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Review of Retrofitting of Building

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ABSTRACT

The use of epoxy resins for repairing concrete cracks is the comman method to restore cracked concrete structure.In this paper, the effectiveness of three chosen brands of epoxy which are commonly used in industry in New Zealand to repair cracked concrete beam are investigated.

Multiple unreinforced concrete beams where tested before and after epoxy repair under vertical loads (Flextural load) to determine the effectiveness of the epoxy to restore the structural strength of continuity of the beam.

The tests were conducted using the third point loading method applying a constant bending moment to the middle segment of the beam span. The result showed that the performance of the repaired beams varies depending on the epoxy type and application methods. It is demonstrated that the viscosity of epoxy if critical ensure full bonding and in turn reinstating the capacity of the cracked sections.

Key words: Concrete cracks, epoxy injection, Flexural testing

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INTRODUCTION

Many of the existing concrete structures throughout the world are in urgent need of rehabilitation, repair of re-construction because of deterioration due to various factors like corrosion, failure of bonding between beam column joints, increase in service loads, etc, leading to cracking, spalling, loss of strength, deflection, etc the need of for efficient rehabilitation and strengthening techniques of existing concrete structures has resulted in research and development of strengthening of structure. Although a majority of concrete structures have.

performed satisfactorily over the past years but many problems have arised due to improper quality of materials, incorrect specification, faulty design and mistakes in construction process or extreme environmental conditions. Cracks in concrete have many causes. They may only, or they may indicate significant structural distress or a lack of durability, cracks may represent the total extent of the damage, or they may point to problems of greater magnitude. Their significance depends on the type of structure as well as the nature of the cracking. To retrofit the cracks on the reinforced concrete beams has different methods. Here we are using epoxy mortar. For patching holes in extreme temperatures, need an epoxy mortar repair that provide excellent flexibility and strong chemical resistant to structure. This project work focuses to retrofit the reinforced concrete beams using epoxy mortar and also to improve the strength to improve the strength of the beam.

Fig. 1 Epoxy Method

NEED OF STRENGTHENING

Following are reasons to strengthening a building:

1. Building which is designed considering gravity load only *i.e.* without considering gravity load only i.e. without considering earthquake force.
2. Due continuous research and development effort in the field of earthquake resistant design of structure
3. Analysis and design change in codes and practice and standard etc. thus structure ay be structurally
4. Inadequate as per recent p-practices, leading to the requirement of strengthening.
5. Sometimes important existing building in a particular locality may require to be strengthened to view of earthquake activity in a region.
6. The building in which the earthquake resistance has deteriorated due to the factor such as decrease in damage etc. strength of construction material due the delay, fire

EPOXY INJECTION PROCESS

The epoxy injection process begins with the application of a capping paste, which serves to seal the surface of the crack and help bond the injection ports to the concrete. The injection ports, which can be either surface mount ports or socket mount ports, are the means by which the epoxy resin will be delivered into the cracks.

Once capping paste is used, ports are drilled or installed, and any loose material and dust is cleared from within the cracks, epoxy injection can begin. Epoxy injection begins at the lowest port for vertical applications and at the widest part of the crack for overhead or horizontal applications

The epoxy will take a minimum of 12 hours to cure and will not cure in very low temperatures or cure very slowly in temperatures beneath 50 degrees F. Once the epoxy has cured, ports can be removed and grinding of the capping paste can occur. In many cases, the surface can even be coated to remove any visual evidence of cracks. There are a few methods that inspectors can use to verify that the epoxy injection process has been effective and is sufficient to repair the structural damage.

SCOPE

Now a days the repair of reinforced concrete structure is a major challenging job for civil engineers. The structures are affected by a lot of stress, Whenever the stress exceeds the limit the structures. Reconstruction of building in a way depletes our natural resourses is not economical. Retroffiting of a structure increases the life span of it with minimum or no usage of natural resourses.

PROJECT OBJECTIVES

- **Reduction of inertia force:** Avoiding local overloads, by removing heavy architectural elements may do this, by building uniform partition walls of light material, by eliminating the storage heavy materials, mostly at the upper floors etc.

- **Increase in energy dissipative characteristics:** This may done by employing material and device in energy dissipative properties, by providing the reinforced concrete frames with partition walls having energy dissipative characteristic, by — filling of the non- functional of R.C. structure deformable materials etc.
- **Elastic characteristic:** This can be recovered by the accurate proportionality of stiffness of the structural member though or more extensive changes.
- **Recovery of the force resistance and ductile capacity:** This can be done by proper design of degree of strengthening and by using strengthening material, which can provide sufficient ductility to be strengthened member

LITERATURE SURVEY

Ohki. Kenji, and bcssho, santoshisept (1980): Five one storey, on bay. one half scale reinforced concrete frames adhere tested in order to obtain the designing data tor a seismic strengthening of the existing morioka station building of the Japanese national railway. In two of them, the existing frames where strengthen with steel plate encasing. It was confirmed that these strengthen frames all have sample earthquake resistance properties. as compared with the existing frames and monolithically cast shear walls. According to the plan for the construction of new Morioka station building for the Tohoku Shinkansen (bullet train) lines of JNR under constructions a part of new station building well be placed on the old station building now in use. has necessitated the seismic strengthening in some way or the other of the old one storey reinforce concrete station building with one storey basement in preparation against increasing earthquake loads from the super structure to be built upon it

