JOURNAL OF CRITICAL REVIEWS

ISSN- 2394-5125 VOL 6, ISSUE 07, 2019

Development in Reinforced Concrete Retrofitting Methods and Technology

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Abstract:

New technologies and materials have been developed and put to use throughout history to overcome the limits of previous ones. Because of the present coal regulations, many seismically vulnerable reinforced concrete buildings cannot resist earthquakes. Additionally, the seismic waves Due to a design flaw, construction flaw, increased loads, and the behaviour of existing structures are all impacted. A number of recent earthquakes have clearly shown the urgent need for structural upgrading and strengthening. A major update is one of the greatest solutions for protecting a building against future earthquakes or other natural disasters, such as hurricanes or floods.

The renovation lessens the structure's vulnerability to damage in the event of an earthquake in the near future. It seeks to strengthen a framework. Be sure you adhere to current seismic design standards. A lot of effort has been put into developing new strategies to improve the seismic performance of buildings in recent years. In relation to constructions. The purpose of this article is to offer an overview of different new and cost-effective methods. Reinforcement of damaged buildings by the use of retrofit methods. In order to improve the performance of any building, a concept known as seismic construction protection has been developed. Future quakes are expected. Future quakes are expected. There have been several earthquakes in India of varying magnitudes lately, resulting in a significant loss of life and property. Structural repairs may benefit from the use of new materials and procedures. Existing buildings that have been damaged or unaffected by earthquakes need to be reinforced.

A structural engineer's primary goal is to reconstruct the structures as quickly and effectively as feasible. In order to successfully restore a certain building, the correct materials, methods, and processes were crucial. It is clear that innovative structural restoration methods offer several benefits over traditional methods. The selection of materials for repair operations, such as steel and reinforced fibre polymers, was mentioned in certain instructions for this study. Numerous factors, seen from a variety of angles, influence the material and method selection process. The amount of money needed, the suitability of the materials, and their general applicability Repairs to buildings that have been damaged or destroyed. Standard repair materials, appropriate technology, manufacturing and conservation and preservation are used in accordance with the project's goals. Fire safety, geotechnical safety, and other similar technical factors may be part of a rehabilitation project. Environmental factors such as water penetration and storm damage may have an impact on the structural integrity of a building.

Treatments, rehabilitation, epoxy, cracks, corrosion, prevention, and retrofitting are some of the key words. There are a variety of different types of beam armoring available, including reinforced polymer fibre sleeves, steel sleeves, and concrete sleeves.

Introduction

The preservation of a historic building is described as the use of methods to preserve the structure's present shape, integrity, and materials. In order to maintain the historical, cultural, or architectural significance that the property has, it is necessary to undergo rehabilitation in order to turn it into a usable new property. When a property is restored to its original state, it is called restauration. The term "rebuilding" refers to the act of re-creating a property. For rehabilitation, it is necessary to identify the desired outcomes in advance and to gather existing building data. Rehab-focused design. The present retrofitting approach is chosen based on its current state of affairs. As a result, the existing structure's current and future performance must be determined. Factors such as performance improvement, viability, environmental impact, ease of maintenance after refurbishment, and economics should be taken into consideration while choosing a technique of retrofitting. Structural renovations are done to enhance the ability to survive. There are several distinct kinds of software. There are a wide variety of transportation and land-keeping structures and structures, as well as marine structures.

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TYPES OF RETROFITTING OF CONCRETE MEMEBRS

A variety of retrofitting techniques are used, namely global and local techniques for retrofitting the existing structure. Parametric analysis was performed to achieve the most viable solution, taking into account different parameters like nodal displacement, drifting stowage and base shear. Retrofitting Classification Techniques:

Towards New Shear Walls Adding:

Towards Adding Steel Bracings.

Towards jacketing (Local Retrofits):

Toward base insulation (or seismic insulation): Base insulation

Mass Reduction Retrofitting Technique:

THE WALL Thickening Retrofitting Technique:

• Method of construction continuous fiber strengthened plate bonding: bonding continuous fiber reinforced plates with the Existing structure surface to restore or enhance load carrying capacity Continuous platform enhanced fiber construction method:

Jacketing with reinforced fiber plates the existing structure periphery to restore or improve load carrying capacity and deformation characteristics Prestressed concrete jacketing method of construction: prestressing wires and prestressing stranded steel wires Instead of lateral ties around the periphery and using mortar and concrete to bind existing member sections To strengthen the structure.· Prestressing construction method for the introduction: use of internal cables for existing concrete membersPrestressing and restoring or enhancing members' load carrying capacity.· Method of repair: to replace some or all existing concrete members with new ones by using the Precast members or on-site concreting for restoring or improving load carrying capacity.

