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A Review on Seismic Evaluation with Shear Wall for Building

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Abstract: From the history of mankind, uncountable deaths were occurred due to unplanned social system, as lesson learnt from disaster of Bhuj earthquake, thousands of people died and lakhs were injured. Present ground reality scenario of suffering people due to disasters, demands technical solutions, so it is necessity of following and implementation of Indian standards codes including national building codes, as a result structures performs as an seismic resistant and efficiently transfers lateral loads. During seismic shakes, designed structures should consist of lateral load transfer mechanisms such as shear wall and bracing systems which enhance the damping properties in addition to seismic vulnerabilities

This paper summaries the method of retrofitting for frame structure under the different seismic loading conditions. The RC structure is need to be retrofitting to resist the seismic load. Retrofitting is one of the best method which not only strength the structure but also proves to be safe against the seismic load. Based on the literature reviews we can analyses and investigate the behaviour for the performance of the steel bracing RC steel bracing in the RC construction field using the staddpro software. The paper which is based on the objective to find and do the analyses the different forces under the different loading condition In the Retrofitted structure which is govern by seismic methods.

Keyword: Reinforced concrete frames, Steel bracings, Strengthening, Shear wall

I. INTRODUCTION

A. Introduction

In the case of reinforced concrete (RC) structures, the aforementioned difficulties constitute a particularly serious problem. This type of construction is widely used for critical public buildings, such as schools, hospitals, fire stations and public administration offices, amongst others. Also, this class of structures is commonly associated to large occupancy buildings such as multi-storey residential blocks, offices and hotels.

However, despite the importance in safeguarding the seismic behaviour of such sensitive structures, there is very little codified criteria and guidelines for assessment and structural upgrading of RC buildings

The problem, however, becomes more intricate when other factors, beyond the reach of regulations, are taken into account. In fact, it is frequent for existing buildings to have suffered structural modifications applied by their owners without due engineering consideration, thus further hindering what may already be a low seismic resistance. Also, quality of construction may be poor, resulting in a defective design-implementation. The latter may lead to disastrous consequences, as recently highlighted by the devastation and human casualties resulting from the Kocaeli (Turkey) of 17 August 1999 and, to a lesser extent, the North Athens (Greece) earthquake of 7 September 1999.

There are three key concepts in seismic design that were fully developed by researchers and engineers. First, earthquake ground motions generate inertial loads that rapidly change with time. Thus, it is common that calculations include a term labeled with a unit of time (usually seconds) and these terms include periods of vibration or their inverse, frequencies; accelerations and velocities. In many other structural engineering problems such as calculations of gravity loads, no unit of time is used.

Second, due to the large uncertainty associated with the forces and structural responses. The earthquake occurrence time, its magnitude, rupture surface features and dynamic response behavior of the structure cannot be predicted with certainty. Methods of probability and statistics are required to include these uncertainties and their effects on the structural performance evaluation and design

The third fundamental earthquake engineering concept that distinguishes this field is that the earthquake loading can be so severe that the materials must often be designed to behave in elastically. Within the domain of Hooke's Law, stress is proportional to strain, but beyond that point, behavior becomes complex. Most of the analytical and experimental work investigating inelastic behavior began approximately in the 1960s.

B. Earthquake Design Philosophy

The engineering intention behind earthquake resistant design is not to make earthquake-proof buildings that will not get damaged even during the rare but strong earthquake; such buildings will be too robust and also too expensive. Instead, the engineers make buildings to resist the effects of ground shaking, although they may get damaged severely but would not collapse during the strong earthquake. Thus, safety of human life and contents inside of the building are assured in earthquake resistant buildings. This is a major objective of seismic design codes throughout the world.

The earthquake design philosophy may be summarized as follows;

1) Under minor but frequent shaking, the main members of the building resist earthquake impact without being damaged (staying at elastic range); however building parts that do not carry load may sustain repairable damage.
2) Under moderate but occasional shaking, the main members may sustain some repairable damage, while the other parts of the building may be damaged even may need replacement.
3) Under strong but rare shaking, the main members may sustain severe (even irreparable) damage, but the building should not collapse.

