

Protection Repair and Maintenance of RCC Structure

Rakesh Kumar¹, Prabhat Kumartandan², Bhupesh Patel³, D.pooja⁴, Reshma Dhruw⁵, Pradeep Nirmal⁶

^{1,2,3,4,5}Graduate student, ⁶Assistant Professor,
Civil Engineering Department, RSR Rungta College of Engineering & Technology Bhilai C.G

Abstract –The purpose of the project is to gain fundamental and practical understanding on concrete repair and rehabilitation of the structures. Large number of reinforced concrete (RC) structure are deteriorating, of tenpre maturely, and need remedial measures to reinstate their safety and/or serviceability. Consequently, the need for repair and protection has grown considerably in recent years. While costs associated with repair of deteriorating concrete structures can be substantial, costs resulting from poorly designed or executed repairs may be even higher. Repair methods need to be designed with consideration for the anticipated or desired remaining service life of the structure. A distinction must be made between repairs intended to stop deterioration fully and those merely aimed at slowing down deterioration processes for a limited period of time. During the research for our project relevant repair methods for damaged concrete structures will be discussed, focussing on design methods. The project will be initiated with various sites nearby Nizampet inspection and repairs will examined. Then the respective repairs will be studied and classified into cracks, corrosion of concrete reinforcement, seepage and deterioration of surface coating. With the help of journals and publications a detailed study will be done on the causes for each repair and a suitable rehabilitation method will be suggested for each repair site by comparing various methods. This paper will consist of studies of various repairs along with pictures, referred case studies and other references.

Keywords- Deterioration, functional condition, reinforced cement concrete, resources.

I- INTRODUCTION

Concrete is the most widely used and versatile construction material possessing several advantages over steel and other construction material. Very often one

comes across with some defects in concrete they are in the form of cracks, spalling of concrete, exposure of reinforcement, excessive deflections or other signs of distress. Corrosion of reinforcement may trigger off cracking and spalling of concrete, coupled with deterioration in the strength of the structure such situations call for repairs of affected zones and sometimes for replacements of entire structure.

The Repair and Rehabilitation of structures include the following : (a) Inspection methods, assessment, monitoring, maintenance of structures. (b) Concrete durability, fatigue issues in bridges, laboratory studies, dynamic testing & analysis (c) Seismic strengthening. (d) General repairs.

Repair: - is the process of restoring something that is damaged or deteriorated or broken to good condition. Repairs are performed on damaged buildings to restore the strength after disaster.

Rehabilitations the process of restoring the structure to service level, once it involves the upgrading or changing of a building's foundation in support of changes desired, its use, design goals or regulatory requirements. Assessing the existing condition of the structure and deciding which component of the structure should be repaired or restored based on all future requirement of the structure. Need for repair and rehabilitation of structures:

- Faulty design of the structure
- Improper execution and bad workmanship
- Extreme weathering and environmental conditions
- High degree of chemical attack
- Ageing of structures.

II- LITRATURE

Externally bonded, FRP sheets are currently being studied and applied around the world for the repair and strengthening of structural concrete members. Strengthening with Fiber Reinforced Polymers (FRP) composite materials in the form of external reinforcement is of great interest to the civil engineering community. FRP composite materials are of great interest to the civil engineering community because of their superior properties such as high stiffness and strength as well as ease of installation when compared to other repair materials. Also, the non-corrosive and nonmagnetic nature of the materials along with its resistance to chemicals made FRP an excellent option for external reinforcement. Research on FRP material for use in concrete structures began in Europe in the mid 1950's by Rubinsky and Rubinsky, 1954 and Wines, J. C. et al., 1966. The pioneering work of bonded FRP system can be credited to Meier (Meier 1987); this work led to the first on-site repair by bonded FRP in Switzerland (Meier and Kaiser 1991). Japan developed its first FRP applications for repair of concrete chimneys in the early 1980s (ACI 440 1996). By 1997 more than 1500 concrete structures worldwide had been strengthened with externally bonded FRP materials. Thereafter, many FRP materials with different types of fibres have been developed. FRP products can take the form of bars, cables, 2-D and 3-D grids, sheet materials and laminates. With the increasing usage of new materials of FRP composites, many research works, on FRPs improvements of processing technology and other different aspects have been performed. Structure repair and rehabilitating is a process whereby an existing structure is enhanced to increase the probability that the structure will survive for a long period of time and also against earthquake forces. This can be accomplished through the addition of new structural elements, the strengthening of existing structural elements, and/or the addition of base isolators. Deterioration of concrete and corrosion of embedded reinforcement structure might make the R.C.0 structure structurally deficient.

III- METHODOLOGY

Grouting Process : - Grouting is the process of placing a material into cavities in concrete or masonry structures for the purpose increasing the load bearing capacity of a structure, restoring the monolithic nature of a structural member, filling voids around pre cast connections and steel base plates, providing fire stops, stopping leakages, placing adhesives and soil stabilization. Primary grouting materials and their common uses are:

Methods of application

Methods of application normally used include: hand pumps, piston pumps, single and plural component pumps, gravity and dry packing placement, micro capsules and single component pressurized cartons.

Guniting Process: - Guniting is an effective technique, which has been extensively used in the rehabilitation of structurally distressed RC members. There have been cases of heavy rusting of the mesh in the form of powder or in the form of a sheet coming out. De-stressing before restoration is possible only in the case of overhead tanks which can be restored when the tanks are empty.

