

Improving the Strength of Existing Building Using Retrofitting Techniques

Mr.S.MAHESH¹, Mr.CH.SANDEEP REDDY², Mr.P M B RAJ KIRAN NANDURI³, Mr.P. BIKKU⁴

Department of Civil Engineering, Samskruti College of Engineering and Technology

Abstract:

Now-a-days retrofitting is becoming popular around the world, as most of the important structures like historical building or some other old structures which becomes weak over the time. Retrofitting is the best method to make safe the existing structures from the future earthquake and other environmental factors. Retrofitting diminishes the helplessness of harm to a current structure amid future seismic movement It plans to reinforce a structure to fulfil the necessities of the present codes for seismic outline. With respect to conventional repair and rehabilitation, retrofit is much better and convenient. Retrofitting helps to enhance the strength, resistivity and overall lifespan of the structure.

Keywords — **Retrofitting, Building, Strengthening.**

I. INTRODUCTION

As infrastructure is expanding, with its expansion there is a requirement of advanced material and technique for its advancement. but for existing structures which has become old are vulnerable to the damage which may cause due to earthquake forces or some other natural damaging calamities. Retrofitting of structures like building, which incorporates restoration, upkeep and reinforcing of the structure, isn't just a need in development and administration in urban territories, yet additionally an issue which emerges to basic architects in property administration disciplines. Retrofitting is characterized as the procedure of change of existing structures like structures, spans, legacy structures to make them more impervious to the tremor powers and other normal catastrophes. It has been seen that structures lose its quality because of seismic activity or because of disappointment of soil factors. At that point there emerges issues like harming of rooftop, establishment, dividers, columns, segments and shafts. For these, structures turn out to be statically dangerous. What's more, there emerges the topic of security and there comes the arrangement Retrofitting

II. Literature Review

Large number of old and existing building in India which are present in earthquake zones are increasing day by day

which may led to the collapse of those building because of seismic activity. This condition has been highlighted in the previous earthquake. Retrofitting of any existing building is a complex task and also requires skill to carry out, but retrofitting for RC buildings is a challenging job due to complex behavior of the RC composite material. The behavior of the buildings that takes place during earthquake depends on the size of the members, amount of reinforcement and also to a great extent on the placing and detailing of the reinforcement. The construction practices in India sometimes may lead to severe construction defects, which make the task of retrofitting even more difficult. Step to step procedure given below.

1. Setting the goals and performance level of building and estimation of seismic hazard.
2. Systematic visual inspection and study of available drawing and documents.
3. In situ examination for quality and corruption of material and arrangement of as assembled drawing.
4. Distinguish inadequacies and plan for nitty gritty examination.
5. Point by point assessment of quality, flexibility, weakening.
6. Plan of Retrofitting plan in light of assessed lacks
7. Examination of Retrofitted building.

In this paper the Concept of sucker examination has been utilized that is turning into a popular instrument in the calling for outline of new structure, seismic assessment of existing structures and creating proper technique for seismic retrofitting of structure in this the depiction about different apparatuses of retrofitting is given.

III. METHODOLOGY

Retrofit in structures is done to enhance the performance during the seismic activities. The applications incorporate diverse sorts of extensions, structures, modern structures, transport structures in urban zones, earth holding structures and marine structures.

1. Principles of retrofitting design:

The various principles of the retrofitting design for buildings are as follows:

1. Strengthening of individuals as opposed to reinforcing of basic framework The members that is susceptible as unsafe or is weak should be strong enough, but mistake like neglecting the strengthening of whole structure must not be happened. Strengthening of association between individuals is very persuasive to basic respectability. Neighborhood fortifying versus worldwide reinforcing. Local strengthening versus global strengthening. Local strengthening of an each member can be done only if this strengthening does not influence the structural execution of the whole structure or system
2. Temporary strengthening against permanent strengthening. In comparison with the standards and requirements of temporary strengthening may be less than that of permanent strengthening.
3. Special considerations should be taken for earthquake resistant strengthening.
4. Make use of the new seismic method technologies

2. Techniques of retrofitting:

There are numerous advancements produced for seismic Retrofitting which depend on controlling the response of particular structure strategies are utilized to give additional damping utilizing dampers like rubbing dampers, elasto-plastic dampers, tuned fluid and tuned mass dampers, lead expulsion dampers visco-flexible dampers, and so on base separation is likewise one of the technique to decrease the vibration of building..

