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ASSESSMENT AND SEISMIC RETROFITTING OF R.C BUILDING FOR ADDITIONAL FLOORS

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Abstract: In general modifying a existing building for the future use includes lots of steps like collecting the data of the existing building, investigating the present condition of the building, preparing new plan for the existing building, analysis the structure with Stadd pro. and provide proper retrofit technique for the existing structure in order to with stand the seismic effect . The decision to repair or replace a structure or its component can be taken only after consideration of likely service life of the structure is established based on the technical and economic evaluations. Once a decision, based on preliminary investigations, is taken to carry out the repairs, proper diagnosis, identification and extent of distress in structural members has to be correctly assessed.
Keywords – Stadd pro, Existing Building, Seismic Effect.

1. INTRODUCTION

Retrofitting is a process of strengthening of older buildings in order to make them more efficient and increase their serviceability. Also we can make a older building seismic resistance by implementing proper strengthening technique. Retrofitting is the toughest of all works, this includes proper and superior supervision, error should be minimised, surface to be retrofitted should be prepared well before commencing the strengthening technique. Generally this is divided as Global retrofitting and local retrofitting techniques.Main objective for jacketing of the structure is to increase the seismic capacity of the structure.Andalso increases the stiffness of the member and this is useful where deformations of the member are to be controlled. If columns in a building are found to be slender, RC jacketing provides a better solution for avoiding buckling problems. Depending on the type of the jacketing used, an increase in strength, stiffness, ductility or a combination of them can be obtained. Several option for jacketing of concreting members are available one of them are the existing member is wrapped with the jacket of concrete reinforced with longitudinal steel and ties or welded with wire fabric. This is widely used in moment resisting framed structure.

The ductility of the column can be enhanced by providing additional tiles, steel plate bonding, and fiber wrap. The joints play crucial for resisting earthquake forces. The joints can be strengthening by enlargement, jacketing by steel collar and fiber wrap.FRP is the advanced retrofitting technique prevailing in the recent years. Several researchers have investigated the possibility and feasibility of fibre reinforced polymer composite jackets for seismic strengthening of columns winding them with high strength carbon fibres around column surface. FRP sheets increase their strength dramatically when compared to conventional retrofitting techniques. Shear and Lateral load carrying capacity of the columns are increased. This comes in various thickness and according to the load required these sheets are wrapped around the columns and beams in layers.

2. LITERATURE REVIEW

Giuseppe Olivetoet al. (2005),This deals with the seismic retrofitting of reinforced concrete buildings not designed to withstand seismic action. After briefly introducing how seismic action is described for design purposes, methods for assessing the seismic vulnerability of existing buildings are presented. The traditional methods of seismic retrofitting are reviewed and their weak points are identified. Modern methods and philosophies of seismic retrofitting, including base isolation and energy dissipation devices, are reviewed. The presentation is illustrated by case studies of actual buildings where traditional and innovative retrofitting methods have been applied.

Anusha Rani et al. (2014), Lessons learnt from past devastating earthquakes repeatedly emphasize on importance of school buildings. In our country performance of school structures are worst in past earthquakes and increase vulnerability of school buildings for damage had multiplied the intensity of impact on society after earthquake occurrence. Collapse of school buildings causes loss of lives of most sensitive part of society i.e. children. The loss to children has huge impact on the community. The school also serve as shelter to homeless during the earthquake.

Ahmed Shaban Abdel-Hay (2014),In some buildings, when quality control is poor, the upper parts of columns have a weak compressive strength, especially in floor zone. Low compressive strength for upper part of the column will lead to areduction in bearing capacity of column. Strengthening of this part using traditional methods such as R.C jackets and steel jackets will not satisfy the architectural conditions. This study is carried out to investigate the overall behavior of R.C square columns with poor concrete at upper part, strengthened with CFRP.

