

Seismic Retrofitting of Existing Multistory Building with Bracing: a Review

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ABSTRACT: The earthquake remains the same in our India. So, India is divided into the seismic zone to know in which the area is more effective to the earthquake. So, now a day needs that structure should be constructed earthquake resistant. Generally maximum earthquake in Bhuj, Gujarat state occurs. It is duty of structure engineer that how minimizes the effect of earthquake in structure. The retrofitting of reinforced concrete structure is most effective for the technical solution for enhancing the lateral resisting capacity of the reinforced concrete structure. During the past 50 years at 5-10 year interval moderate to severe earthquake occur. In presently due to population increasing, high rise building required. In high rise building wind and earthquake force are more effective. Stiffness of the structure will reduce, if increasing the height of the building. To enhance the lateral resisting capacity and stiffness of the structure retrofitted structure used. Bracing system also reduces the value of Bending moment, and Shear force in the column the bracing will provide on outer periphery on column of building. In present study, for seismic zone 5 and zone 3 we did the comparison study on different spanning bracing used. To after analyzing we will be checked that how many ways bracing can be applying on the structure that drift and displacement value give should be minimum and enhancing the lateral resisting capacity of the structure. In high rise building due to earthquake load and wind load failure of chances is the maximum. Structural engineer always try that the how to minimize failure of chances. Different type methods are developing whose structure failure not occurs during earthquake. This chapter deal with one method name retrofitting with X type bracing. For finding the minimum value of some parameter like drift and displacement do the analysis of structural system. Retrofitting structure with x type bracing placed on different-Different span, we'll analysis for all case.

KEYWORDS: ETABs, drift, displacement, Seismic Zones.

INTRODUCTION

Earthquake is a tragedy if we do the study of history document of past damages, tectonic feature such as fracture fault evidences of previous earthquakes. In past reveals many earthquakes about which researchers have studied and earthquake is still coming in study of which researchers are engaged today. We always want earthquake damage should be the minimum and our life should be safety. Earthquake happens because of tectonic movement. A tectonic movement is very helpful for a civil engineer for designing any structure and maintaining its economy. In the earthquake, zoning map of India seismic zones are mentioned (Zone 2, Zone 3, zone 4, zone 5) Population have been increasing day by day and land is decreasing. So, people are constructing high rise building to live in. Whenever earthquake occurs, the structure of foundation gives response. This response does not depends only on dynamic characteristic, it depend on external environment and type of soil also. When earthquake force occurred on high rise building, it can resolve in three direction i.e,x,y,z Now a day's high rise building of demand increasing through a human because populations continue increasing. Engineer responsibility also increase, if the height of building continues increasing.

In high rise building chances of failure maximum occur due to earthquake load and wind load. In high rise building all requirements fulfill is additionally challenging. Increasing the height of building, chances increase of maximum value of drift and displacement also. Everywhere structure of design depend upon many factor like type of soil, seismic zone, reinforcement, etc. but other factor also include like shape of a column and beam, size of a column and beam. High rise building designing by many systems also shear frame structure, braced frame structure, tubular structure, etc.

Retrofitting with X type bracing is only one among significant to control the drift, and displacement of building. For retrofitting using steel type bracing because it gives flexibility, better quality control, lesser weight then RC structure. Steel bracing also takes few places. Retrofitting with steel bracing is employed for locating the minimum value of drift and displacement and increasing the lateral resisting capacity of structure in this method in the older structure adds the new technology. Due to this method structure will become the earthquake resistant. With the help of the retrofitting increase the life of the structure. Due to this method material can be reused. During the construction if some components of the structure are not

fitting, then with the help of the retrofitting make the fit of the component. If we retrofit of one the component of the structure then show the effect on the overall performance of the structure.

During the retrofitting of the structure material should be the light weight. The different types of the retrofitting method are developing, but before the retrofitting of the structure which the method of the retrofitting is good for the particular member and also should be economical. During Retrofitting with bracing steel bracing is good because the steel material is light weight comparing to RC material. Steel material also gives flexural strength and tensioning also.

LITERATURE REVIEW

Bruneau (2001) in this chapter proposed that the comparison study in Newyork city of 20 story hospital building retrofitting by using low yield steel for low seismic zone and retrofitting by using infill steel for high seismic zone. He did the non linear in elastic analysis and they got that retrofitting by low yield steel give minimum value of drift and enhancing the lateral resisting capacity of structure .

Mahmoud and Maheri (2003) analyzed the comparison study for finding the behavior factor of x braced frame and unbraced moment resisting frame by pushover analysis, after analyzing they find that x braced frame give more ductility as compare to unbraced frame.