.The selection of the type of intervention is a complex process, and is done by considering the technical ,financial and social

aspect.. The following are various factors which are affecting the choice of various intervention techniques.

- The Cost versus the importance of a structure
- Availability of proper workmanship
- Fulfillment of the requirement and performance goals of the owner
- Duration of work/disruption of use
- It should be aesthetically compatible as well as significant
- Reversibility of the intervention
- The extent of quality control
- Structure must be of Political and/or historical significance
- Structural similarity with the existing structural system
- Abnormality of stiffness, strength and ductility
- Ampleness of local stiffness, strength and ductility
- Controlled harm to non-auxiliary parts.
- sufficient limit of establishment

3. Factors which affect the retrofitting techniques

- Effect occurred due to the changes done in the stiffness of the member.
- Size of task (techniques including uncommon materials and strategies might be less practical on little projects).
- Environmental conditions like temperature variation (methods using adhesives might be unsuitable for applications in high temperature environments; outer steel techniques may not be reasonable in destructive conditions)
- Dimensional/freedom limitations (area amplification may be restricted by how much the extension can infringe on encompassing clear space).
- Accessibility
- Availability of materials, equipment and qualified contractors
- Construction cost, maintenance costs, and life-cycle costs; and Load testing to verify existing capacity.

4. Methods of retrofitting:

A. Structure level or Global Retrofit Methods:

In structural level or global retrofit method it could be done in two way. i) Conventional methods in which the seismic resistance of existing building is increased

ii) Non conventional methods in which seismic demand is reduced. Customary techniques for

retrofitting or fortifying are utilized to upgrade the seismic protection of existing structures by taking out or decreasing the antagonistic impacts of plan or development. These methods includes the strengthening by adding the various options like shear wall, infill wall, braces ,etc

B. Member level or Local Retrofit Methods:

These are the methods available for the existing RC structure to which upgrade is needed. In these systems of retrofit it abels to increase stiffness , strength, and also energy absorption capacity and also reduces the influence of seismic waves. The application of these retrofitting systems is dependent on their effectiveness on the structures in technique and constructional costs aspects. In spite of having much advantage in enhancing the stiffness and strength for the buildings, the use of such big systems like reinforced concrete shear walls to retrofit buildings under seismic actions becomes more and more limited due to its complication in erection and very high costs for foundation system because of high seismic forces acting on the walls

Innovative approaches to retrofitting:

The primary inventive techniques for retrofitting might be assembled into the accompanying classes:

- Decrease in Stiffness.
- Increase in Ductility.
- Damage controlled structures
- Composite materials
- Any suitable combination of the above methods

5. Structural audit :

Structural Audit is an essential instrument for knowing the consition of existing structures. The Audit highlights & evaluate all the risky, sensitive areas and whether the bldg. needs immediate attention. It should also cover the structural analysis of the existing frame and pinpoint the weak structural areas for static, wind & earthquake loads. If the bldg. has changed the user, from residential to commercial or industrial, this should bring out the impact of such a change.

6. Purpose of Structural Audit :

- To save Life & Property

- To know the proper condition of building and to increase the expected future life of it.
- Highlight the critical areas and risky areas that need to be taken action with immediate effect.
- To proactively help the inhabitants and the general public to comprehend the reality of the issues and the direness required to go to the same.
- To conform to Municipal or some other statutory necessities.

7. Recommended ndt tests:

The accompanying NDT tests are completed on structure elements on the basis of preliminary survey

- a. Core tests to examine the estimated equivalent in situ compressive strength & to establish correlation between Rebound hammer test & in situ strength of concrete.
- b. between Rebound pound test and in situ quality of cement
- c. USPV test to survey the integrity of concrete.
- d. Carbonation test to assess the depth of carbonated concrete
- e. Cover test to assess the cover provided to RCC structural members
- f. Half cell potentiometer test to determine the probability of active corrosion

8. Procedure and details

considering the safety of the structure, the work Encompass condition assessment, finding out the exact strength of the structure, evaluation for seismic forces to find out the threshold limit seismic activity up to which it can resist, and finally selection of retrofit straegies and construction process, considering all the conditions the process is completed.