Sachin S. Raval et al.(20l3), Strengthening of Reinforced Concrete (RC)beams is required due to design errors, deficient concrete production, bad execution processes, damage due to earthquake, accidents such as collisions, fire, explosions and situations involving changes in the functionality of the structure etc. Jaeketing has been considered as one of the important methods for strengthening and repairing of RC beams. Jacketing of RC beams is done by enlarging the existing cross section with anew layer of concrete that is reinforced with both longitudinal and transversereinforcement.

3. METHODOLOGY

The partially existing G+1 building with a story height of 6.1 m was studied and it was analyzed and designed for additional floors(G+4) and retrofitting techniques were implemented were ever necessary. This G+4 structure is converted into a Office building and the additional floors are designed as a RC framed structure with conventional structural elements. All the data of the existing buildings were collected and studies were made about the condition of the structure The proposed floor system will be structural concrete slab. The finishes for the floor is 45 mm. Live load for the office building is 4 kN/m2.The seismic zone III is considered. The zone factor for seismic zone III is taken as 0.16. The nature of soil considered as Medium soil sites. The importance factor for the building is taken as 1.5 and response reduction factor is 5 for Ordinary Moment Resisting Frames. These values are taken from IS 1893 Part 1: 2002.

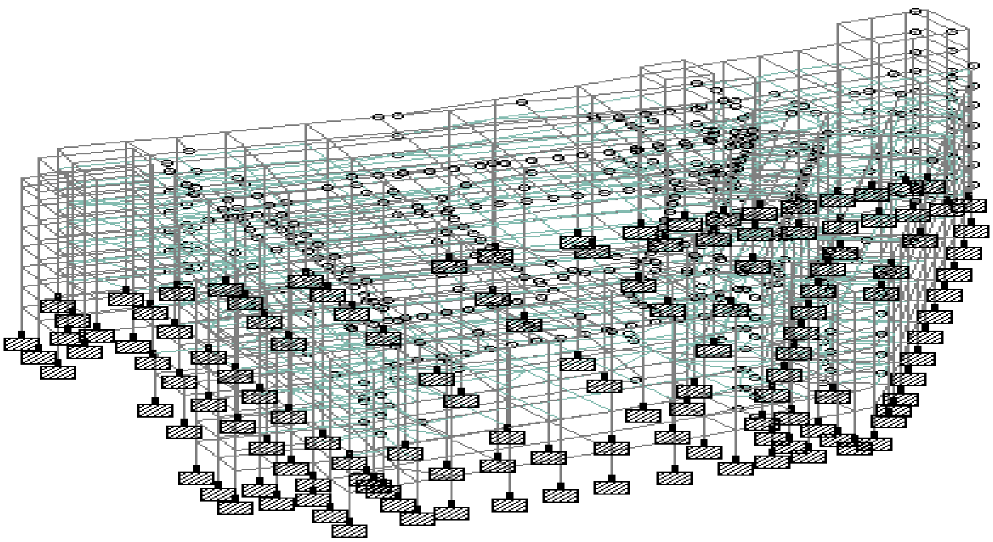

Fig.1.Overall view of the structure in stadd pro

In this study thepartially existing building with a storey height of 6.1m is selected and retrofitted in order to with stand lateral effects and load induced due to additional floors.This building is analyzed considering nonlinear flexural and shear failure of the frameelements. Shear failure model is developed from the linear static analysis. The building is also analyzed ignoring the shear failure of the frameElements for demonstrating the importance of shear failure model in seismic evaluationstudy. All the analyses are carried

