V Anusha* et al.
(IJITR) INTERNATIONAL JOURNAL OF INNOVATIVE TECHNOLOGY AND RESEARCH
Volume No.7, Issue No.5, August-September 2019, 9264-9267.

Retrofitting Of Reinforced Concrete Frames Using Steel Bracings

V ANUSHA
MTech student, Dept of CIVIL, Priyadarshini Institute of Technology, & Science for Women's, Chintalapudi, Tenali, A.P, India.

K RATNA REDDY
Assistant Professor, Dept of CIVIL, Priyadarshini Institute of Technology, & Science for Women's, Chintalapudi, Tenali, A.P, India.

Abstract: **Steel braced frame is among the architectural frameworks used to confront quake masses in multi-storied buildings. Several present strengthened concrete buildings require to retrofit to conquer the deficiencies to stand up to seismic hundreds. Making use of steel supporting systems for reinforcing or retrofitting seismically insufficient strengthened concrete structures is a feasible remedy for reinforcing quake resistance. Supporting device reduces flexing moments and shear forces within the columns. The side tons is transferred to the foundation via axial action. Overall weight of the existing structure will certainly not alternate significantly after the software program of the bracings. Steel bracing is least pricey, easy to set up, occupies much less space and has flexibility to layout for setting up the preferred electricity and also stiffness. The supporting device boosts not best the lateral rigidity and power capability nonetheless additionally the variation capability of the form. Inside the here and now look at, the seismic general efficiency of strengthened concrete (RC) homes rehabilitated using concentric steel bracing is examined. The bracing is equipped for outer columns. a ten storey building is evaluated for seismic zone III as per IS 1893-2002 the use of ETABS software program. The models are retrofitted with varied metal bracing frameworks on perimeter columns storey wise and also assessed for seismic pressures. The structure is examined for designs with Angled supporting, 'V' kind supporting, Upside down 'V' kind supporting, blended 'V' kind supporting, 'X' kind supporting, 'k' type supporting as well as in comparison with an un supported frame. The efficiency of many kinds of metal bracing in fixing up a 10 floor constructing is tested. The effect of the distribution of the metallic bracing along with the top of the RC structure at the seismic efficiency of the fixed up building is examined. The concept parameters on this check out to analyze the seismic analysis of houses are side displacement, storey go with the flow, axial pressures inside the columns, Base shear. The portion reduction in side variation is observed out. It's far discovered that the 'X' type of steel supporting thoroughly contributes to the structural stiffness as well as minimizes the maximum floor drifts of the frameworks. The supporting systems improve now not simplest the side tightness however additionally the variation capability of the shape.**

Keywords: **ETABS; RC Frame; Steel Braced Frame; High Level Concrete; Stiffness; Strength;Shape;**

1. INTRODUCTION:

Among the easy, inexpensive as well as effective techniques for conditioning of strengthened concrete frameworks against lateral caused quake tons is using steel cross bracings. The mix of strengthened concrete framework with steel cross supporting is not an usual practice due to unidentified behavior and performance that needs to be checked out. Research study on using this approach of retrofitting has actually begun because 80s in which cross bracings have been used indirectly together with a steel frame constrained by a concrete framework. In addition to its great expenditures as well as its feasible not successful economic validation, using this system might cause a dynamic communication between steel bracing and also concrete frames. Although sometimes, using added steel structure to enhance existing concrete framework, appears to be essential, yet in the stage of system redesigning, the additional loads transferred by cross bracings can be contributed to the style loads. This may remove the demand for a pricey and also occasionally bothering steel structure [1] Therefore, developing a system of steel cross bracing in a way that it has much less financial and also technological issues appears to be an appropriate selection. In order to accomplish this goal, using steel cross bracings which are directly attached to concrete structure Is researched. There are some records which reveal the application of this technique in practice [2] and speculative [3] versions in Iran. In this cross supporting system, the details of cross supporting connection to the framework have substantial impact on the habits of the system as well as require be studying as well as examining thoroughly. In this examination, the same strengthened concrete structures with comparable cross supporting elements with different details for the connection of cross supporting to the structures, are created and evaluated.

Fig.1.1. Concrete Jacketing of Column.

