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Health Monitoring of An Existing RC Structure Considering Seismic Analysis Using Analysis Tools Staad : A Review

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ABSTRACT

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Seismic assessment of an existing structure which is not designed as per seismic criterias are not considered safe during natural disaster which can cause loss of life and property. Therefore it can be consider as an important point to be considered during redesigning or retrofitting of the structure.
In this paper we are reviewing literatures presented by different authors around the world related to retrofitting and seismic assessment of existing structures.
Keywords : Seismic Assessment, Staad.Pro, Forces, Displacement, Strength, Rebound Hammer, Retrofitting.

I. INTRODUCTION

Seismic retrofitting is mainly done to meet the seismic safety requirements. The planning of alterations to existing buildings differs from new planning through an important condition; the existing construction must be taken as the basis of all planning and building actions. India is one of the most earthquake prone countries in the world and has experienced several major or moderate earthquakes during the last 15 years. About 50-60 % of the total area of the country is vulnerable to seismic activity of varying intensities. Many existing buildings do not meet the seismic strength requirement. The need for seismic retrofitting of an existing building can arise due to several reasons like: building not designed to code, subsequent updating of code and design practice, subsequent upgrading of seismic zone, deterioration of strength and aging, modification of existing structure, change in use of the building, etc. Seismic retrofit is primarily applied to achieve public safety, with various levels of structure and material survivability determined by economic considerations. In recent years, an increased urgency has been felt to strengthen the deficient buildings, as part of active disaster mitigation, and to work out the modifications that may be made to an existing structure to improve the structural performance during an earthquake.

II. Literature Survey

In this literature review we are presenting survey of researches presented by authors related to seismic analysis of existing structures.

MAYORCA et. al. (2004) observed that Masonry structures are widely used due to its low cost and construction easiness especially in developing countries. In spite of the efforts to provide guidelines for the construction of sound earthquake resistant houses, every year casualties due to collapsing masonry houses during earthquakes are reported. Although it is clear that retrofitting the existing housing stock is urgent, successful campaigns oriented in this direction are scarce or inexistent. To overcome this situation, retrofitting techniques involving inexpensive construction materials available in remote regions and low-skill labor as well as aggressive educational campaigns are needed. This paper presents an innovative retrofitting method for masonry houses, which consists of using polypropylene bands arranged in a mesh fashion and embedded in a mortar overlay. These bands, which are commonly used for packing, are resistant, inexpensive, durable and worldwide available. In order to verify the suitability of the proposed method, a series of masonry walls, with and without retrofit, were tested under in-plane loads. Although the retrofitted wall peak strength was almost the same as that of the bare wall, its post-peak strength was larger and sustained for lateral drifts over 2%. In order to investigate the proposed retrofitting features for different material properties and mesh configurations, numerical simulations based on a discrete modeling approach were performed. The effects of the band mesh pitch and connection distribution combined with different masonry types were examined.

U.Akguzelet. al. studied that the latest research findings into the effects of multiaxial loading on the seismic performance of as-built and FRP retrofitted three-dimensional (3D) beam-column joints with and without floor slabs are presented. For this purpose, the experimental results of four 2/3 scale, deficient RC beam-column joints are presented and conclusions are drawn on the basis of observed global and local performance. Special emphasis is given to the feasibility and efficiency of a retrofitting intervention using glass fibre reinforced polymer (GFRP) composites. A performance-based retrofit approach is adopted with attention given to the targeted specific limit states or design objectives. In addition, a numerical study is presented to calibrate and develop versatile finite element (FE) model, based on microplane concrete, to simulate the response of the 3D corner as-built joint under bidirectional loading with concurrent varying axial load and compared with the experimental results.

AmlanK.senguptaet. al. studied live case of three storeyed building and provided shear walls, infills bracings etc to enhance structure strength and determined that all these global retrofitting techniques are improving structure stability.