Mc Adams et al (1998) have studied the Epoxy resins were first commercialized in 1946 and are widely used in industry as protective coatings and for structural applications, such as laminates and composites, tooling, molding, casting, bonding and adhesives, and others.1,2 The ability of the epoxy ring to react with a variety of substrates gives the epoxy resins versatility. Treatment with curing agents gives insoluble and intractable thermoset polymers. Some of the characteristics of epoxy resins are high chemical and corrosion resistance, good mechanical and thermal properties, outstanding adhesion to various substrates, low shrinkage upon cure, good electrical insulating properties, and the ability to be processed under a variety of conditions. Depending on the specific needs for certain physical and mechanical properties, combinations of choices of epoxy resin and curing agents can usually be formulated to meet the market demands. However, in terms of structural applications, epoxy resins are usually brittle and notch sensitive. As a result, tremendous effort has been focused on toughness improvement during past three decades

Wen-Cheng Liao, (2010): The main objective of this study was to develop and validate a seismic design methodology for RC SMF which is able to produce structures with predictable and intended seismic performance. Based on performance limit states of target drift and desired yield mechanism, this design methodology accounts for inelastic structural behaviour directly, and practically eliminates the need for assessment or iteration by nonlinear static or timehistory analysis after initial design.

Farid and S. Ahmad (2011): This paper presents the result of an experimental investigation on the strengthening of existing cracked RC members. The beams were then repaired with he application of polymer modified mortar technique an improvement in the load carrying was observed in the beams after the retrofitting.

Susanne Heyden (2014): This paper presents the results of an experimental study to investigate the behaviour of structurally damaged full-scale reinforced concrete beams retrofitted with laminates in shear or in flexure. It was found that the efficiency of the strengthening technique by carbon fibre reinforced polymer in flexure varied depending on the length. The main failure mode in the experimental work was plate debonding in retrofitted beams.

CONCLUSION

Epoxy Injection Systems is very effective at repairing concrete cracks, delaminations, and hollow planes when used according to manufacturing recommendations.

Job analysis and proper preparation are very important to insuring the maximum performance from the Epoxy Products, or any other concrete repair products, the right equipments are critical. Proper setup continuous mixing epoxy injection machines must always be used with no exceptions.

Injection staff and management must have the training and experience to do the work right the first time. Epoxy injection has to be done right the first time. There is no second chance, so it is critical that your injection work be done by well trained and equipped, experienced personnel.

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REFERENCES

[1]. Construction and Build- ing Materials 21: 157–163. Ohama, Y. 1996. Polymer-based materials for repair and improved durability: Japanese experience. Construction and building materials 10 (1): 77–82. Ryou, J.S. & Otsuki, N. 2005.

[2]. Design of concrete structures, Part 1–1: General rules and rules for build- ings. Brussels (Belgium): European Committee for Standardization. EN 206-1 2000. Concrete Part 1: Specification, perform- ance, production and conformity. Brussels (Belgium): European Committee for Standardization. Issa, C.A. & Debs, P. 2007. Experimental study of epoxy repairing of cracks in concre

[3]. ACI Committee E706 2003a. Structural crack repair by epoxy injection (ACI RAP Bullettin 1). Farmington Hill (MI): American Concrete Institute. ACI Committee E706 2003b. Crack repair by gravity feed with resin (ACI RAP Bullettin 2). Farmington Hill (MI): American Concrete Institute. Aggelis, D.G. &Shiotani, T. 2007. Repair evaluation of concrete cracks using surface and throughtransmission wave measurements. Cement & Concrete Composites 29: 700–

[4]. Ekenel, M. & Myers, J.J. 2007. Durability performance of RC beams strengthened with epoxy injection and CFRP fabrics. Construction and Building Materials 21: 1182–1190. EN 1992-1-1 2004.Eurocode

[5]. Talebobaidat, Susanne Heyden, Ghazi Abu-farsakh, Yahia, Abdel Jawad (2010) "Retrofitting of reinforced concrete beams using composite laminates", Journal of composite material

[6]. Hussein m jawad (2010) "Retrofitting of reinforced concrete beams using composite laminates", Journal of composite material.

[7]. S. Ahmad, A. Barbhuiya, Y. Farid (2011) "Use of polymer modified mortar in controlling cracks in reinforced concrete beam" Journal of composite material IS-456:2000, and IS-1062:1982

[8]. Hussein M Elsanadedy, Tarek H Almusallam, szleh H Alsayed, Yousef A Al Salloum (2012) "Flexural strengthening of RC beamsusing textile reinforced mortar-Experimental and numerical study" Journal of composite material.

[9]. Ashtashil Bhambulkar et al., "Overview of Cantilever Bridge: Review", Elementary Education Online, 2021; Vol 20 (Issue 3): pp. 2643-2646.

[10]. Ashtashil Bhambulkar et al., "A Review Technique in Structure Health" International Journal of Management, Technology and Engineering, Volume IX, Issue III, 2019, 5509-5511.

[11]. Ashtashil Bhambulkar et al., "A Review Technique in Structure Audit" International Journal of Management, Technology and Engineering, Volume IX, Issue III, 2019, 5512-5514.