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Retrofitting of Concrete Members Using Adhesives

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ABSTRACT: Now a days structures which have less than ten years to complete it's structural strength life need retrofitting. The retrofitting of structure is carried out by modifying the existing structure to regain its strength and also to protect the structure from earthquake, flooding or other calamities. Retrofitting or strengthening the concrete member can be done by adding some adhesives in existing damaged parts of structure such as nano-materials or nano-particles, self compacting concrete, grouting, fiber reinforced polymer, carbon fiber reinforced polymer, epoxy adhesives. The nano-particles can be used to affect the concrete include cement properties, concrete mixtures etc. We can introduced innovative ideas for high strengthening for the self compacting concrete. Also the self compacting adhesive have been effective substitutes with their extraordinary mechanical and thermal properties. Grouting is process of repairing the old structural member or strengthening them. Grouting can be done by various method by the injection method is time saving. Thus these adhesives can be used for retrofitting in future existing world and can be claimed to be a effective method to increase the life of Structures.

KEYWORDS: Retrofitting, Strengthening, Nano-material, Grouting.

I. INTRODUCTION

1.1 General

Retrofitting of old structures is a crucial process aimed at enhancing the safety, functionality and sustainability of existing buildings and infrastructure. This practice involves the modification, strengthening or upgrading of older structures to meet modern safety codes, energy efficiency standards and performance requirements. When They weaken due to age or wear and tear, they are retrofitted with new stronger members using RCC method. Sometimes the use of low grade materials in its construction or due to the application of additional load because of change in functioning or due to seismic forces for which structure had not been designed originally due to the strength of structure is reduced. It increases the structure's stability and security.

Grouting & Nano-particles are the techniques which we are used in retrofitting and strengthening of concrete members. Grouting is the process of utilizing grout to fix issues such as concrete fractures, tile gaps, joint seals, soil stabilization, etc. It is a versatile technique used to enhance the structural integrity and performance of concrete members. The types of grouting are epoxy grouting, cement grouting, chemical grouting, pressure grouting, compaction grouting and jet grouting in our study, we are used the epoxy grouting method. Epoxy grouting provides high-strength bonding and is used when structural adhesion and water resistance are critical. Epoxy resin based grouts are mixed with hardeners to create a strong and durable grouting material. Epoxy grouting is often employed in repairing structural members.



Figure 1:Crack more than 15mm

We can do the retrofitting on framed structure as well as load bearing structure. The load bearing structures are generally made by stone masonry. The stone masonry structures are widely subjected to cultural heritage. The preservation of stonemasonry structures is necessary for future generation. These stone masonry structures are damaged by climate change, pollution, increasing urbanization etc. These deterioration of structures are prevented by retrofitting. The retrofitting increases the lifespan of the building and saves money, it also increases the strengthening and load bearing capacity of load bearing structure.

1.3 Objective

1. Analyzing the research on retrofitting with respect to strengthening of structural members by using different types of adhesives.
2. Studying the advantages of using nanomaterials, epoxy, carbon fibre reinforced polymer, carbon textile reinforcement and grouting.
3. Studying of live structure of building that we visit in the city that structure is load bearing structure.
4. After studying that damaged load bearing structure we will be decide which adhesives used in retrofitting of structural member of load bearing structure.

II. LITERATURE REVIEW

2.1 Techniques of Retrofitting

Komal Bedi(2013): In this study, the retrofit process consists of many treatments such as preservation, rehabilitation, restoration, reconstruction. Preservation is to maintain the existing structure. Rehabilitation is the repair or regain the original status of existing structure. Restoration is the restoring the properties of existing structure. Reconstruction is the rebuild the existing structure. In this study, retrofitting consists of retrofitting of concrete members, retrofitting as a structural body, foundation retrofitting, repair of cracks, retrofitting of historical buildings, innovative technologies for historic preservation, seismic retrofitting technique, member level retrofit, surface treatment and recent retrofitting methods.

Mohammad Al-Zu'bi, Mizi Fan, Lorna Anguilano(2022): The study examines the drawbacks of existing epoxy adhesives and Cement-Based Adhesives (CBA) for retrofitting fibre reinforced polymer jointed elements. Epoxy adhesives have disadvantages like debonding failure and toxic work environment. They also say that the epoxy

adhesives have traditionally used alongside of FRP material for retrofitting of concrete member. CBA has poor performance in fire and limited contribution. A high-performance nanoparticle modified bonding system was developed, combining nanoparticles with epoxy resins and CBA, proving to double or quadruple their properties.

