A Review on Impact of Fire Steel Reinforcement of Concrete

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***Abstract*- With the increased incidents of major fires in buildings; assessment, repairs and rehabilitation of fire damaged structures has become a topical interest. This is a specialized field involves expertise in many areas like concrete technology, material science and testing, structural engineering, repair materials and techniques etc. Research and developmental efforts are being carried out in this area and other related disciplines. In this topic the experience of real life problems are presented which add immense value to this. This topic also gives a comprehensive knowledge on the overall strategy for the restoration of fire damaged buildings and also presents a critical appraisal of the assessment procedures by different nondestructive techniques, specifications and execution of repair techniques.**

***Index Terms*- Steel reinforcement, Impact study, concrete.**

INTRODUCTION

With the increased incidents of major fires and fire accidents in buildings; assessment, repair and rehabilitation of fire damaged structures has become a topical interest. This specialized field involves expertise in many areas like concrete technology, material science and testing, structural engineering, repair materials and techniques etc. Research and development efforts are being carried out in these related disciplines. Any structure can undergo fire accident, but because of this the structure cannot be denied neither abandoned. To make a structure functionally viable after the damage due to fire has become a challenge for the civil engineering community. The problem is where to start and how to proceed. It is vitally important that we create buildings and structures that protect both people and property as effectively as possible. Annual statistics on losses caused by fires in homes and elsewhere make for some unpleasant readings and sadly through these events we learn more about fire safety design.

We are all aware of the damage that fire can cause in terms of loss of life, homes and livelihoods. A study of 16 industrialized nations (13 in Europe plus the USA, Canada and Japan) found that, in a typical year, the number of people killed by fires was 1 to 2 per 100,000 inhabitants and the total cost of fire damage amounted to 0.2% to 0.3% of GNP. In the USA specifically, statistics collected by the National Fire Protection Association (USA) for the year 2000 showed that more than 4,000 deaths, over 100,000 injuries and more than $10bn of property damage were caused by fire. UK statistics suggest that of the half a million fires per annum attended by firefighters, about one third occur in occupied buildings and these result in around 600 fatalities (almost all of which happen in dwellings). The loss of business resulting from fires in commercial and office buildings runs into millions of pounds each year. The extent of such damage depends on a number of factors such as building design and use, structural performance, fire extinguishing devices and evacuation procedures. Although fire safety standards are written with this express purpose, it is understandably the safety of people that assumes the greater importance. Appropriate design and choice of materials is crucial in ensuring fire safe construction. Codes and regulations on fire safety are updated continually, usually as a result of research and development.

methodology

Damage Classification Of Structural Members:

Based on the information collected from the spread sheets indicating the condition of surface appearance of concrete (plaster/finish, colour, crazing), structural conditions and further correlated with the results of NDTS and laboratory tests, the structural members have been designated with various damage

classifications. Combined with the personal experience of the expert, the visual inspection and the various tests present a fairly accurate condition of the damaged structural element. Since the reinforced concrete is a highly variable matrix, sometime the results of different tests appear to give somewhat contradictory results but with experience, these can be reconciled. Based on the damage classifications, the repair classification and repair requirements are given below;

Criteria For Damage Classifications:

Table 1.4: Damage classifications

Class of damage	Repair classification	Repair Requirements
Class 1	Superficial	For repair use cement motor trowelling using cement slurry bonding
Class 2	General	Non-structural or minor structural repairs like restoring cover to reinforcement using cement polymer slurry as bonding layer and nominal light fabric reinforcement or using epoxy mortar over the primary coat epoxy primer. No fabric for small patches of area less than 0.09 sq.m
Class 3	Principal Repair	Where concrete strength is significantly reduced, strengthening to be carried out with concreting in case of slabs and beams and jacking in case of columns. For less damaged columns concreting is also proposed. The bonding material used shall be epoxy formulation. Additional reinforcement shall be provided in accordance with load carrying requirement of the member. Both residual and final strength to be checked by design procedure.
Class 4	Major repair	Repair method is demolition

Method of Representing Class Of Damages In The Drawings:

The information on class of damage, is tabulated in the grid sheets in the form of drawings for the site references The grid drawing plans are prepared in conformity with the original structural drawings for each floor i.e the same column nos. beam nos. and slab nos. are adopted as had been done in the original structural drawings. Each structural member like column, beam and slab is marked with class of damage in different colour for each floor in grid drawing and then these are consolidated in tabulated form under schedule of damage classification i.e. separately for columns, beams and slabs and members having same class of damage are grouped together. The grid drawing for a particular floor show damage classification of beams and slabs of that particular floor as seen from the bottom and of the columns supporting that particular floor. The damage classification for columns, beams and slabs have been marked in red ink, black ink and green ink respectively on the grid drawings. The members unmarked are unaffected and members marked 'O' are also unaffected. Reference to spread sheet numbers are also indicated in the grid drawings for each floor. Similarly, reference of grid drawing is also shown in spread sheets for the co-relation of the data. Another grid drawing(plate 3.6) of the same floor is prepared in which class of repair corresponding to the class of damage is marked in different colours as per the legends mentioned below.

Slab	
Structurally unaffected	Left as it is
Superficial repairs	yellow colour
General repairs	Green colour
Principal repairs	Red colour
Major repairs	Shaded black
Beam & column members	
Superficial repairs	○
General repairs	●
Principal repairs	★
Major repairs	*

CONCLUSION

Studying the characteristic changes in the mechanical properties of the bars by Tensile strength testing using Universal Testing Machine shows that the

increase in ultimate load and decrease in percentage elongation of the specimen which mean that there is significant decrease in ductility of the specimen.

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