

# Study on Structural Failures and Remedial Measures

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## Abstract

In this Research, various reasons for structural failures like Faulty Design, Inferior quality of materials, Poor Workmanship, Weathering conditions, Natural calamities etc., have been discussed. It is also discussed about the various methods of doing the repair works that is remedial measures. To know better about the nature of concrete elements, Eighteen (18) concrete beams with nominal reinforcement have been cast. They were grouped into Six (6) batches each containing Three members. All the beams were subjected to loading test in Loading Frame at Government College of Engineering, Salem. Three beams were kept as control specimens. All the beams were first tested up to initial crack condition. The control specimens were tested up to ultimate failure. The values of load and deflections were obtained and tabulated. Five methods of repair work was done on the five groups of members. The repair materials used are GPRF of 225 GSM, 300 GSM, 400 GSM, Jute Fiber and Steel Jacket. After curing they were tested up to failure. The values of Load and Deflections were noted. Load Cells are used for noting down the Deflections. From the values obtained it was noted that, out of all the methods applied Steel Jacketing is found to be the most effective and also most economical. So that method is recommended for the concrete repairing work.

## INTRODUCTION

They could build their huts in safe places which were not affected by natural calamities by experience. If anything happened like failure they could repair them with the least cost materials available in nature.

All Civil constructions are subjected to failures in one or other way at a particular time except some important monuments like The Taj Mahal, The Kutub Minar, The Great Wall at China, The White House etc., The failures of buildings are broadly classified into two types. Viz structural failures and the other is nonstructural failures. Structural failure affects the structures in a noticeable way and also the life of the occupants. Structural failure means the failure of a concrete construction to fulfill the purpose for which it was constructed. Nonstructural failures includes defects in brickwork, defects in plaster work,

defects in plumbing work, and defects in electrical work etc., which do not affect the safety of structure to a great extent in grand manner.

## REVIEW OF LITERATURE AND NEED FOR RESEARCH WORK

For every thesis it is important to study about what happened previously regarding the topic and what is presently going on related to this thesis. Here the literature is split into two parts. In the first part studies about structural failures is done and in the second portion the literature about remedial measures is done. It has also been mentioned the difference done in the current thesis.

### Failures of Structures

A Study about the. From the study it was stated that the relative displacement, which is displacement of a point on a structure with respect to its original location or an adjacent point on the structure that has also undergone movement, can be an effective indicator of post event structural damage. The available techniques for measuring relative deformations, identify their limitations, and propose areas where further research is needed were also reviewed. Suggestions for current challenges and research opportunities are proposed with emphasis on accuracy



considerations, the need for creating a national database of structure information, and methods for large-scale automated assessment.

DimitriosG. presents key parameters that affect numerical modeling of steel frame structures for reliable collapse simulations. The collapse assessment was based on experimental data obtained from a full-scale shaking table collapse test of a 4-story steel moment frame and a blind numerical analysis contest that was organized in parallel with the collapse test. It was shown that (1) there is no clear advantage between three-dimensional (3D) and two dimensional (2D) analysis in the prediction of a side sway collapse mechanism for buildings with a regular plan view as in the case of study; (2) the assumption of Rayleigh damping leads to better predictions of structural response compared with stiffness proportional damping; and (3) accurate prediction of collapse necessitates that  $P-\Delta$  effects always be considered in the analysis. It was also proved that accurate simulation of steel component deterioration is a key factor for reliable prediction of collapse behavior. It was notable that a combination of bending strength increase and delay of local buckling in first-story columns is most effective for the enhancement of seismic performance against collapse.

Experiments were conducted by. It was stated that, losses from water distribution systems were reaching alarming levels in many cities throughout the world. Leakage is often the principal cause of water loss because of ageing and deterioration of these systems, and pressure has been verified to assume a key-role in water-loss management. A simple analytical model based on a beam with elastic constraints was presented to estimate the leak area (from which the leakage is then estimated) in longitudinally cracked pressurized pipes and to evaluate the effect of pressure on the opening area of the crack. The model was calibrated on the results of a three-dimensional finite-element analysis and then validated by experimental results. The validation had been carried out for a wide range of pipes made of different materials (PVC, cast iron, asbestos-cement, and steel) with radii ranging from 27.5 to 110 mm, thicknesses from 1.5 to 12 mm, and crack lengths from 50 to 200 mm. The beam model, notwithstanding its simplicity, provides reliable leakage evaluations in longitudinally cracked pressurized pipes.

#### OBJECTIVES AND METHODOLOGY

This Research work consists of studying about the failure of beams, mainly formation of cracks and to find the remedial measures. Two retrofitting methods that is wrapping Technique and steel jacketing methods are applied to repair the cracks.

#### Objectives

The objectives of the work are

- To find the failure mode (development of crack) on the beam when it reached the cracking load and ultimate load.
- To carry out different Rehabilitation Methods. To identify the best method of rehabilitation in aspect of strength and deflection

#### PRELIMINARY TESTS AND REPAIR MATERIALS

As this thesis mainly concentrates on study of structural failures, mainly cracks, it has been decided to cast beams which are main component of any construction. So the materials used for casting should be tested for their properties. Then the beams are casted. As preliminary work all base materials are tested for necessary properties like specific gravity, water absorption, sieve analysis, cement, cube test for concrete and cement are done as per prescribed IS codes.

#### EXPERIMENTAL STUDY AND DISCUSSION

##### GENERAL:

For preparing the specimens for this work, beam moulds of required size were fabricated. Three beams were kept as control specimens for comparison. Five rehabilitation methods are adopted, and for each rehabilitation method three beams were utilized. Therefore totally Eighteen beams were casted.

##### Specimen Detail

Specimen details like dimensions cross sectional details and longitudinal sectional details are given below.

##### Specimen Detail

The beam size is 150mm X 200mm with span of 1500mm. . The beam has been cast by using . For Tension and compression Reinforcement two numbers of 12mm dia. rod are provided, 8mm dia. rod is provided as shear reinforcement at 100mm c/c distance. Shear reinforcement is provided with two legs, with a leg length of 35mm. Details of the specimen were tabulated in

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