Yasmeen Taleb Obaidat, Susanne Heyden, Ola Dahlblom, Ghazi Abu Farsakh, Yahia Abdel Jawad(2011): The study examines the effectiveness of retrofitting damaged reinforced concrete beams with GFRP laminates in shear and flexure. The study considers factors like internal reinforcement ratio, position, and length of CFRP. The results show that GFRP laminates are structurally efficient and restore stiffness and strength. The main failure mode was plate debonding. FRP is environmentally and economically better than other strengthening materials, offering low weight, high stiffness, and corrosion resistance.

2.2 Adhesives in Retrofitting

Laksham Sanassee, Asish Seeboo(2019): In this case, we study that the jacketing are used to Strengthening the bases and beams, steel channel were added to Strengthening the existing slab. There is the period that was called monitoring period. In this they observe that the hairlines come to cracks before that they apply the two coats of the white point to the internal face of the structure and put this point for weekly monitor period and they declare that there is with no increase in the concentration and propagation of crack. It was consider that strengthening is appropriate. This case deal with inspection, assessment and strengthening of Reinforced concrete structure.

Lampros N Koutas, Zoi Tetta, Dionysios A Bournas, Thanasis C Triantafillou

(2019): Textile reinforced mortars, also known as fabric reinforced concrete, are a cost-effective solution for strengthening historical or old structures. These thin layers combine specially designed mortar with glass and carbon fiber grid reinforcement. They are fire-resistant, compatible with concrete and masonry substrates, and can be applied on wet surfaces or low temperatures. The process Involves surface preparation, applying the first layer of mortar, impregnating textile fibers, and applying the final layer.

Ankit Dasgupta (2018): In this study, the use of fibre reinforced polymers in retrofitting of structural members is specified. Retrofitting is done to recover a structure from damage created to a member such as corrosion, bond failure, reinforcement exposure etc. The effect of using FRP on each member of a RC building is reviewed with different types of methods used for it. The types of fibre reinforced polymers are carbon fibres, glass fibres and combination or Matrix of it is also specified in this study. Maintaining seismic support to the structure whole retrofitting is most essential parameter to be considered in upgradation of RC structure. Thus fibre reinforced polymers can be a good addition to further Innovation in retrofitting for future of monumental as well as aged structures.

III. PROPOSED METHODOLOGY

In this project, we conducted extensive research on various literature pertaining to our topic. Following a thorough examination of retrofitting literature, we carefully selected materials that would enhance the strengthening of the structural element. Initially, our plan is to conduct a comprehensive structural assessment to identify any external and internal damage. We will also inspect the concrete members to determine any deterioration. Subsequently, we will assess the retrofitting requirements, such as improving load-bearing capacity or filling cracks. During this process, we will ensure that the concrete structural member surface is cleaned to remove any contaminants that may interfere with epoxy bonding, such as dust, concrete particles, dirt, etc. We will then select the appropriate epoxy material required for that particular structural member to increase load-bearing capacity, repair cracks, etc. For the retrofitting process, we will select the proper proportion of grout material and epoxy and mix it thoroughly. We will then inject it into the damaged concrete member, starting from the lowest point and moving upward, ensuring that the injected grout fully penetrates in the concrete member. The experiment's results can then be analyzed to see where the structural part can acquire strength or restore its prior strength. Although we plan to use other adhesives, we currently lack knowledge about them. Therefore, we will conduct further research on other adhesives.



Figure 2: Epoxy Injection

IV. DESIRED OUTCOMES

- The desired conclusion for retrofitting of concrete member using epoxy grouting is that this method has proven to be effective in enhancing the Strengthening of concrete member.
- Epoxy grouting offers excellent bonding and load transfer capabilities, which can help to restore or improve the load bearing capacity of the structural member.
- It is also effective in sealing, and preventing water ingress, thus protecting against corrosion and reinforcing the overall longevity of the structure.
- The ultimate goal of retrofitting using epoxy grouting is strengthening the concrete member.
- At last, our desired outcome is to fix the concrete member with higher compressive strength providing grout using adhesives.

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