Guniting Process: - Guniting is an effective technique, which has been extensively used in the rehabilitation of structurally distressed RC members. There have been cases of heavy rusting of the mesh in the form of powder or in the form of a sheet coming out. De-stressing before restoration is possible only in the case of overhead tanks which can be restored when the tanks are empty.

IV- MATERIALS USED IN REPAIRS

Polymer modified concrete/cement mortar Polymer cements concrete, which is prepared by adding polymer or monomer to ordinary fresh cement concrete during mixing. This is based on first hand experiences of repair and restoration works of high rise buildings ,bridges, marine installations and bomb- blast affected structures.

Fiber-Reinforced Plastics These materials that are used for cracks are applied over it like a patch, using high strength epoxy adhesive increasing their service life and fortify steel or concrete structures against earthquakes or other natural hazards.

Epoxy resins The epoxy resins are widely used in the repairing of cracks, patching and grouting of concrete, industrial flooring, structural adhesives, anti-corrosive linings, etc. Various types of resins, hardeners and modified epoxy systems are commonly used in structures.

Polymer-based materials Polymer-based materials are being widely used in the building industry in various forms such as coatings, membranes, adhesives, sealants, etc because other high durability.

V-APPLICATION

- After the concrete surface has been prepared, a bonding cost should be applied to the entire cleaned exposed surface.
- It should be done with minimum delay.

- The bonding cost may consist of bonding agent such as cement slurry, cement and mortar, epoxy, epoxy mortar, resin materials etc.
- Adequate preparation of surface and good workmanship are the ingredients of efficient and economical repairs.
- The mechanism of corrosion of reinforcing steel in concrete.
- The diagnosis of deterioration in concrete structures including the planning and interpretation of defect investigation.

VI- ADVANTAGE & DISADVANTAGE

➤ Advantage :-

- The maintenance of RCC structure increases its lifespan.
- The repair of RCC structure improves its appearance.
- Concrete frames are inherently fire-resistant.
- Also increase the strength of structures.

➤ Disadvantage:-

- The maintenance of RCC structure increases cost of structure
- Develop cracks between old and new concrete.

VII- CONCLUSION

Every building has some life span after time passes certain problems arises like paint deuteriation, corrosion, seepage problems, deflections in beams etc. Buildings will become unstable due to all these problems. So, repair works should be done in order to gain the strength of the structure. Repair and Rehabilitation is necessary to save hazardous failure of structures. It is recommended for old buildings which have some signs like cracks, corrosion of embedded materials, etc. Therefore, timely maintenance of structures is required. Most of the olden structures are given strength by doing process of repair and rehabilitation like Charminar. The selection of technique is used as per cost, location of site and other factors. Thus, for proper maintenance, the techniques likewise.

REFERENCES

[1] AN, W., SAADATMANESH, H. and EHSANI, M.R. RC Beams Strengthened with FRP plates II: Analysis and Parametric Study, *Journal of Structural Engineering*, ASCE, Vol. 117, No. 11, 3434-3455, 1991.

[2] DE LORENZIS L. and NANNI, A. Shear strengthening of reinforced concrete beams with near-surface mounted fibre reinforced polymer rods, *ACI Structural Journal*, Vol. 98, No. 1, 60-68, and 2001

[3] HASSAN, T. and RIZKALLA, S. Strengthening of Bridge Slabs with FRP Systems, *PCI Journal*, Vol.47, No. 1, pp. 76-93, 2002.

[4] MALEK, A., SAADATMANESH, H., and EHSANI, M.plate due to stress concentration at the plate end, *ACI StructuralJournal*, Vol.95, No. 1, 142-152, 1998.

[5] Abdel-Jaber, M.S., Walker, P.R. and Hutchinson, A.R. 2003.Shear Strengthening of Reinforced Concrete Beams UsingDifferent Configurations of Externally Bonded Carbon FibreReinforced Plates, *Materials and Structures Journal*, 36 (259),RILEM, France, June 2003, 291-301.

[6] Buyukozturk and Hearing. 1997. Failure Behavior of PrecrackedConcrete Retrofitted with Fiber-reinforced PlasticRepair, *Engineering Techniques Press*, 2: 21-32. Kendall, D.1999. The Selection of Reinforcing Fibres for StrengtheningConcrete and Steel Structures Using Reinforced Plastics, *Structural Faults + Repair-99*, 8th International Conference,London, UK, 13-15.

[7] Teng, J.G., Lam, L. and Chen, J.F., Shear strengthening ofRC beams with FRP composites, *Progress in StructuralEngineering and Materials*, 6(2004) 173-184.

[8] Khalifa, A., Gold, W.J., Nanni, A., and Abdel-Aziz M.I,Contribution of externally bonded FRP to shear capacity offlexural members, *ASCE Journal of Composites forConstruction*, No. 4, 2(1998) 195-203.

[9] Malek, A. and Saadatmanesh, H., Ultimate shear capacity ofreinforced concrete beams strengthenedwith web-bonded fiberreinforcedplastic plates, *ACI Structural Journal*, No. 4,95(1998) 391-399.

[10] Kachlakev, D., Miller, T., Yim, S., Chansawat, K. andPostisuk, T., Finite element modelling of reinforced concretestructures strengthened with FRP Laminates, *Final ReportSPR316*, Oregon Department of Transportation Research Group,May 2001.

[11] D. Kachlakev and D.D. McCurry "Behavior of full-scalereinforced concrete beams retrofitted for shear and flexural withFRP laminates" *Composites: Part B* 31 (2000) 445-452

[12] Alex Li, Cheikhna Diagana, Yves Delmas "CRFPcontribution to shear capacity of strengthened RC beams" *Engineering Structures* 23 (2001) 1212-1220