

REPAIR TECHNIQUES AND REHABILITATION OF THE BUILDING

James Smith

Scholar, Princeton University, NJ 08544, USA

Abstract

A. Repair

The main purpose of repairs is to bring back the architectural shape of the building so that all services start working and the functioning of building is resumed quickly. Repair does not pretend to improve the structural strength of the building and can be very deceptive for meeting the strength requirements. The objective of any repair should be to produce rehabilitation – which means a repair carried out relatively low cost, with a limited and predictable degree of change with time and without premature deterioration and/or distress throughout its intended life and purpose.

B. Rehabilitation

Structural rehabilitation involves the upgrading or changing of a building's foundation in support of changes in the building's owners, its use, design goals or regulatory requirements. In every case it is determined that it is cheaper to rehabilitate the structure and make the building improvements instead of demolishing and constructing a new building in the allotted space

C. Retrofitting

The engineering which involves in modifying the existing buildings for structural behavior without hampering its basic intent of use is termed as retrofitting. It becomes necessary to improve the performance of structures including those facing loss of strength due to deterioration or which have crossed their anticipated lifespan. The realization of retrofitting depends on the authentic cause and measures adopted to prevent its further deterioration. This development includes repair, retrofit, renovation and reconstruction wherever required. A proper load path has to be analyzed by a structural engineer and a decision has to be taken if any additional member like shear walls, etc needs to be added.

Repair and Rehabilitation is necessary to save hazardous failure of structures due to deterioration. It is recommended for old buildings which have some signs like cracks, corrosion of embedded materials, etc. Therefore timely maintenance of structures is required. The selection of technique is used as per cost, location of site and other factors. Thus for proper maintenance, the techniques likewise Rebound Hammer Testing, Ultrasonic Pulse Velocity Evaluation, etc. are utilized. After analyzing the problem of building, we can apply the appropriate repair methods which are described above i.e. Guniting, Routing and Epoxy Injection.

Scope of repairs and rehabilitation

Health Assessment of the existing structures in adherence with

latest tools. In depth Structural Audit and Condition assessment calcs for the structures with emphasis on load path and decapitation of seismic forces. Repairs and retrofitting methods and Post retrofitting evaluation for behavior of the structure.

1. Introduction

The existing buildings nearing its serviceability life and showing sign of break down does calls for technical intervention for enhancing their life and to avoid any accidental failure due to seismic event or other structural reason. The deterioration of the structures takes place due to Weathering action, Fire, Natural calamities like earthquake, Flood, Tsunami, cyclones, Soil and structure interaction (Settlement of soil or soil failure), defects in construction and many more. Post the technical evaluation of such structures, the decision to repair or replace a structure or its component has to be taken. This has to be in compliance with economy, construction feasibility and as per latest trends and techniques.

2.1 Structural Audit

Structural Audit forms a preliminary step towards rehabilitation of buildings. Health assessment/structural Audit of any existing structure, do determine whether its functionality is as per desired and acceptable. It ensures the existing structure is thoroughly inspected as per relevant codes, techniques and the serviceability of the structure is judged based on it. It is an activity where actual data related to civil structures is observed, measured, registered and conclusions are drawn. This is performed through all times by responsible designers, contractors and owners with almost identical objectives to check that the existing structures behave as intended. The Audit helps to understand critical areas to repair and enhance life cycle of building by suggesting preventive and corrective measures like repairs and retrofitting

i. SHOTCRETE

Shotcrete is a method in which combination of sand and Portland cement are applied on the required area. This sand and cement is mixed pneumatically and then conveyed in dry state itself to the nozzle of a pressure gun, where water gets mixed and the hydration takes place just before to the expulsion. By this technique the material bonds perfectly to prepared surface. While application on irregular or curved surfaces, its high strength and good physical characteristics, make it an ideal means to achieve added structural capability in walls and other elements of building. With this there are some of minor restrictions to the technique as clearance, thickness, direction of application etc.

ii. EPOXY RESINS

Epoxy resins are excellent binding agents which are used as repair material. The use of epoxy resins gives high strength in the repair works. Epoxy resins are composed of chemicals with proportions which when changed gives results as per requirement. These epoxy components are mixed just prior to their application. The product formed by the addition of epoxy resin has low viscosity and it can be injected in small cracks also. The epoxy resins having higher viscosity could be used for the purpose of surface coating or for filling the larger cracks or holes also. The strength of epoxy mixture depends upon the temperature of curing. Lower the temperature higher will be the strength achieved.

iii. EPOXY MORTAR

In case of larger void spaces, epoxy resins of either low viscosity or higher viscosity are combined with sand or aggregate to form epoxy mortar. This mixture of epoxy mortar has much higher strength than the Portland cement concrete. Thus the mortar is not a stiff material for replacing reinforced concrete. It has also been reported that the epoxy is a combustible material. Therefore the epoxy material is not used alone. The epoxy mortar formed from mixing of sand and aggregates gives a heat sink for heat generated and with this it also provides increase in modulus of elasticity.

iv. GYPSUM CEMENT MORTAR

Gypsum cement mortar has very limited use regarding its structural application. This gypsum cement mortar has lowest strength at the failure among other materials of repair.

v. QUICK-SETTING CEMENT MORTAR

This quick setting cement mortar was actually manufactured for the use as a repair material for reinforced concrete floors that are adjacent to steel blast furnaces. This mortar is a non-hydrous magnesium phosphate cement with two components, a liquid and a dry; these are mixed in similar way of Portland cement concrete.

vi. MECHANICAL ANCHORS

Mechanical type of anchors gives wedging action to provide anchorage. Some of the anchors provide shear and tension resistance both. In the purpose of achieving strength these type of manufactured anchors are used. Alternatively for chemical anchors bonded in drilled holes polymer adhesives are used.

CONCLUSION

There should be keen observation where we had applied protective coatings.

- It is essential to carry out the periodic maintenance of structures.
- Each repair technique and repair material is suitable only for its particular application for which it is prepared.
- Honey combing and bug hole like surface defects requires immediate repairs.
- To restore the durability and serviceability of building the damaged part of structures should be repaired on priority basis however; structures affected by corrosion of reinforcement need special treatment to care of corrosion besides restoration of strength.
- Before repairs & rehabilitation of damaged structures it is essential to carry out detailed condition assessment of the building with non destructive and destructive tests so that suitable remedial measures and repair techniques could be employed.

REFERENCE

- 1) Halil Sezen, M. Asce (2012), "Repair And Strengthening of Reinforced Concrete Beam-Column Joints With Fiber-Reinforced Polymer Composites" *Journal of Composites For Construction* © ASCE.
- 2) J. Bhattacharjee (2016), "Repair, Rehabilitation & Retrofitting of RCC For Sustainable Development With Case Studies" *International Journal (CIVEJ) Vol.3, No.2.*
- 3) Jay H. Paul (2002), "Repair, Renovation And Strengthening of Concrete Structures"
- 4) Manish Kumar (2016), "Structural Rehabilitation, Retrofitting And Strengthening of Reinforced Concrete Structures" *International Journal of Civil, Environmental, Structural, Construction and Architectural Engineering Vol: 10, No: 1.*
- 5) Mr. Pavan D. Tikate, Prof. Dr. S. N. Tande (2014), "Repair and Rehabilitation of Structures"
Ed. New York: McGraw-Hill, 1964, Authors

