

Study on Retrofitted RCC Beams

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Abstract:

RCC is the most popular construction material used in structural applications. But, its susceptibility for deterioration under extreme environmental conditions leading to its fracture and failure under over loading poses problems to their extensive adaptation and requires rehabilitation at some stage. In this investigation, the effect of plate bonding technique of retrofitting as a rehabilitation measure for strength gains of stressed RCC beams is studied. Ferro cement sheets are used as retrofitting material due to their easy availability, higher durability and better flexibility in its applications. This paper reports the effect of such retrofitting technique using Ferro cement sheets on stressed RCC beams.

INTRODUCTION

Reinforced concrete is one of the most abundantly used construction material, not only in the developed world, but also in the remotest parts of the developing world. The RCC structures constructed in the developed world are often found to exhibit distress and suffer damage, even before their service period is over due to several causes such as improper design, faulty construction, change of usage of the building, change in codal provisions, overloading, earthquakes, explosion, corrosion, wear and tear, flood, fire etc. Such unserviceable structures require immediate attention, enquiry into the cause of distress and suitable remedial measures, so as to bring the structure into its functional use again. In the last few decades several attempts have been made in India and abroad to study these problems and to increase the life of the structures by suitable retrofitting and strengthening techniques. Of the various retrofitting techniques available, plate bonding is one of the most effective and convenient methods of retrofitting. Among the plate bonding techniques FRP plates are quite popular now-a-days. But it is observed that the use of FRP is restricted to developed countries or urban areas of the developing countries due to higher initial cost and requirement of skilled labor for their application. Thus, there is a need to develop an alternative technique, which is economical and can be executed at site with the help of semiskilled labor available at site. Ferro cement jacketing is found to be one such attractive technique due to its properties such as good tensile strength, lightweight, overall economy, water tightness, easy application and long life of the treatment. Many experimental studies have been conducted in recent years to strengthen flexural members by using various materials. The flexural strength and ductility of beams repaired with Ferro cement was reported to be greater than the corresponding original beams and the beams repaired by the conventional method. Beams rehabilitated with Ferro cement jackets show better performance in terms of ultimate strength, first crack load, crack width, ductility and rigidity of the section. It was observed that the cracking and ultimate strength increases by 10 percent and 40 percent in case of rehabilitated beams, whereas these increases were 10-30 percent and 40-50 percent in case of composite sections. The jacketing increases the rigidity of the beams

and lead to 37percent and 29 percent reduction in deflection. The crack width of the composite beams and rehabilitated beams decreases on an average by 42 percent and 36 percent respectively. The behaviour of Ferro cement in flexure depends upon various parameters such as mortar, type of wire mesh, orientation of wire mesh etc.; hence the behavior of Ferro cements jackets. In this present work, the beams are stressed upto 75 percent of the safe load and then retrofitted with Ferro-cement jackets with wire mesh.

EXPERIMENTAL PROGRAMME

To carry out the investigation, two prototype beams of size 230mm x 230mm x 2000mm reinforced with two bars of 10 mm diameter in tension and two bars of 8mm diameter in compression were cast using the proportioned mix. Out of these four beams, one is used as control beam (Type- A) and tested to failure to find out the safe load carrying capacity corresponding to the allowable deflection as per IS: 456-2000 i.e. span/250. The other one beam is stressed to 75 percent of the safe load obtained from the testing of the control beams and then retrofitted with 15 mm thick Ferro cement jackets made with 1:2 cement sand mortar and w/c ratio 0.40. The jacket was reinforced with single layer of 40mm x 40mm square welded wire mesh. The wire mesh orientation 45 degree is used in the Ferro cement jackets. Since it is considered one of the best orientation Ferro cement jacketing process. The beams were divided into two categories. Control beams is designated as type-A, whereas, beams retrofitted with welded wire mesh is designated as type – B beams.

Material Properties

The properties of various materials used in the experimental study are reported.

- Grade of Concrete: M20
- Grade of steel : Fe415