Seismic Response of GIB Brace and Other Brace System in Soft Storey Building– A Review

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Abstract- *over the past few decades, we can see that soft-storey mechanisms are generally undesirable for the seismic response of building structures. In this type building non-structural element and structural element are damaged. Recently a new bracing system called gapped inclined bracing is used to reduce the soft storey effect. Gapped incline bracing is providing at ground storey. This gapped inclined bracing resist the lateral force acting on soft storey building. And reduce the damage of the structure. Provide good performance in soft storey building. There for Gapped incline bracing compair with x-brace, v-brace and infill wall. And check the seismic parameter such as displacement, storey drift, base shear, p-Δ effect.*

Compare Gapped incline bracing with x-brace, v-brace, and invert v-brace at different length, angle and location. Make model of RCC building with G+5, G+10, G+15 and G+ 20 for different brace system. And analysis is done with response spectrum method in Etab software.

Keywords- Soft Storey, Retrofit, RC Building, Gapped-Inclined Brace, Response Spectrum Analysis, Displacement, Storey Drift, Base Shear.

I. INTRODUCTION

Most of all building is damage due to earthquake. Structures are subjected to two type of load which is acting on structure. One is static and other is dynamic. Static load are not varying with time but dynamic load are varying with time. All structure are designed as a static load. Dynamic load are not consider because they are rarely occurred in structure. Dynamic load are occurred when wind load, earthquake load acting on structure. Buildings are poor performance due to this load. And damaged due to this.

When designing building we provide lateral force resisting system. We protect the building and reduce the damage of the structure. Most of the buildings are damaged due to soft storey at ground floor. .

In last past few years many research has been done on soft storey building and they try to reduce soft storey effect.

II. LITERATURE SURVEY

Gian Michele Calvi, Timothy Sullivan (ASCE-2014) [1]:

This paper gives mechanisms of GIB and Introduction. They check drift ratio for existing and retrofit column and compair with different height and gap distance. GIB system provide at soft story in single storey building. They derive the equation for area of GIB, axial force on brace, gap distance etc. Check the parameters like displacement, storey drift, and base shear using the gapped inclined brace in soft-storey building. When Gap distance between 2.7 to 4.6mm. And confinement factor from 1.15 to 2.0.

Result from this non-linear analysis of soft-storey building indicate that decrease displacement and storey drift, increase deformation capacity and reduce p-delta effect of soft storey building by using the gapped inclined brace at soft storey.

Hossein Agha Beigi, Michele Calvi. (Earthquake Engineering Structural Dynamics-2014) [2]:

This paper compares three systems in soft storey building. Which are without bracing, infill wall and gapped inclined bracing in retrofit soft storey building. And make the G+6 model for soft storey building for each system. And check the model for displacement, storey drift and Pick ground acceleration for different intensity level. And from this analysis gapped inclined brace give better result than other two systems. By using this brace reduce the displacement, storey drift and increase the deformation capacity. And also floor acceleration for GIB less than 70% that of the infill wall.

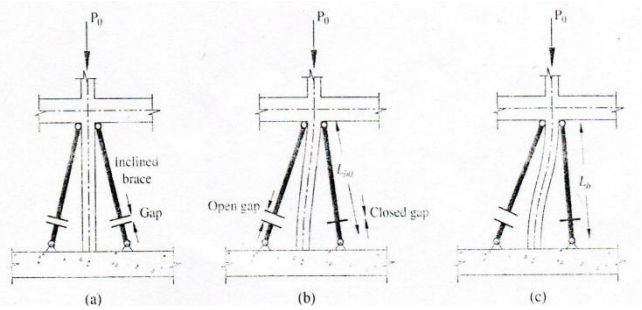

Fig.1 Mechanisms of Gap Inclined Brace

Prof. Sarita Singla, Rahul Kalra. (ACEE-2012) [3]:

In this research paper using multi-storey G+17 building with different brace system like x brace, v brace, k brace for the multi storey building. This brace provide at different location such as middle bays, exterior frame and corner. From the analysis of different model x bracing give better performance than other bracing system and reduce the lateral displacement and storey drift for building. And k bracings are the least preferred bracing system.

In result maximum displacement at X-brace is 82.36mm as compare to 156mm in other brace system. And in X- brace 75.63% reduction in drift compare with V and K brace are 15.04% & 11.53%.

Dr.M.Ashok Kumar. (Journal of Mechanical and Civil Engineering-2016) [4]:

In this research paper Comparision between with inverted v brace and without brace for different zone. using G+23 soft storey building. And analysis the result with parameter like displacement, storeys drifts in different zone 3 and zone 5. Also compare with different type of soil (as per IS 1893(Part-1):2002). Use Etab software for time history analysis. From the result of Etab software indicate that displacement vs zone graph for Inverted V brace system and without brace system. In both system Inverted V brace system give better result than without brace in soft-storey building. And as per result maximum displacement is 27.9mm in zone 3 and 37.6mm in zone 5.