2. RELATED STUDY:

Retrofit strategy refers to options of increasing the strength, stiffness, and ductility of the elements or the building as a whole. A retrofit strategy is a technical option for improving the strength and other attributes of resistance of a building or a member to seismic forces. The retrofit strategies can be classified under global and local strategies. A global retrofit strategy targets the performance of the entire building under lateral loads. A local retrofit strategy targets the seismic resistance of a member, without significantly affecting the overall resistance of the building. The grouping of the retrofit strategies into local and global are generally not be mutually exclusive. For example, when a local retrofit strategy is used repeatedly it affects the global seismic resistance of the building. It may be necessary to combine both local and global retrofit strategies under a feasible and economical retrofit scheme. Steel cross bracing system in combination with moment resisting frame may cause an increase in the stiffness and strength of the structure. In general, moment resisting frame and cross bracing system have two different performances which differ from each other in their type of deformation against lateral loads. The predominant deformation mode of the cross bracing system is flexural which is like vertical cantilever, although, moment resisting frames usually deforms in shear mode.

Fig.2.1. Steel jacketing of column

3. METHODOLOGY AND MATERIALS:

In low-rise buildings with minute withstanding frameworks which are enhanced by steel cross bracing system, the distinction in between the deformation modes of framework and cross bracing system is not substantial, and also second anxieties do not have much effect on the security of cross bracing framework in an extreme quake [7] In these buildings, the side rigidity of the minute resisting structure can be conservatively ignored, and develop the structure presuming that the cross supporting system can carry the side lots; or design the cross bracing system for side lots excess the minute withstanding frame ability. In high-rise buildings which have both moment standing up to as well as go across bracing systems, each system changes the various other's weak points to be boosted so that there will be a boost in the stiffness as well as lateral strength of the framework. Moreover, the difference in between the efficiencies of the two systems will bring about a non-uniform distribution of the shear pressures between them. This is performed in a way that throughout the side contortion in the framework's moment resisting framework in the lower stories, the structure leans to the cross bracing system, as well as in the upper stories the minute withstanding framework itself prevents the cross bracing system from contortion. For that reason, in these stories the shear pressures brought by the minute withstanding frame might be more than the whole applied shear forces on the structure, as a result of the adverse result of the performance of the system in the upper stories. Below, according to the common straightforward techniques, the distribution of the shear pressures proportional with the stamina of architectural components, will certainly lead to impractical results. It ought to be observed that because bring the entire lateral forces by the cross bracing system is not that much trusted, so it is additionally necessary to take the communication of both systems into consideration [6] Concerning the above pointed out factors, it must be discovered that in those structures which are reinforced by steel cross supporting system, the behavior of the consolidated structure will be totally various from that of the primary structure. Therefore, in the design of cross supporting systems, correct choice of the adjustments of action modification aspect (R) of the structure need to be considered completely. It is not merely low quality of products and damages of structural components serves as the reasons to retrofit a structure. Adjustment of the building's function, adjustment of ecological conditions, as well as modification of legitimate building regulations can additionally be the reasons for retrofitting. Retrofitting needs to be performed by specialists from each area. In most retrofitting process, an engineer plays the main role. A designer has to evaluate and evaluate the architectural capacity. An engineer must also develop and also recommend the best retrofitting techniques to reinforce the structural deficiencies. The duty of the beginner is restricted to determine the possibility of lack of the structure capacity.

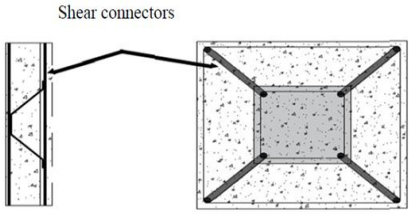

Fig.3.1. Profile of shear connectors between original column and jacket reinforcement.

Steel jacketing refers to encasing the column with steel plates and filling the gap with non-shrink grout. The jacket is effective to remedy inadequate shear strength and provide passive confinement to the column. Lateral confining pressure is induced in the concrete as it expands laterally. Since the plates cannot be anchored to the foundation and made continuous through the floor slab, steel jacketing is not used for enhancement of flexural strength. Also, the steel jacket is not designed to carry any axial load. If the shear capacity needs to be enhanced, the jacket is provided throughout the height of the column. A gap of about 25 to 50 mm is provided at the ends of the jacket so that the jacket does not carry any axial load. For enhancing the confinement of concrete and deformation capacity in the potential plastic hinge regions, the jacket is provided at the top and bottom of the column. Of course there is no significant increase in the stiffness of a jacketed column. Steel jacketing is also used to strengthen the region of faulty splicing of longitudinal bars. As a temporary measure after an earthquake, a steel jacket can be placed before an engineered scheme is implemented.

4. EXPERIMENTAL ANALYSIS:

The input and output conventions used correspond to common building terminology with ETABS, the models are defined logically floor-by-floor, column-by-column, bay-by-bay and wall-by-wall and not as a stream of non-descript nodes and elements as in general purpose programs. Thus the structural definition is simple, concise and meaningful. In most buildings, the dimensions of the members are large in relation to the bay widths and story heights. Those dimensions have a significant effect on the stiffness of the frame. ETABS corrects for such effects in the formulation of the member stiffness, unlike most general-purpose programs that work on centerline-to-centerline dimensions. The results produced by the programs should be in a form directly usable by the engineer.