PRINCIPLES OF RETROFITTING DESIGNS

The principles of building retrofitting are — reinforcement of members versus structural system reinforcement. Members who do not meet safety requirements should be strengthened, but the reinforcement of the whole often is a mistake

The structural system is overlooked. Strengthening the relationship between members is very important for structural integrity.

Local reinforcement versus global reinforcement. Local strengthening of a single member is possible

Only if the reinforcement does not affect the entire system's structural performance.

Temporary reinforcement versus permanent reinforcement. Temporary standards and requirements

Reinforcement may be less than for permanent reinforcement.

Special earthquake-resistant strengthening considerations.

Use of new earthquake technologies.

IV. SELECTION OF THE PROPER RETROFITTING MEASURE

Proper studies of the existing structure using different analytical tools must be conducted in order to recognize the weak areas within the structure before retrofitting. It also helps to choose an appropriate retrofit measure to be taken in economic and security aspects.

Structures in the sensitive acceleration region and velocity area of the spectrum may require Different measures for retrofitting. The retrofitting option appropriate for one structure can prove inefficient for another Different dynamic structure behavior.

Furthermore, after refurbishment the rigidity of a structure can increase significantly, thereby increasing demand for load. Structure rather than retrofitting. The increase in rigidity depends also on the type of retrofit measure out. Conventional refit

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measures such as jacketing of steel/concrete and the inclusion of new walls will increase the structure aresignificantly rigid; thus, its dynamic behavior is altered. This re-analysis of the upgraded the structure is to be implemented. Modern techniques for jacketing, such as reinforced fiber polymer (FRP), can be implemented

The best way to build structural capacity without altering rigidity. In addition to increasing the structural stiffness, the conventional retrofitting method could have a major impact Develop new load paths which may lead to load concentration at ground level. This occurs in Frame structures in reinforced concrete (RC) where the inclusion of concrete shear walls between the columns is carried out Out as a measure of retrofitting. In this way, the existing base of the adjacent columns will probably be stressed. The proper retrofitting technique shall be chosen by analyzing the existing structure in detailed-analysis incl. Re-design of the structure may be necessary after retrofitting measures are introduced, so seismic retrofitting goals are me

RETROFITTING OF DESIGN PRINCIPLES

Design principles shall follow several factors, even in case of retrofitting, as in case of new constructions. For example, to take full advantage of the potential ductility of retrofitted RC members, flexure is desirable instead of shear and should govern ultimate strength. Shear failure is catastrophic and does not occur before notice

Distress. Most RC columns and beams have been found to be poor in shear strength and need of strengthening. Shear deficiencies occur because of several reasons, such as insufficient shear strengthening or reduction in shear Corrosion-related steel areas, increased service load; older codes design principles and construction defects. Shear, bending, axial and ductile capacity should be improved as far as possible in case of retrofitting. Of the structural and structural components as a whole. Most existing practices appear to be enhanced Containment of axial, shear and ductile behavior, which mainly increases structural members. Increased flexure Capacity can also be achieved if proper details and design principles are applied.

In reinforced concrete constructions, there are three basic types of structural deficiency. These are deficiencies in design, detail and construction:

GENERAL DEFICIENCIES IN REINFORCED CONCRETE (RC) STRUCTURES

Deficiencies in design Include· Lack of lateral load resistance (e.g. lack of shear walls or special moment-resistant) frames) os Redundancy deficiency (alternative loading paths) of the structural system (that is, sparse beams and columns or inappropriately placed to trigger a total structural collapse in case of damage to only a few members)

• Irregularities in plan or elevation (e.g., plan L or T – plan shaped, or vertical reversals)

The presence of soft or weak floors, especially in the floor, such as in the case of large first floors.

Door and window openings

Presence of short columns that usually fail in a catastrophic pattern

· Presence of surpluses

· Strong-beam Weal-column joints, i.e. cases in which the beams are stronger than the columns with which they are linked.

The problem is that such connections tend to suffer damage in columns instead of beams, and since

Floors over the column answer more on the column than on the beam; column damage can be more disastrous

Beam damage.

Include key detail deficiencies the insufficient transverse reinforcement bars these are the smaller reinforcement bars perpendicular to the beams and columns axis. Transvers Strengthening offers resistance to shear forces and imparts concrete confines within. This confining increases ultimate

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concrete strength and allows for more damage without a beam or column unfortunately, failing. Wide spacing of transverse bars close to beam-column joints is particularly important. Specific provisions for narrower transverse reinforcement distances are provided by modern design codes.