The important buildings, like hospitals and fire stations, play a critical role in post-earthquake activities and must remain functional immediately after the earthquake. These structures must sustain very little damage and should be designed for a higher level of earthquake protection. Likewise, dams, nuclear power plant, etc. should be designed for higher level of earthquake motion not to cause another disaster after a strong ground motion. Figure 1 shows schematic system behavior for seismic demands

C. Seismic Retrofitting of Concrete Structures

It is the modification of existing structures to make them more resistant to seismic activity, ground motion, or soil failure due to earthquakes. The retrofit techniques are also applicable for other natural hazards such as tropical cyclones, tornadoes, and severe winds from thunderstorms.

Fig1.1 Additional Shear Wall

D. Need for Seismic Shear Wall to the Structure

1) To ensure the safety and security of a building, employees, structure functionality, machinery and inventory
2) Essential to reduce hazard and losses from non-structural elements.
3) Predominantly concerned with structural improvement to reduce seismic hazard.
4) Important buildings must be strengthened whose services are assumed to be essential just after an earthquake like hospitals.

E. Problems faced by Structural Engineers Are

Lack of standards for retrofitting methods – Effectiveness of each method varies a lot depending upon parameters like type of structures, material condition, amount of damage etc.

F. Design of Shear Wall

Shear walls construction is an economical method of bracing buildings to limit damage. For good performance of well-designed shear walls, the shear wall structures should be designed for greater strength against lateral loads than ductile reinforced concrete frames with similar characteristics; shear walls are inherently less ductile and perhaps the dominant mode of failure is shear. With low design stress limits in shear walls, deflection due to shear walls is small. However, exceptions to the excellent performances of shear walls occur when the height-to length ratio becomes great enough to make overturning a problem and when there are excessive openings in shear walls. Also, if the soil beneath its footing is relatively soft, the entire shear wall may rotate, causing localized damage around the wall. Shear wall Is designed as per IS 13920: 2016 Clause 10-page no. 14, IS 456: 2000.

G. General Requirements

The thickness of the shear wall should not be less than 150mm to avoid unusually thin sections. Very thin sections are susceptible to lateral instability in zones where inelastic cyclic loading may have to be sustained.

The effective flange width for the flanged wall section from the face of web should be taken as least of

1) The minimum reinforcement in the longitudinal and transverse directions in the plan of the wall should be taken as 0.0025 times the gross area in each direction and distributed uniformly across the cross-section of wall. This helps in controlling the width of inclined cracks that are caused due to shear.
2) If the factored shear stress in the wall exceeds $0.25\sqrt{fck}$ or if the wall thickness exceeds 200 mm, the reinforcement should be provided in two curtains, each having bars running in both the longitudinal and transverse directions in the plane of the wall. The use of reinforcement in two curtains reduces fragmentation and premature deterioration of the concrete under cyclic loading.
3) The maximum spacing of reinforcement in either direction should be lesser than lw/5 , 3tw, and 450mm, where lw is the horizontal length and tw the thickness of the wall web.

II. LITERATURE SURVEY

Nasr. Z. Hussan, Mostafa A. Osman et.al (2017), (1) In this proposed work, the discovery in the earthquake evaluation of multistoried flat slab developing rested on plain and also sloping ground are done by the scientists. For sloping ground and plain ground, linear analysis technique is utilized in ETABS software. You will find 4 instances which had been viewed in ten storey developing resting on the rest and plain ground of 3 cases on oblique ground at perspective of 100,200,300 were also mentioned. Following the analysis as well as comparison of result Storey drift in flat slab is much more in basic ground as in comparison to inclining ground.

P. Sriniwasulu and A. Dattatreya Kumar et.al (2015), (2)In this particular work, the finding of genuine functionality of R.C.C. dull slab developing under earthquake loading continues to be done. It was discovered that because of seismic loading, the result on the flat slab in terminology of storey displacement, frequency, base shear, storey stage acceleration and definitely the result of pounding shear in all kinds of dull slab i.e. dull slab not such as drop, dull slab with fall, flat slab with just shear wall structure, flat slab with drop as well as shear wall structure have additionally concluded. The R.S.M is needed with the aid of ETABS application. Following the end result was compared, essential mode of frequency is twenty % increase in flat slab with drop and also in order to improve stiffness property with shear wall structure the worth was enhanced with ninety six %. The importance of essential frequency was significant at bottom floor and also much less at the best floor as well as the importance of essential time period increased at best floor to bottom floor. The storey shear great appears to be comparatively large at bottom floor and much less at top floor. Thus concluding this particular, the flat slab inclusive of drop as well as shear wall structure is better choice to conquer the displacement in X direction, too base shear enhanced when industry increases. In case drop has supplied in interior panel and then punching shear gets lowered by 25 %