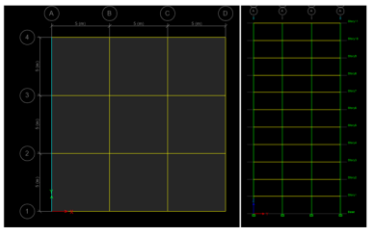

Fig.4.1. PLAN and ELEVATION of Building.

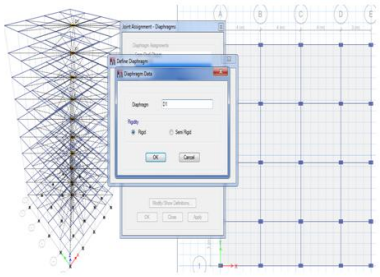

Fig.4.2. Defining Diaphragm action.

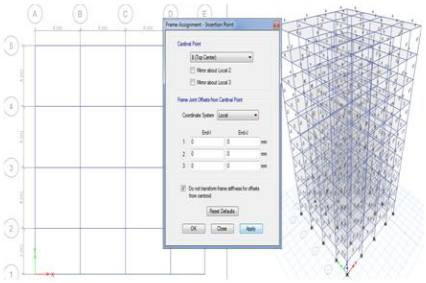

Fig.4.3. Insertion point.

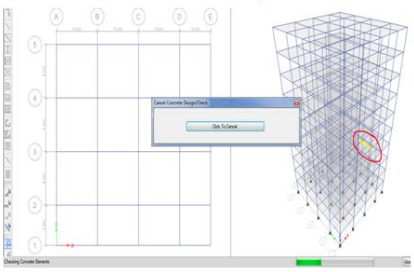

Fig.4.4 Concrete frame design.

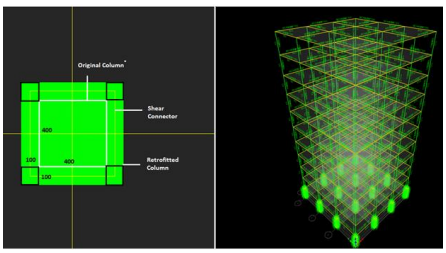

Fig.4.5. Concrete Jacketing for column.

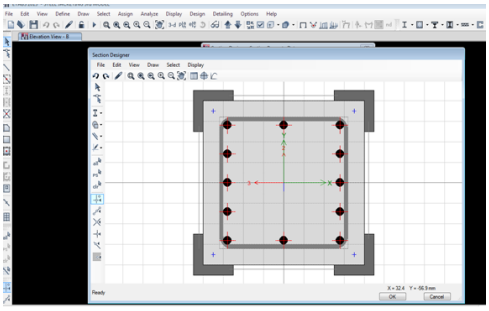

Fig.4.6. Steel Jacketing for column.

Based on the results obtained from the response spectrum analysis of a six(G+10) storey RC framed building, trends in the responses of columns are observed for three types of column jacketing and are presented here term of bending moments(mx and my),shears and axial forces. Besides this the response of the total building in terms of top storey displacements, Inter-storey Drifts and lateral loads on to stories is observed and presented.

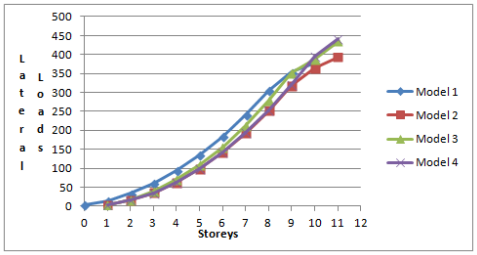

Fig.4.7. Storey vs Lateral loads on each storey.

5. CONCLUSION:

Increase in moments and axial forces were observed in Model 1 (structure which is upgraded to Zone 3). Therefore we can say that size of existing columns is not sufficient to take the loads, hence accordingly column sizes are increased to make the structure safe. It has been observed that the entire jacketing models has less time period than normal RCC structure, but the least time period was found in FRP, from which we can say that FRP jacketing model is more stiffer than RCC and steel jacketing. From the displacements and drifts ratio graphs, it was observed that, the displacement and drifts ratio is drastically reduced in FRP Jacketing (Model 4) and Steel Jacketing (Model 3) models when compared to normal RCC structure (Model 1). Hence significant effect of RCC, Steel and FRP jacketing was observed. Therefore RCC, Steel and FRP jacketing models has better performance. Hence we can conclude that FRP jacketing is more effective in increasing both strength and deformation capacity of the retrofitted columns.

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