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Retrofitting of RCC Beam Column Joint Using (HFRC) Hybrid 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 HFRC. It was determined that load carrying capacity for beam-column joint retrofitted with HFRC was increased.

1. Introduction

Reinforced concrete is mostly used in the Construction of structures which are designed according to the specifications given in the standard codes to meet the service life. Environmental factors like high humidity, air and water pollutants also cause corrosion and develop cracks leading to the failure of structural elements. The loads are taken into account for the design of the various elements of the structure like beams, columns and slabs. The structures are also gullible to deterioration due to earthquake, inadequate design of construction. . Replacement of the damaged structural elements and the integrity of other connecting members are very difficult and cost intensive process. so retrofitting is the solution which can be done by following 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 HFRC.

In comparison to the above, retrofitting with HFRC confinement is the oldest and cost effective technique used to strengthen the concrete structures. HFRC consists of closely-spaced and uniformly-distributed reinforcement which provides ductility to the otherwise brittle concrete. This inherent property makes the HFRC 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.

2. Literature review

Kondraivendhan and Pradhan (2009) Studied hybrid Reinforced Fiber Reinforced concrete effects and behaviour of concrete. Different grades of concrete are used with the effect of Hybrid Reinforced Fiber Reinforced Concrete 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) It was found that the effect and failure of large scale square and rectangular columns wrap with fibre reinforced polymer. By the experimental research on a major scale found that square RC columns wrapped with carbon fiber reinforced polymer (CFRP) sheets. The total effect of longitudinal and transverse reinforcement and FRP jackets on the behaviour of concentrically loaded columns were mostly focused. total 20 RC columns were fabricated and tested to failure under axial loading.

Xiong et. al. (2011) studied the ductility and load carrying capacity of circular concrete columns with Hybrid Reinforced Fiber Reinforced Concrete including steel bars. It was found that increase the compressive strength along with the ductility.

Kaish et. al. (2012) studied the effect of Hybrid Reinforced Fiber Reinforced Concrete jacketing with some modifications. This jacketing technioques confined with three types of of Hybrid Reinforced Fiber Reinforced Concrete. 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) d for this purpose.

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

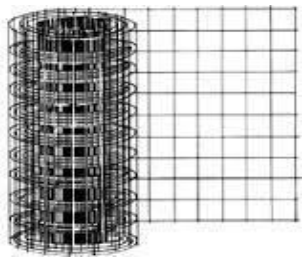

Fig. 1 Welded wire mesh.

In case of pre-stressed specimens, the load carrying capacity is increased by 33%. Ductility is also increased. In case of stressed the ultimate load capacity was 60% and 80%, 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

3. Conclusions

After the experimental study it was found that behaviour 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, following are the conclusions:

1. HFRC confinement increased the ultimate load carrying capacity of columns and beams.
2. Economically HFRC technique is long lasting than other techniques.
3. By using HFRC, it was found that failure of Beams and columns are minimized in large scale.

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