Amlan and Sengupta(2004) performed the seismic analysis of structure for seismic zone three for retrofitting existing multistory building, for analyzing the structure they consider that plinth beam are absence at ground level, in this case they got drift value maximum, not weak column.

Marletta (2005) proposed that the comparison study of retrofitted structure by using two method

(1) modern method (2) Traditional method, after retrofitting the structure they did the pushover analysis of seismic analysis.

Marletta(2005)discussed the comparison study between retrofitted structure using traditional method and retrofitted structure using innovative methods. After seismic analysis of structure they described that all retrofitting method enhancing the strength of structure.

Mahini (2010) performed the comparison study of the RC frame between retrofitted by using the x type bracing and retrofitted by FRP sheet. They did the seismic analysis, and they get that x type bracing retrofitted the structure gave the more lateral resisting capacity compared to retrofit by FRP Sheet.

Zaid and Sadoon (2011) explained the study about retrofitting methodology of non-ductile reinforced concrete moment resisting frame structure that's cost effective. After analyzing they got that 37% reduction value of roof displacement. Drift value was minimum and stiffness was increased.

Kadid (2011) proposed that the reinforced concrete frame with bracing and without braced. They did the pushover analysis for finding the behavior of braced structure. After analyzing the structure, they got that dynamic characteristic also important for structure but enhancing the strength by braced structure.

Hendramawat and Safarizkia (2013) analyzed the comparison study between non linear static pushover analysis, and dynamic time history analysis. He got that enhancing the strength of structure not clearly shows of retrofitted structure with bracing.

Faella (2014) performed the seismic analysis of retrofitted structure with steel bracing. They get that enhancing the safety of reinforced concrete structure.

Betar (2015) in this paper proposed that the earthquake resistant structure by using Egyptians code, after designed they got that lateral strength were adequate up to three story and chances of failure of structure were maximum after three story. Means acceleration, displacement, drift value was minimum above three story.

Mohammed (2016) discussed that different type bracing for retrofitting of structure, after retrofitting of structure they are analyzing the structure, and they got that 66.66% reduction in drift value when using x type bracing compared to unbraced structure. X type bracing give maximum value of axial force whereas other type bracing give minimum value of axial force.

Naga and Kumar (2016) comparison study between retrofitted structure with bracing and withoutretrofitted structure. After

the seismic analysis they got that drift and displacement value minimum and if they increased height of structure shear also decreased.

Kalam (2017) proposed that the earthquake structure give the more value of the deflection so required to be retrofitted structure, so retrofitting by using seismic damper these damper seismic energy absorbs during earthquake so drift and displacement value reduced.

Sharma (2017) for analyzing they used to that building with bracing, the shear wall and the digrid. After analyzing they got that shear variation linear for non braced structure whereas good result of shear in braced structure. Retrofitting with the bracing structure also gives lateral resisting capacity of structure.

Swetha and Sunil (2017) explained different type bracing for retrofitting the structure. If they used x type bracing for retrofitting of structure they got after analyzing that 45% reduction value of displacement. Aspect ratio increase, then displacement value decreased.

Dhanush (2017) explained the etabs and ansys software for analyzing the retrofitted structure using concrete jacketing. After analyzing they got that that if size of column increased, deflection also decreased. They also got that if thickness of jacketing increased, deflection decreased.

Varsha (2018) comparison study of the seismic analysis result for the earthquake zone 2 and the soil type 2 also. They got that the column and the beam are weakening, if increasing the load on the column and the beam. So, the retrofitting of the structure required, they did the seismic analysis of the retrofitting structure, and they got that lateral force are parallel to the slab so strength of the column and the beam enhanced.

Sharma (2018) comparison study between the retrofitting by the braced and unbraced structure. They got after analyzing that without the braced structure drift, and the displacement value more whereas, the retrofitting by bracing give the minimum value of the drift and the displacement.

Shmerling (2019) comparison of the seismic analysis result between retrofitted with the center mass and without retrofitted the structure. They got the result after the comparison for both cases that minimum inters the story drift and the minimum acceleration value for retrofitted the structure.

Somil and Khattar (2019) comparison study between concentric braced frame and eccentric braced frame for retrofitting using bracing. After analyzing they got that minimum value of deflection in eccentric braced frame. They got also that increasing the eccentricity, then deflection value also increase.

Mohod (2019) explained the seismic analysis of retrofitted the structure using the different technique of the retrofitting for checking the performance of the structure. After analyzing they got that minimum drift value, enhancing the stiffness, and the shear carrying the capacity of the structure in retrofitted the structure.