Akadid, D.Yahiaoui (ScienceDirect-2011) [5]:

In this research paper using G+3 &G+6 soft storey building. With different brace like X-brace, V- inverted, zipper brace, ZX- brace. And compair with different parameters such as displacement, lateral drift for G+3 and G+6 building. Also when different section is provide. Using staad pro 2007 with pushover analysis method.

From the pushover analysis of different model ZX bracing and Zipper brace give better performance than other bracing system and reduce the lateral displacement and storey drift for building. Decrease in displacement compare with other system when section is large.

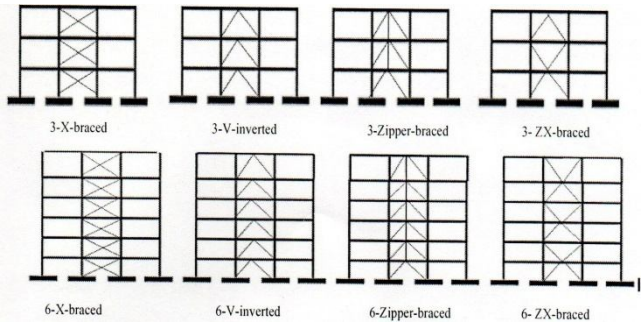

Fig.2 Bracing Models

Adithya, Swathi rani, Shruthi H.K. (SSRG Journal of Civil Engineering-2015) [6]:

In this research paper comparison with x brace, v brace, single diagonal brace, inverted v brace and without brace for multi storey building. In this study G+19 building having same floor plan with 4 bays of 4m each along longitudinal direction and along transverse direction. Use etabs software for time history analyses. x brace reduce shear force compair to single diagonal brace system .And also % reduction in displacement is 28.82 in X-brace & 68.43 in single diagonal brace system.

C.V.Alkunte, M.V.Dhimate, M.B.Mahajan. (Imperial Journal of Interdisciplinary Research-2016) [7]:

In this research paper using G+25 soft storey building. With brace, shear wall, infill wall. And compair with different parameters such as displacement, base shear for building. Using Etab with pushover analysis method. From the pushover analysis brace give better performance than other system in base shear. And from the result infill wall is less used in high rise building. In shear wall Time period and displacement reduce compare with brace system. Also base shear in brace is 4038.413KN & in shear wall 4312.5 KN.

Salman Mashhadifarahani (ASRJETS-2015) [8]:

In this research paper Comparision between moment resistant frame and braced frame in structure analysis. Selection of an appropriate structural system in steel structures is one of the factors affecting the weight of consumed steel and consequently, the economics of the project. In this paper, building with similar plans in 4,8,12 and 16 stories were modeled with different structural system and factors such as the effect of regulation control for steel structure weight and maximum roof displacement, structure frame weight and values of base shear are explored.

In present research, we assess moment resistant frame vs. Braced frame steel consumption and compare two

structural systems with 4,8,12 and 16 stories. Moreover, effect of combination of concentrated load as well as control of roof drift on structural weight is evaluated. Result reveals that using braced frames in buildings with up to 8 stories is more economic compared to moment frames.

Keith D. Palmer, Charles W. Roeder, Jacob Powell, Carol K. Shield (IJSS-2012) [9]:

In this paper concentrically braced frames are stiff, strong system frequently used to resist wind and seismic loading: in regions of high seismicity in the US special concentrically braced frames are used. CBF configurations vary, but in low rise or other structures with modest levels of demands single-storey, X-configured braced frames are commonly used. HSS frame most use in US. The result shows that the ultimate inelastic deformation capacity of the system is less dependent on the specific design detail at this splice. Additionally, the bi-directional load testing indicated that the out-of-plane demands did not impact the system performance.

Madhusudan G. Kalibhat, Kiran Kamath, Prasad S.K, Ramya R. Pai (JMCE-2013) [10]:

The present study focuses on the effect of a provision of concentric bracings on the seismic performance of the steel frame. In the present study two different types of concentric bracing like x-brace and invert v-brace used. Take 3,5,7 and 10 storey building and calculate displacement, drift for storey building. From the analysis invert v-brace give good result compare to x-brace system.

III. CONCLUSIONS

From this review we conclude that due to seismic force structure are damage so reduce this lateral force in structure we use different types of bracing in building. This type of bracing provide in single-multi storey building to reduce displacement, storey drift and base shear value in building.

Recently a new brace called GIB used same as X-brace, V-brace and invert V-brace. This bracing used in soft storey building. Also used this brace in retrofit building to provide strength in structure. X-brace give good result in single-multi storey building from above research paper. Further we compare GIB brace system and other brace system like X-brace, V-brace and invert V-brace system. And check % reduce in displacement, storey drift at soft storey.

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