The behavior of beam-column joints in plane frames under seismic loading has been extensively investigated by experimental testing since the 1960`s. Most of these studies were undertaken with the aim of verifying the design of new space frame joints, whilst there has been far less experimental investigation into the behaviour of under-designed (e.g. following older code of practice when compared to current one and prior to capacity design principles were introduced) beam column joints in space frames either in as-built or retrofitted configurations **(Hertanto, 2006; Chen, 2006; Akguzel et al., 2010b; Engindeniz, 2008**).

Several experimental tests have been conducted to investigate the behaviour of deficient full-scale RC buildings strengthened with FRPs using uni-directional **(Balsamo et al., 2005)** and bi-directional pseudo-dynamic **(Ludovico et al., 2008)** or quasi-static lateral load tests **(Della et al., 2006)**. **Garcia et al. (2010)** also reported the experimental results of uni-directional shake table tests performed on a full-scale RC frame with poor detailing in the beam-column joints in as-built and CFRP retrofitted configuration.

Recently, as part of a more extensive research program on the Seismic Retrofit Solutions for RC buildings in New Zealand **(Pampanin, 2009; FRST website)**, a non-ductile 3-storey 2/5 scale RC frame model structure was tested under unidirectional horizontal input shaking on the shake table of the University of Canterbury to assess the effectiveness of the proposed FRP retrofit technique and validate the adopted design procedures **(Akguzel et al., 2011a; Quintana-Gallo et al. 2011, 2012).**

According to**Harshitha and Vasudev (2018)** earthquake is the one of the major disaster known to mankind since many years, there has been a considerable contribution from earthquake engineers for the safety of the structure. One of the alternatives to reduce the damage caused due to the earthquake is adopting structural steel bracings in the structure. These members can be utilized in the building as a horizontal load resisting system to improve the stiffness of the frame for seismic forces. This study is based on analysis of RC framed structure through structural steel braces using ETABS software and aims to understand the behaviour of the different bracing system for dissimilar arrangements. G+10 structure in zone IV is selected and analyzed with diverse braces. The efficacy of braces is studied by means of 16 models out of which one is the bare frame model. The performance of the structure is studied in terms of base shear, lateral displacement and time period. The outcomes of the analysis are compared and it was observed that the seismic behavior of braced framed building is enhanced as compared to unbraced framed building. It was also observed that the various arrangements of bracing systems have great ineffect on seismic performance of the structure.

Tsige and Zekaria (2018) analyzed a office medium rise building for earthquake force by considering three type of structural system. i.e. Bare Frame system, partially-infilled and fully- Infilled frame system. Effectiveness of masonry wall has been was studied with the help of five different models. Infills were modeled using the equivalent strut approach. Nonlinear static analyses for lateral loads were performed by using standard package ETABS, 2015 software. The comparison of these models for different earthquake response parameters like base shear vs roof displacement, Story displacement, Story shear and member forces are carried out, found that the seismic demand in the bare frame is considerably more when infill stiffness is not taken with larger displacements. It has been concluded that fully infilled frame is around 15% more compared to bare frame model; frame with 25% masonry wall decreased is nearly 10% more compared to the bare frame; frame with 50% of the masonry wall decreased is nearly 8% more compared to the bare frame and frame with 75% of the masonry wall decreased is about 5% more compared to the bare frame. This is because the bare frame models do not account the stiffness rendered by the infill panel, it gives significantly longer time period.

Patilet. al. (2018) Studied the effective bracing system for G+20 building by using STAAD.pro v8i. The purpose of this study is to analysis and design different parameter in high rise steel structure. In this research G+20 structure is taken with eccentric bracing system under different types of lateral loading.