R. S More and V. S. Sawant et.al (2015),(3)The job done in this approach type, the evaluation of flat slab of earthquake loading state has drawn out. In this particular analysis, flat slab was created with the aid of D.D.M, Finite element method and e.f.m (for abnormal geometry as well as abnormal layout). Different the end result, it's been discovered that in Is actually Code 456 2000, there are not a provisions regarding flat slab for seismic loading, it's merely depending on the gravity loading problems. In case the developing hasn't done correctly, then cracks are developed near the assistance which concluding the drastic success when any framework considered during construction.

Bhagavathula Lohitha as well as S.V. Narsi Reddy et.al (2014)(4) Investigate a current RC framed building (G three) with soft storey was analysed for 2 diverse cases (a) considering both infill mass as well as infill stiffness and also (b) contemplating infill mass but without considering infill stiffness utilizing software SAP2000. 2 distinct support situations were considered checking the outcome of support problems in the multiplication elements. Non-Linear and linear analyses were carried out for the models. Realized that support problem influences the result substantially and may be essential parameter to choose the force amplification component.

Anchal V. Sharma as well as Laxmikant C. Tibude et.al (2016) (5) learned a RC framed building (G three) with wide open ground storey was analysed for linear elastic evaluation with the by hand or maybe commercial software program its realized the displacements for the wide open ground storey is smaller than the completely unfilled wall framed and blank framed building for all of the seismic zones.

D. J. Chaudhari, Prajakta T. Raipure et.al (2015)(6) analyses RC framed building (G ten) with OGS for all the influences of multiplication aspect of other international codes and Indian Standard codes of the seismic study and loads fragility curves that is produced by STAAD PRO. And after the evaluation they mentioned the OGS frames in terminology of terrain storey drifts is growing in increasing order of MF"s by most codes for all of the overall performance level. As per Is code the very first storey is much more weak next ground storey however for Israel code it's false. Additionally they mentioned that as per Israel code, MF just in ground storey might not supply the likely outcomes in any other stories. In case MF put on also for any adjacent storey might enhance the functionality of OGS buildings.

Aditya Deshmukh et.al (2015) (7) studied a RC framed building (G ten) construction with open ground storey just for the various seismic zones with the different situations of creating element: (a) unfilled frame developing (b) building with uniform infill in most storey (c) building with OGS (d) OGS with stiffer column (e) OGS with corner shear wall structure (f) OGS with corner cross bracing (g) OGS with composite columns. And also the designs had been produced from the business software program ETABS. From the lateral displacement graphs he found out that lateral displacement is much higher in OGS style as compared to various other structures. Additionally he mentioned with corner shear wall displacement minimization is bigger therefore it's ideal type of OGS building with corner shear wall.

Also, he realized that by studied that OGS building with corner shear wall structure and also cross bracing are discovered to be really successful in decreasing stiffness irregularity plus bending OGS and moment with stiffer column plus composite columns are extremely successful decreasing drift and stiffness irregularity but there's increasing bending moment and shear force in original storey. And ductility is found much more in the infill frame board compared to the open ground storey developing version.

Prof. Dipak Jivani, Dr. R.G. Dhamsaniya, Prof. M.V. Sanghani et.al (2017)(8) examined the dynamic evaluation provides higher time period as in comparison to fixed analysis.

Higher time period noticed in bare frames as well as the time period improves as the opening area portion of construction increases that is the happened due to decrease in stiffness.

It's been discovered that optimum base shear as well as roof displacement capability both the items is bigger for the with no infill situation than the with infill situation. And developing modeled with infill stiffness has much more ductility than building modeled with infill stiffness. Also, he realized that following pushover analysis foundation shear multiplication element found out is smaller than the Is actually code recommended.