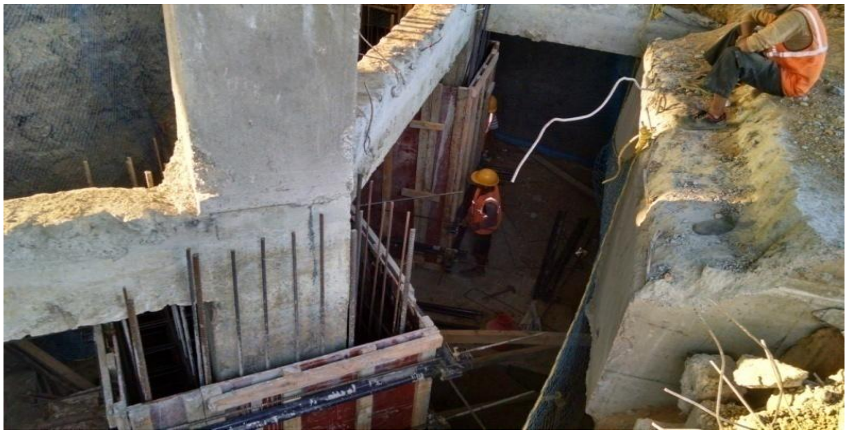

Fig.2.Placing Of Work

out in commercial software STADD PRO. Developing computational model is an important part on which linear or nonlinear, staticor dynamic analysis performed. Accurate modeling of the nonlinear properties of various structural elements is very important in nonlinear analysis. Beams and columns are modeled by 3D frame elements. To obtain the bending moments and forces at the beam and column faces beam-column joints are modeled by giving end-offsets to the frame elements. The beam-column joints are as considered to be rigid. The column end at foundation assumed as fixed for all the models in this study. Nonlinear properties at the possible yield locations are to be considered for all the frame elements. By assigning 'diaphragm' action at each floor level the structural effect of slabs due to their in-plane stiffness is taken into account.

Isolated footing is a individual type footing reinforced with required amount of steel to with stand the axial compression. In this case the safe bearing capacity of the soil is 500 kN/m^2. The loads to the isolated footings are analyzed using Stadd pro, the bending moment and area of steel obtained is used for design. The depth of max. isolated footing for the proposed columns is 800 mm and the width and the breadth of the footing is 3.00 m. The RC sections are shown in Fig. 5.3. Using 25 mm dia bar at 150 mm spacing.

5. RESULT ANALYSIS

From the above result the maximum load occurs in a existing column (C68) maximum axial load of 10344 kN and maximum moment of 748 kNm and that column is retrofitted with conventional retrofitting method. It is jacketed with extra steel of 4#25 and 16#16. The column size has been increased to 950 mm x 950 mm from 650 mm x 650 mm. This jacketing helps us to improve the efficiency of that column by 69%.As for the footings concerned the existing footings are strengthen by jacketing technique. The old footings are enlarged to 5 m x 5 m with extra steel of 16 mm dia. rods with 125 mm spacing. Here also there is an increase up to 60% to 70 % of efficiency of the footing.The maximum bending moment of beam occurs in B294 located at the second floor level. Maximum bending moment at top is 2171 kNm and at the bottom is 1565 kNm. This is reinforced with 14#32 dia. Bars top and bottom having a beam size of 600mm x 900mm. The existing beams are wrapped with FRP sheets according to increase their strength. Percentage of increase in strength is subjected to the number of layers wrapped around the beam. Nearly minimum 50% of the strength is increased due to this FRP wrapping.

6. CONCLUSION

From the above result it is evident that retrofitting an old structure can increase their efficiency locally and also globally. There are so many retrofitting techniques which are active today in that we only choose RC jacketing and FRP wrapping. Planning helped us to improvise the non useable area into useable area and convert this utility building into a corporate working space. This created more room space which is eventually needed for office kind of building. Implementing the retrofitting technique not only increased the efficiency of a member this also increased the life time of the member locally which in whole increases the life time of the building. We also saw growth in aspects like load carrying capacity , resist deformation, shear capacity, flexural strength, confinements of members etc. Reinforced jacketing provides us a remarkable 50% to 70% increase in strength life time of the old column.

Glass fiber reinforced polymer (GFRP) wrapping increases the axial load carrying capacity by providing addition confinement to the concrete without increasing the original column size. Effective confinement with GFRP wrapping resulted in improving the compressive strength. GFRP wrapping for square and rectangular columns, the enhancement in axial load was about 70% to 80%, respectively.

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