Daspute (2020) explained the comparison study between the retrofitting using the shear wall and the retrofitting using bracing. After analyzing they got that both method of the retrofitting is beneficial because the lateral displacement and the drift value was minimum in the shear wall and bracing system are helpful transferring load through axial action.

Fauzan (2021) explained the seismic analysis of the retrofitting by using the concrete jacketing and the shear wall the dental hospital building of Andalas University. They did the comparison study between two methods and they got that drift and displacement value minimum of retrofitting structure using shear wall method. As compare concrete jacketing method, shear wall method of retrofitting economical.

CONCLUSION

This review of literature concluded that we will be use x type bracing to retrofit the structure. To retrofit the structure checks the bracing by placing it on the different- different span. Apply x bracing, which span get the minimum value of drift and displacement. If we apply the x bracing to the continuous spans in horizontal and vertical direction, it will give minimum value of drift and displacement .so we will use on continuous span of x bracing for retrofitting of high rise building.

REFERENCES

- (1) M. Bruneau, T. (2001) Seismic retrofitting of flexible steel frames using thin infill panels, Elsevier, 01-11.
- (2) Mahmoud R. Maheri, R. A. (2003) Seismic behaviour factor R for steel x braced and Kneebraced, Elsevier, 01-10.
- (3) Amlan K. Sengupta, C. S. (2004) Seismic analysis and retrofit of existing multistory, 13th world conference, 01-15.
- (4) Marletta, G.O. (2005) Seismic retrofitting of reinforced concrete building, ISET, 01-27.
- (5) Marlette, G.O. (2005) Seismic retrofitting of reinforced concrete building using traditional and innovative technique, ISET, 01-26.
- (6) S.S. Mahini (2010) Seismic performance of ordinary RC frames retrofitted at joints by FRP sheets, Elsevier, 26-36.
- (7) A Kadid, D (2011) Seismic assessment of braced RC frames, Elsevier, 01-07.
- (8) Zaid Al sadoon, M.S. (2011) Seismic retrofitting of non ductile reinforced concrete moment resisting frame structures, 2nd international engineering mechanics and materials specialty conference, 01-11.
- (9) Hendramawat Safarizkia, S.K. (2013) Evaluation of the use of steel bracing to improve seismic performance of reinforced concrete building, Elsevier, 01-10.
- (10) Faella, L.M. (2014) Steel bracing configurations for seismic retrofitting of a reinforced concrete frame, ICE, 01-13.
- (11) El Betar, S.A. (2015) Seismic performance of existing RC framed buildings, Elsevier, 01-10.
- (12) B. Naga Niranjan kumar, D. k. (2016) Seismic analysis of high rise building using inverted bracing with ETABS software, IJRD, 01-14.
- (13) Mohammed Hyderuddin, M.M. (2016) Retrofitting of reinforced concrete frames using steel bracing, IJSRD, 01-05.
- (14) Abdul Kalam, M. B. (2017) Method of seismic retrofitting by using ETABS software, IJCIET, 01-06.
- (15) Dhanush S. S., U. F. (2017) Retrofitting of existing rc columns by reinforced concrete jacketing using ANSYS and ETABS, IJSR, 01-07.
- (16) S. P. Sharma, J.P. (2017) Literature review on the seismic performance of multi storey building with different locations of shear wall and diagrid, IJSR, 01-08.
- (17) Swetha sunil, S.P. (2017) Seismic study of multistory RC building with different bracings, IJIRSET, 01-07.
- (18) B M Varsha, D.M. (2018) Analysis, design and seismic retrofitting of an existing building, IJIRSET, 01-06.
- (19) Rishabh Sharma, D. S. (2018) Seismic analysis and retrofitting of a multistory RC building, IRJET, 01-05.
- (20) Shmerling, A. (2019) Seismic retrofitting of two way UN symmetric plan buildings with added masses, Elsevier, 01-20.
- (21) Mohod, M.V. (2019) Performance of different retrofitting technique on existing RCC structures, IJRTE, 01-05.
- (22) Somil khattar, K.M. (2019) Seismic performance of reinforced concrete frame with steel bracing system, IJRTE, 01-06.
- (23) Daspute, B.D. (2020) Review on seismic retrofitting of RC structure with exterior shear walls and bracing, JETIR, 01-12.
- (24) K N Jeevan Kumar, S.P. (2020) Behavior of multi storey RCC structure with different types of bracing against earthquake forces, IJRET, 01-11.
- (25) Fauzan, I.J. (2021) Seismic retrofitting analysis using concrete jacketing and shear wall on dental hospital building of Andalas University, IOP publishing, 01-12.