Short length of overlap with split joints

These are places where one of the longitudinal reinforcement bars says a column ends and overlap. With a second that goes further along the column, as in the lower part of the column. If there is too little overlap,

Force cannot be appropriately transferred in one bar to the next, resulting in a generally unforeseen weakness.

Column point.

Building deficiencies Include

Adverse conditions such as those mentioned above may be further exacerbated by building defects, such as low buildings. Quality manufacturing, the use of lower materials and deviations from structural drawings and specifications Phase of construction.

SPECIAL CONSIDERATIONS FOR EARTHQUAKE SAFETY

During earthquakes the acceleration on the top floors of the structured load wall buildings would be higher. As a result, top level wall panels are highly vulnerable, both outside of the plane and inside the plane. Also, the compressive stress on top floors in brick masonry would be minimal due to the dead burden from the top floors. Thus the shear strength of such masonry walls on the upper floors was lower than in the lower stories. Upper floor in earthquakes Failures in a load-bearing wall system are more likely so retrofitting measures in the upper part are carried out much more detailed floors.

The weakening concentrations of stress in such window / door openings corners may take place without lintel / sill bands, and failure is more likely to be initiated at these locations. Also out of – the loading of the plane can cause serious damage and even collapse because of insufficient rigidity in such walls? To

Strengthening such wall panels could be replaced by solid walls or steel bands, channels can be replaced by window opening be provided from both sides of the wall throughout the periphery of openings. Likewise, horizontal bands of the sill and lintel mesh on both sides could be supplied accordingly. The thickness of the wall. These actions would greatly improve the performance of brick walls and of the entire structure the performance of the structure in masonry structures should also be checked for development Aircraft shear stresses that may occur during an earthquake loading and appropriate jacket measurement shall be used to reinforce it as required.

RETROFITTING OF CONCRETE MEMBERS

Long-lasting fiber Continuous plate bonding method: Bonding the existing structure onto the surface of continuously fiber bonding plates to restore or improve load transport capacity.

The method of reinforced platform jacketing: continuous fiber reinforced plates around

Existing structure periphery to restore or improve load-carrying capacity and deformation features

TREE Method of construction of pre-stressed concrete jacketing: Pre-stress wires and pre-stress stranded steel

wires on the periphery of existing member sections and using mortar and concrete to

Bind them to strengthen the structure.

Pre-stressing construction introduction method: internal cables to be provided for existing concrete members

Pre-stressing and re-establishing or improving members' carrying capacity.

Method of repair: to replace some or all existing concrete members with new ones by using the

Precast members or load-carrying concreting on site for restoration or improvement.

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INNOVATIVE TECHNOLOGIES FOR HISTORIC PRESERVATIONS

Preserving heritage architecture is a cultural objective that communities and nations are rigorously pursuing in order to promote their history, culture and aesthesia. Structures built by traditional methods in the remote past have over time been affected by extreme load events such as earthquakes.

Periods. Retrofitting is a technological and scientific approach based on recent developments, where modern methods and construction materials are used for repairing and reinforcing historical structures. The use of reinforced concrete is suggested in the form of cast-in walls, jackets or straps;

Strengthened laminates for walls and slabs strengthening. Innovative use of materials like form memory alloys, self-compaction Also suggested are concrete or thin lead layers. Methods for moderating the are given special attention Follow-up of destructive earthquakes. Seismic energy absorption equipment and base insulation are two effective means of protecting against future seismic events, although many have been met with their application inpractice, technical challenges. Modern materials and equipment offer a wide range of refurbishments to improve structural system behavior, global Strength, and stiffness or seismic hazards mitigation. Some of the common retrofitting techniques are listed below:

Post-stressing

One of the potentially efficient retrofit options for reinforced concrete or masonry buildings is the post-tensioning (Fig1). Masonry's compressive strength is relatively large, but the strength is only low. Therefore, it is the most effective in carrying loads of gravity. Induced tensile stresses usually exceed pressure and reinforcement to provide the necessary strength and ductility, must be added.

Figure No. 1 External Post Tensioning

Figure No. 2 External Post Tensioning to restore or increase capacity

Wraps Composite

Composite wraps or carbon fiber jackets are used for reinforcing and adding ductility to reinforced concrete and maceration components without any penetration. Composite wraps on reinforced concrete columns are most effective Additional containment provided.

Figure No. 3Carbon FRP fiber installation

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Figure No. 4FRP Composite Strengthening services Concrete solutions

Micro-piles

Micro piles are used in foundation rehabilitation projects and seismic upgrades to improve the ultimate capacity of the foundation and reduce deflecting of the foundation.