Krishna et. al. (2017) Studied that with the upsurge in the tallness of the structure surges the intensity & effects of Lateral loads comprising of seismic & wind loads. Wind load resistance becomes a governing factor once the structure achieves the description of tall structure due to the inefficiency of rigid or semi rigid frames to control the displacement & deflection. Thus, reducing the strength & stiffness of the structure. Braced frame system is a highly competent & cost-effective method to control the deflections arising due to the fluctuating wind loads. In the present investigation three different types of concentric braced frame systems were analyzed in terms Shear force, bending moment, nodal displacement & reactions by using STAAD.Pro V8i software as per Equivalent static analysis method. An

(G+11) irregular high-rise structure was assumed to be situated in Bhuj with Basic wind speed 50m/s.

Numerical analysis of a high rise masonry infill RC building in order to evaluate seismic performancehas been done by**Hasan (2017)**. In this regard, frame is designed by linear beam and column elements. An 8-storey RC frame structure with different amount of masonry infill walls and bare frame were considered. Modeling of masonry infill walls had been done by diagonal strut approach. Infill panels are modeled by truss elements and the boundary condition at the support is considered restrained in all direction and linear material properties are used. The observation of the response of building structures shows that there is significant contribution of infill in the characterization of their seismic behavior. During modeling of a structure the influence of infills are generally neglected as usually those are classified as non- structural elements. As a result, it becomes unattainable to calculate the actual seismic response of framed structures. In his study, story displacement curves and storey drift curves were found from static analysis, response spectrum analysis and time history analysis which are used in comparing the effects of different configuration of masonry infill wall in structure. Regarding with the analysis results, the effects of infill were determined in the structural behavior under earthquake.

Paudel (2017) studied that in open ground story buildings, sudden change of stiffness takes place along the building height which makes the storey more flexible than the adjacent story. Hence columns and beams in those storeys got heavily stressed. Presence of infill walls in the frame alters the behavior of the building under lateral loads. However, it is a common industry practice to ignore the stiffness of infill wall for analysis of framed building. Architects trust that examination without considering infill solidness prompts a traditionalist plan. However, this may not be in every case genuine, particularly for vertically sporadic buildings with broken infill walls. Henceforth, the displaying of infill walls in the seismic investigation of encircled buildings is basic. Indian Standard IS 1893: 2002 permits examination of open ground story buildings without thinking about infill solidness yet with an augmentation consider 2.5 pay for the firmness intermittence. Notwithstanding, as experienced by the specialists at outline workplaces, the duplication factor of 2.5 isn't practical for low ascent buildings. This calls for an assessment and review of the code recommended multiplication factor for low rise open ground story buildings. And concluded that Column forces at the ground story increases for the presence of infills in upper storeys, but design load multiplication factor 2.5 is found to be much higher, it is actually found to be 1.15. Not significant change in beam forces of the first-floor beams was obtained after the consideration of infills too. Time periods decreases with the increase of amount of infill in the buildings (highest for without infills and lowest for the fully infilled case). This results in the attraction of more earthquake force for the lower time periods. Story drift is found to be lowest for fully infilled and highest for without infills but drift of first story is highest for the building with infills above ground floor (i.e. open ground story).

Mohabbiet. al. (2016) described the effect of infill wall in formation of short column at military aid watchtower in Turkey has been analyzed and the analysis result compared with effect of earthquake that have been seen after earthquake. Concluded that Strength of masonry infill, even though considered non-structural, influence the lateral behavior of RC frames, Structural drift is reduced by infills, because of reduced ductility of RC edges, and segments specifically, Shear constrain in short section in RC outlines builds, inferable from the nearness of infills which prompts disappointment of the structure. A fractional infilled short segments structure pulls in bigger power and manages basic harm. Amid the horizontal burdens inappropriate shear stream due to halfway infilled structures will harm the short segment prompting auxiliary disappointment. Solution for this type of problems is isolation the infills from the surrounding frames.

III. Conclusion

Authors in past perform analysis of a old RCC structure but none of them describe its present strength and after retrofitting strength using analysis tool. The numerous analysis was done on experimental setup but here we are going to perform analysis of a case study which is approx. 35 year old RCC structure.

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