurich, Switzerland.*

.Dragos Banu and N. Țaranu (2010), traditional solutions for strengthening Reinforced concrete slabs.". Buletinul institutului politehnic din iașipublicat deuniversitatea Tehnică Gheorghe Asachi" din IașiTomul LVI (LX), Fasc. 3,

Habibur Rahman Sobuz, Ehsan Ahmed, Noor Md. Sadiqul Hasan, Md. Alhaz Uddin(2011). Use of carbon fiber laminates for strengthening reinforced concrete beams in bending. International journal of civil and structural engineering volume 2, no 1,

M. Hosseini1, S. Dias, J. Barros (2013). Behaviour of RC slabs flexurally strengthened with prestressedNSM CFRP laminates. FRPRCS11Joaquim Barros & José Sena-Cruz (Eds)UM, Guimarães,

Jiho Moon, Mahmoud M. Reda Taha, and Jung J. Kim (2017). Flexural Strengthening of RC Slabs Using a Hybrid FRP-UHPC System Including Shear Connector*Advances in Materials Science and EngineeringVolume 2017,Article ID 4387545, 7 pageshttps://doi.org/10.1155/2017/4387*Seidu, S.O (2008). Influence of Inoculant's type on thermal analysis parameters of ductile irons, *4thinternaltion conference, Galati, Romania*, pp. 237-241.