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Review Paper on Retrofitting of RCC Beam Column Joint Using Hybrid Reinforced Fiber Reinforced Concrete

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Abstract – *This paper represents the change of Reinforced concrete structural components which are found to exhibit distress, even before their service period is over due to several causes. Such unserviceable structures require immediate attention. And it was done by replacing reinforced concrete by Hybrid Reinforced Fiber Reinforced Concrete. It was determined that load carrying capacity for beam-column joint retrofitted with Hybrid Reinforced Fiber Reinforced Concrete was increased.*

Key Words: *Reinforced concrete, Hybrid Reinforced Fiber Reinforced Concrete, Distress, Retrofitted, and beam-column joint.*

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I. Introduction

Reinforced concrete is the commonly used material for the construction of structures which are designed in accordance to the specifications given in the standard codes to meet the service life. Based upon these specifications, the loads are taken into account for the design of the various elements of the structure like beams, columns and slabs. During the service life if the loading conditions change due to purpose of use of the structure, this can result in non-performance of the structural elements for which it was designed earlier. The structures are also susceptible to deterioration due to earthquake, flood, cyclone, carbonation, chloride attack, environmental pollution, deficiencies of the material used, inadequate design and faulty construction. The environmental stresses/factors like high humidity, air and water pollutants also cause corrosion and develop cracks leading to the failure of structural elements. Replacement of the damaged structural elements is very difficult and cost intensive process and the replacement of a particular structural element in the existing structure also creates risk to the integrity of other connecting members. To restore the required strength of the deteriorated structure, retrofitting is the solution. Retrofitting can be done in two ways:

1. Global Retrofitting
2. Local Retrofitting

In Global Retrofitting, the entire structure is retrofitted to fulfill the serviceability requirements. It involves the analysis and design of the entire structure as per the specifications given in standard codes. Whereas, in Local

Retrofitting, only specific member of the structure is either strengthened or replaced. Jacketing construction is the most preferred method of retrofitting that can be applied by the following techniques:

1. Confinement with fiber reinforced polymers such as aramid fibers, carbon fibers and glass fiber polymers.
2. Confinement with external steel caging techniques.
3. Confinement with Hybrid Reinforced Fiber Reinforced Concrete.

In comparison to the above, retrofitting with Hybrid Reinforced Fiber Reinforced Concrete confinement is the oldest and cost effective technique used to strengthen the concrete structures. Hybrid Reinforced Fiber Reinforced Concrete consists of closely-spaced and uniformly-distributed reinforcement which provides ductility to the otherwise brittle concrete. This inherent property makes the Hybrid Reinforced Fiber Reinforced Concrete a distinctive composite construction material. The unique properties of Hybrid Reinforced Fiber Reinforced Concrete such as water proof, fire resistant, durability, low self-weight and crack resistant makes it an ideal material for wider applications.

II. Literature Review

Kondraivendhan and Pradhan (2009) Studied effect of Hybrid Reinforced Fiber Reinforced Concrete confinement on behavior of concrete. The effect of different grades of concrete confined with Hybrid Reinforced Fiber Reinforced Concrete was studied by keeping all other parameters constant. It was found that with the increase in compressive strength of the concrete significantly improved in lower grades of concrete such as M25 which showed 78% increase as compared to higher grade of concrete M55 which resulted in an increase of 45.3%.

Turgay et. al. (2010) studied the effect and failure mechanisms of large- scale square/ rectangular columns wrapped with fiber reinforced polymer (FRP). The experimental research program studied the performance of large-scale square RC columns wrapped with carbon fiber reinforced polymer (CFRP) sheets. Moreover, the research was mainly focused on the investigation of the total effect of longitudinal and transverse reinforcement and FRP jackets on the behavior of concentrically loaded columns. A total of 20 large-scale RC columns were fabricated and tested to failure under axial loading in the structural laboratory.

Xiong et. al. (2011) studied the load carrying capacity and ductility of circular concrete columns confined by Hybrid Reinforced Fiber Reinforced Concrete including steel bars (FS) where they are proposed to increase the compressive strength along with the ductility. Due to Hybrid Reinforced Fiber Reinforced Concrete caging along with steel bars specimens showed higher ductility, compressive strength and energy absorbing capacity than BS or FRP strengthened circular columns**.**

Kaish et. al. (2012) studied the effect of Hybrid Reinforced Fiber Reinforced Concrete jacketing with some modifications. Three types of Hybrid Reinforced Fiber Reinforced Concrete jacketing techniques were used to confine the column specimens that are; square jacketing with single layer wire mesh and rounded column corners (RSL); square jacketing using single layer wire mesh with shear keys at the centre of each face of column (SKSL) and square jacketing with single layer wire mesh and two extra layers mesh at each corner (SLTL) are considered for this purpose.

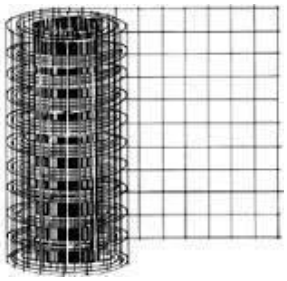
Have been developed in the recent years, such as low cost dwelling buildings and strengthening of a wide variety of structural elements.

III. Conclusions

This experimental study is carried out to analyze the behavior of RCC columns with different of slenderness ratio and Hybrid Reinforced Fiber Reinforced Concrete confinement on the strength of the columns. Based on test results, the following conclusions are obtained:

1. Hybrid Reinforced Fiber Reinforced Concrete confinement increased the ultimate load carrying capacity of columns.
2. It is essential to find out the specific areas where Hybrid Reinforced Fiber Reinforced Concrete confinement can be used.
3. Economically Hybrid Reinforced Fiber Reinforced Concrete technique is long lasting than other techniques.

R. Hafiza, S. Sameen, T. Rahman (2015) studied the column specimens for the ultimate load capacity and stressed samples confined with Hybrid Reinforced Fiber Reinforced Concrete using welded wire mesh as the confining material.



Welded wire mesh.

In case of pre-stressed specimens, the results showed that the confining increased the load carrying capacity to 33%. Ductility of the specimens also increased. In case of stressed samples to a value of 60% and 80% of the ultimate load capacity, the confinement enhanced the ultimate load capacity to 28% and 15% respectively. With the confinement the column specimens failed in a ductile manner as compared to brittle failure of the control specimens

Ornela Lalaj, Yavuz Yardım, Salih Yılmaz (2015) Stated that Hybrid Reinforced Fiber Reinforced Concrete is the oldest form of the reinforced concrete, dating back two centuries. It is composed of mortar and galvanized steel wire mesh. It is used for a wide range of application including construction of boats, water tanks, slabs and roofs, and lining of tunnels. Nowadays, reinforced concrete is widely known and used material, whereas Hybrid Reinforced Fiber Reinforced Concrete has limited applications. Properties such as high strength/weight ratio and good resistance to cracking and impact loadings are bringing Hybrid Reinforced Fiber Reinforced Concrete under the spotlight again. New applications

IV. Acknowledgement

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