Amol karemore, Shrinivas Rayadu et.al (2015) (9) studied a (G+3) building with OGS for the seismic zone 3 and they have done pushover analysis to evaluate effect of seismic behaviour of building. They found that OGS building are more sensitive to earthquake than full infill building duo to soft storey effect. Infill walls increases stiffness while decreases lateral displacement. They noticed that there is no effect of zone on multiplication factor. As per IS 1893stated that magnification factor of 2.5 to be applied on calculated shear force and bending moment is very much. After linear and non-linear analysis they concluded that the magnification factor (MF) for bending moment is in the range of 1.06-1.98 for columns and for beam is in range of 0.92-1.06 of ground storey. Magnification factor (MF)) for shear force is in range of 1.42-1.52 for column and for beam is in range of 0.97-1.07 of ground storey.

Akshay S. Paidalwar1 and G.D. Awcha et.al (2017)(10) stated that the stiffness of the structure is an important factor in case of OGS type building. RC framed building with open ground storey is known to be performing poorly during the strong earthquake shaking. In elastic analysis it has been observed that for OGS building the stiffness is almost same to Bare Frame building.

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III. RESEARCH METHODOLOGY

A. *Methodology*

Research is a systematic and logical search for new and helpful information on a specific topic. A systematic approach to solving a problem is known as research methodology. It's a science that studies how research should be conducted. The ways in which researchers describe, explain and predict phenomena are referred to as research methodology.

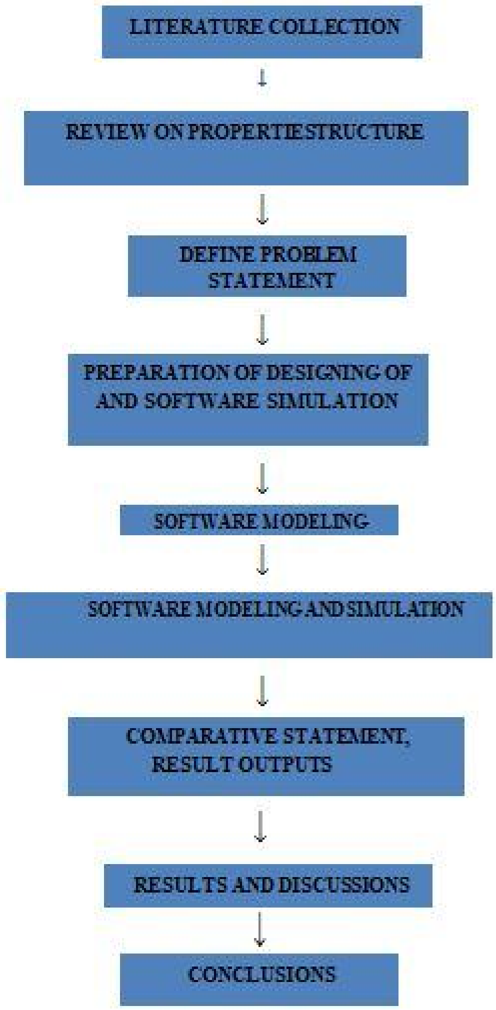

Fig 1.3: Research Methodology

B. *Research Design*

The characteristics of a good research design consist of the definition of the problem, estimation of the time required for the research project, and estimation of expenses. the purpose of research design would be collecting the necessary data and to do so correctly and economically. A research design is simply and purely the framework for a research which guide the collection along with analysis data. The two fundamental kinds of research design were triggered in this project.

IV. CONCLUSION

This project work was a small effort towards perceiving the how introducing bracing or a shear wall in a building can make in difference in protecting the building in earthquakes. Almost all the buildings in India are RC frame, and earthquake tremors are felt every now a then in some or the other part of the country. Hence through this project it was tried to appreciate the effectiveness and role of this small extra structural elements that can save both life and property, at least for most of the earthquakes.

V. FUTURE-SCOPE

1) Displacements will be studied in different storeys with different Bracing system.
2) There is a gradual decrease in the value of lateral forces from bottom floor In future it should be calculated in each floor ground floor to top floor in equivalent static method.
3) By analysing different models, we have concluded that the shear wall at exterior corner of the building Should check and in different systems, X-bracing system is more suitable.
4) Both combination of shear wall at exterior corner with X-bracing gives the maximum base shear and displacement and storey drift should be check.

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