1. The removal of existing plaster from the vulnerable parts and also applying treatment to remove the formation of alkali salt caused due to chemical wash or hot water without detoriating bricks. with the help of power driven or pneumatic chisel of standard including cleaning loose friable materials, chiseling is done up to 20mm of detoriated concrete. also removal of rust around the steel utilizing rust expelling papers or physically (appeared in Fig.), at that point apply of zinc introduction on the steel to build the quality of the steel and to give support to the structures.



Fig.1. Removal of existing plaster

2. To give and apply of pre-stuffed polymer adjusted defensive mortar, giving and putting in position smaller scale concrete and giving and applying low goeey hydrophobic silane-siloxane dissolvable to maintain a strategic distance from entrance of water and water borne salts to limit blooming and to fill the openings and breaks in the dividers and roof because of maturing.



Fig. 2. Grouting

3. The giving and grouting Chemical injection(epoxy base) by settling least 10 mm measurement spout of reasonable length, over the surface of RCC part additionally along the splits, wherever required . Initially gaps are influenced utilizing drill to machine. Little pipes of width 10 mm embedded in those holes.(Shown in Fig.) By utilizing manual or electrical pumping machine the epoxy base compound is embedded in the dividers to increment and recover the quality of the harmed some portion of the structure particularly



Fig.3. 10 mm measurement spout

4. Giving new mortar ideally M50 review over the structure which increment the quality of the structure, process known as concrete jacketing
5. Applying a new paint, give updated electronic suite, and other vital things to make the structure same as previously.



Fig.4. Concrete jacketing

IV REASONS MAY LEAD TO RETROFITTING

There are some reasons that may lead to retrofitting:

1. Building which are designed considering gravity loads only.
2. Advancement exercises in the field of Earthquake Resistant Design (EQRD) of structures and different structures result into change in outline ideas into change in design concepts.
3. Absence of opportune modifications of codes of training and standards.
4. Lack of revisions in seismic zone map of country.
5. In instances of adjustments in structures in high seismic action zone i.e. increment in stacking class, increment in number of story and so forth.
6. In cases of deterioration of Earthquake (EQ) forces resistant level of building e.g. decrease in strength of construction material due to decay in structure, damage caused by fire, and settlement of foundations.

7. The quality of construction actually achieved may be lower than what was originally planned.
8. Lack of understanding by the designer.
9. Improper planning and mass distribution on floors.

V. CONCLUSION

In this paper we presented a comprehensive study, its steps, procedure and the use of retrofitting in various fields. blend of designing, machines and years of experience make this conceivable to build up the innovation of retrofitting. At display day, retrofitting has an extremely lucrative market in the created and additionally creating nations. It gives various approaches to make develop the damaged structure and allows to expand the lifespan of a structure, increasing its functioning and safety. Retrofitting mainly relies on the modern technology and the unique ideas of the engineers and may vary from place to place.

REFERENCES :

1. *Retrofitting: Urban Design Solutions for Redesigning Suburbs* by Richard Florida.
2. *Seismic Retrofitting Project: Assessment of Prototype Buildings* published by TGCI.CPWD Research Paper
3. Abdullah, A; and Takiguchi, K, "Experimental Investigation on Ferrocement as an Alternative Material to Strengthen Reinforced Concrete" Column," *Journal of Ferrocement*, V. 30, No. 2, pp. 177-190.
4. Amlan, Sengupta K, Badari VT Narayanan, Asokan A, (2003), "Seismic retrofit of existing multistoried buildings in India-An overview of the method and strategies", *Workshop on retrofitting of structures, IIT Roorkee*,pp 17-28.
5. Dat Duthinh & Monica Starnes : 'Strength and Ductility of Concrete Beams Reinforced with Carbon FRP and Steel' , *National Institute of Standards and Technology Gaithersburg*, (2001) MD 2089.
6. Dr. Adnan S. AL-Kuaity : 'Rehabilitation Of Damage Reinforced Concrete Columns', *Al-Qadisiya Journal For Engineering Sciences* (2010) Vol. 3 No. 1
7. Murat Engindeniz : 'Repair and Strengthening of Reinforced Concrete Beam-Column Joints', *State of the Art, ACI Structural Journal Technical Paper*, Title no. 102-S18.
8. Shri. Pravin B. Waghmare: 'Materials And Jacketing Technique For Retrofitting Of Structures', *International Journal of Advanced Engineering Research and Studies EISSN2249 – 8974*.