Seismic Evaluation Retrofitting of Existing Building

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Abstract:

A seismic evaluation of building means the strengthening of building pre-earthquake or post-earthquake. Necessity of strengthening is required, when the structure is not having sufficient capacity to resist the specific demand of the earthquake. In ancient times, it observed that the most of the existing structures failed due to inadequate design for earthquake and sudden change in soil the structure. The aim of this paper is to strengthen or retrofit the existing building. In this dissertation strengthening means increase the seismic resistance of building beyond its pre earthquake state, and also reconstruction or renewal of any part of an existing building to provide better structural capacity i.e. higher strength and ductility than the original building. Seismic evaluation and retrofitting are undertaken for the life -line buildings, such as hospitals, police stations, fire stations, major administrative buildings, schools, educational buildings, historical monuments etc. Necessity of seismic evaluation building because of lack of timely revise code, lack of timely revision of seismic zone map of contour and also depend on the quality of construction, addition or modification or change of use of building etc. The basic aim of retrofitting is to increase strength as well as ductility.

Keywords: Seismic Evaluation, Retrofitting.

Introduction

FRP means a matrix of polymeric material that is reinforced by fibers or other reinforcing material. The role of FRP for strengthening of existing or new reinforced concrete structures is growing at an extremely rapid pace owing mainly to the ease and speed of construction, and the possibility of application without disturbing the existing functionality of the structure. The advantages of FRP are including their high strength-to-weight ratio, corrosion resistance, environmental and chemical resistivity, electromagnetic insulation, impact resistance, limit thickness and easy application, clean and smooth finished surface.FRP can be used to increase shear strength of member to provide ductility to concrete.

Pushover analysis is a static, nonlinear procedure in which the magnitude of the lateral force is incrementally increased, maintaining the predefined distribution pattern along the height of the building. With the increase in the magnitude of the loads, weak links and failure modes of the building are found. Pushover analysis can determine the behaviour of a building, including the ultimate load and the maximum inelastic deflection. At each step, the base shear and the roof displacement can be plotted to generate the Pushover curve. It gives an idea of the maximum base shear that the structure is capable of resisting at the time of the earthquake. For regular buildings, it can also give a rough idea about the global stiffness of the building. It shows the performance levels, behaviour of the components and failure mechanism in a building. It also shows the types of hinge formation, the strength and capacity of the weakest components using a pushover analysis.

This design performance based design, which depends on two key elements i.e. demand and capacity. Demand is the representation of the earthquake ground motion. Capacity is representation of structures ability to resist demand. The main output of a pushover analysis is in terms of response demand versus capacity. If the demand curve intersects the capacity envelope near the elastic range, then the structure has a good resistance. If the demand curve intersects the capacity curve with little reserve of strength and deformation capacity, then it can be concluded that the structure will behave poorly during the imposed seismic excitation and need to be retrofitted to avoid future major damage or collapse.

Literature Review:

Aghaei et al. (2008), presented the analysis of the numerical study to simulate the behaviour of retrofitted reinforced concrete (RC) frames. In this paper G+1 building using carbon fibre reinforced polymer (CFRP) analyze with help of ANSYS Software. This paper showed strengthen RC frame by FRP Laminate, effect of strengthening in joints of frame, thickness effect on concrete surface, best orientation of alignment for major direction of Fiber in columns, beams and joints. The incensement in thicknesses of CFRP is negligible but it is proved with ascending thickness or plies (layers) with complete bonding internal stresses of concrete and FRP laminate are reduced, so FRP layer fail later. Furthermore conclude with Retrofitting by FRP laminates and more concrete strength we have less deflection

Khans (2013), studied comparative response of conventional R.C building and the building having energy dissipating devices subjected to Seismic loads by using SAP2000. The objective of this study is to see the variation of load-displacement graph and check the maximum base shear and displacement of the frame. The results of present study demonstrate that most of the plastic hinges are forming within beam element.

Khalid and Shinde (2012), presented the analysis of reinforced concrete column and beam strengthened by fiber reinforced polymer by using fine element analysis of STAAD PRO software. In this paper 2 bay 3 storey's and 3 bays 5 storey building were using STAAD PRO and analyzed for different crack location and various thickness of FRP. There comparison between sounds RC Frame, RC frame during earthquake load, RC frame retrofitted using FRP laminate. The result obtained this demonstrate that the use of FRP laminate is far more effective and easy than reinforced concrete jacketing and steel profile jacketing strengthening of RC frame. In this paper the result confirmed that FRP laminate allow RC retrofitted to withstand the lateral load that of original retrofitted RC frame. FRP laminates are better option of retrofitting because they can withstand the seismic load effectively.

Singh A.K (2013), studied the intensive retrofitting of RCC framed institutional building structure under construction which is institutional building having triple basement of G+10 with 3 basement. In this paper the strength of slab investigated by using ultra sonic pulse velocity instrument also the found out the crack pattern of slab. In this paper CFRP laminate used to retrofit of the slab section. In this paper use SAFE 12.2.0 software was used to analyze and design the typical slab. The bending moment and deflection pattern were obtained. They also described the method of designing of slab with using CFRP material. The results of this paper carbon laminate are now protected against any damage.

Methodology:

Study Design

Analysis of seismic forces as per Equivalent static analysis and response spectrum analysis.

Materials and Methods

Pushover static analysis can be done by using SAP-2000 with following sequence

1. Analysis existing building by Non-linear static analysis.
2. Select the suitable method for retrofitting as per requirement
3. Design the FRP as per ACI440-2R and TR 55.
4. Comparison of the results before and after retrofit of existing building.

Project Development:

In the present analysis, only static analysis will be done by considering mass of the structure. The project may be extended for dynamic analysis by considering vibration effect. And also the application of different types of retrofitting materials such as an aramid fiber, glass fiber will be suggested and the new technique of retrofitting, if possible.

Conclusion:

In this project we do the comparative study of existing building before and after retrofitting. This comparative study check with help of analysis by using seismic analysis method. To the check failure formation with help of pushover analysis by using SAP 2000 software.