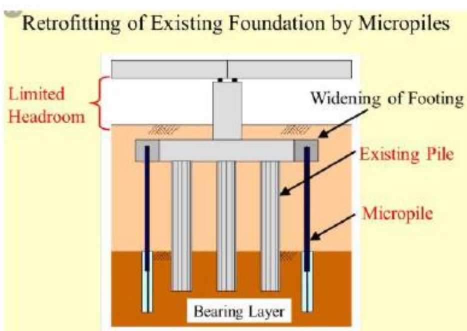

Figure No. 5Model Foundations Retrofitted

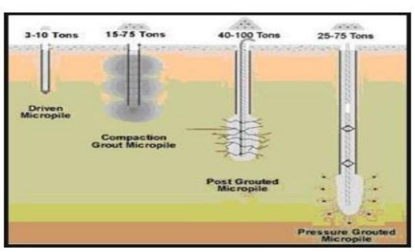

Figure No. 6Micro Pile Foundations with Micro Piles

Conclusion

In this research, novel materials and techniques were used to upgrade Indian buildings for earthquake and energy efficiency. As shown by violent earthquakes or a high level of energy consumption, historic buildings need to be renovated because of their inferior design (Heating and refreshment). In order to improve the security, energy, and resource efficiency of low-rise residential structures in the European Union, this article evaluated cutting-edge approaches for building retrofitting. The following is a summary of the paper's findings and conclusions:

Before the 1970s, earthquake-resistant concrete constructions had to be upgraded. It was classified into two primary categories: local and global retrofits. Six solutions were described. It is possible to increase their seismic response by using concrete, steel, and composite to a particular member. All three of them work.

Concrete is labor-intensive to deal with, whereas steel need a high level of upkeep throughout the course of its lifespan.

Starting a business requires a large investment in the building and the composite materials. Shear or base insulation walls or steel braces may be used to enhance the whole structure at the same time. Shear wall is a time-consuming and expensive construction method. Some connection difficulties can be solved with a steel brace, but they must be shown. Base isolation is a useful technique, however it cannot be used on all sorts of constructions. There are many options for the construction approach, each with their own advantages and disadvantages.

Geometry, position, and individualization. Various strategies should be evaluated and analysed before making a final decision. One of the best. The best. The retrofit plan may be more flexible if various approaches are employed, since the benefits of each can be used jointly. There is a growing requirement for knowledge of composite materials and design issues. Rehabilitation of concrete components. Concrete and composite layers may readily be joined. Good detailed procedure must be followed if the structure's outlines are to be accurately followed. Preventing early failure was the next step. Fracture mechanics-based design concepts are being developed. Material selection (fibre, resin, adhesive) and their form are regarded to be key factors in the choosing process.

It is vital to take the next step in order to make use of these strategies as efficiently and safely as possible.

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This research evaluated the application of FRP in the repair and strengthening of plain and reinforced cement concrete. The following conclusions may be taken from this research. FRP was tested for its maximum efficiency using a variety of techniques in this paper, including: the number of FRP layers, FRP strips with and without FRP anchorage, FRP, FRP strips fully and partially contained FRP horizontal and sloping pattern bands with mechanical fasteners, near surface mounting (NSM), externally reinforced (EBR), and externally reinforced on groove (EBROG). The methods of reinforcing improve the cargo capacity of samples and scissors generated at a 45-degree angle they have been limited in their use of. There was a reduction in both the breadth and length of the cracks. A higher ultimate load in FRP concrete beams was achieved thanks to the mechanisms used, and the failure plane at the interface was relocated. The specified interface is represented by a concrete FRP interface.. The binding strength dropped as the groove diameter increased in the EBROG technique's testing of various groove sizes. Concrete flexural behaviour has been greatly improved as a result of these procedures. Flexural responses have improved significantly, and deflections have been seen. Reduced, as well.

Almost all components of earthquake engineering that need close interaction are covered by risk assessment and retrofit. Especially in the realm of acceptable risk across disciplines. Existing risk owners and government buildings are increasingly in need of more effective and trustworthy analysis tools and innovative retrofit strategies due to this growing awareness. Using a benchmark analysis tool is essential for testing and establishing simpler restrictions Not accessible through the web. Simplified linear or force-based processes that are small, dependable, and consistent are also required.

A limited number of minor cycle test data may be used to develop analytical acceptability requirements for existing structures that are seismically weak. To fill up the most critical holes, you'll need a systems coder. A great deal of data is required to account for the possibility of a nearby collapse. Test the capacity of components to support a gravity load when deformed severely. local and local are intertwined To avoid penalising duplicate structures in the case of a worldwide failure or collapse, further definitions are required. One or more local components have failed.

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