SEISMIC ANALYSIS OF A HIGH-RISE BUILDING FRAME WITH AND WITHOUT SHEAR LINKS OF DIFFERENT MATERIALS

Mayuri Madrosiya[1], Mayur Singi[2], Monika Koshal[3]

[1] PG Scholar, CED, SKSITS Indore, M.P., India [2,3] Assistant Professor, CED, SKSITS Indore, M.P., India

***Abstract-** Tall building development involves various complex factors such as economics, aesthetics look, technology, municipal regulations, and politics. Among these, economics has been the primary governing factor. For a very tall building, its structural design is generally governed by its lateral stiffness. Comparing with conventional orthogonal structures for tall buildings such as framed tubes, vertical shear link enhanced structures carry lateral seismic loads much more efficiently by their diagonal member's axial action. A shear link structure provides great structural efficiency to minimize stress concentration of a structure with bracings. A shear link structure is a type of structural system consisting of bracings connected through horizontal rings which create an elegant and redundant structure that is especially efficient for high-rise buildings. A vertical shear link structure is different from braced frame systems, since shear panel is vertically installed at joints of bracing as main structural elements participate in carrying gravity load in addition to carrying lateral load due to their configuration.*

Vertical shear-links in characteristic bracing systems, not similar to one located in the structure and can be easily changed or modify therefore, after the seismic effects, considering that other frame elements will remain elastic, only the vertical shear-links should be change, and then frame structure can function normally. a X type bracing system will be designed and fit with high accuracy and a small change in its characteristics reduce the ductility without increasing the stiffness, but unlike knee brace, vertical shear-link can be easily designed and implemented.

***Keywords*: Deck Slab, IRC Class AA loading, Stresses on Slab, Stresses on Girders and piers. Staad pro., etc.**

I. INTRODUCTION

It has been seen in past seismic tremors that the structures on slants serve more fiendishness and fold. Shudders cause valid harm to structures, for case, disappointment of individuals in the building and if the power of tremor is high it prompts breakdown of the structure. In past years populace has been developed undeniably and because of which urban zones and towns began spreading out. Considering this reason different structures are being inborn slanting zones. An enormous part of the harsh reaches in India goes under the seismic zone II, III and IV zones in such case working in perspective of inclining grounds are exceedingly slight against seismic tremor. This is an eventual outcome of the way that the bits in the ground floor contrast in their statures as appeared by the inclination of the ground. Sections toward one side are short and on flip side are long, by virtue of which they are exceedingly fragile. Seismic powers act more separate in sloping areas because of the auxiliary anomaly. Likewise, it has been contemplated that the earthquake activities are inclined in sloping ranges. In India, for instance, the north-east states. The shortage of plain ground in sloping ranges forces development movement on slanting ground bringing about different vital structures, for example, strengthened cement surrounded doctor's facilities, universities, inns and workplaces laying on uneven slants. The conduct of structures amid earthquake relies on the dissemination of mass and firmness in both even and vertical planes of the structures. In sloping locale both these properties differ with inconsistency and asymmetry. Such developments in seismically inclined territories make them presented to more prominent shears and torsion.

II. OBJECTIVE OF THE WORK

- Determination of the effect of bracing with shear link on the performance of mid rising moment resisting frame structure.
- Determination of effect of shear link bracing of steel and aluminum material on lateral forces.
- Comparison of bare frame with braced structure and bracings with shear links on the frame.

III METHODOLOGY

The building configuration selected is a representative of building that is common in Indian seismic Zones IV as per IS:1893-2002 (Part-1) located in medium soil region in seismic zone iv. The building is found to be deficient of the lateral seismic load corresponding to that of particular earthquake zone. Hence, it needs to be strengthened by providing aluminum and steel bracing with or without shear links; assumed value for this problem is shown in below table.

Table No 1. Description of Bridge

S no.	Description of assumed parameters	value
1	Seismic zone	IV
2	Soil type Medium	medium
3	Importance factor	1
4	Response reduction factor	3

5	Number of storey	12
6	Grade of concrete	M-20
7	Grade of steel	Fe-415
8	Slab thickness	150mm
9	Exterior wall thickness	230mm
10	Interior wall thickness 120 mm	120mm
11	Bay width in X direction	3 m
12	Bay width in Z direction	5 m
13	Size of beam	230 x 400 mm
14	Size of column	400 x 400 mm
15	Storey height	3.5

Here building frame is modeled in analysis tool staad pro in which steel and aluminum bracings with or without bracings are introduced, and seismic lateral forces are applied as perI.S. 1893 part-1 2002, dead load as per 875 part-1 and superimposed live load as per 875 part-2 is calculated and applied. Selected five cases for comparison first one is bare frame, Second is frame with bracing of steel at the corners, Third one is frame with bracings of steel and shear links, Fourth one is bracings of aluminum at the corners,Fifth one is bracings of aluminum and shear links**.**

STAAD.Pro is a multipurpose program for analyzing the different forms of structures. The following three activities must be performed to achieve that goal -

- Modeling of the frame using STAAD.Pro.
- The calculations to decide the explanatory results.
- Result check is all empowered by devices contained in the framework's graphical environment.

A performance-based approach is used for the seismic retrofitting design of the building, The performance of the building on various loading condition are find out to give precise result of this investigation.

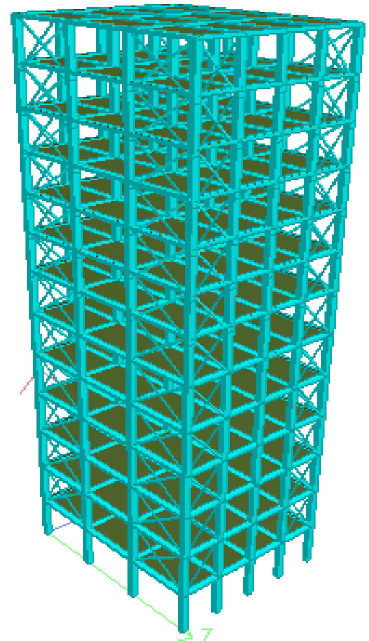

Figure 1: 3D Model with Bracing

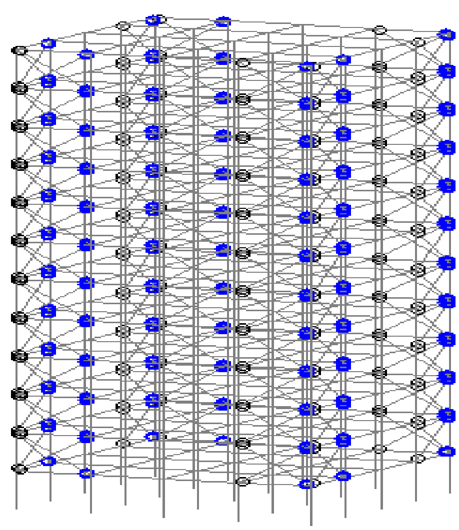

Figure 2: Steel Bracing with Shear link

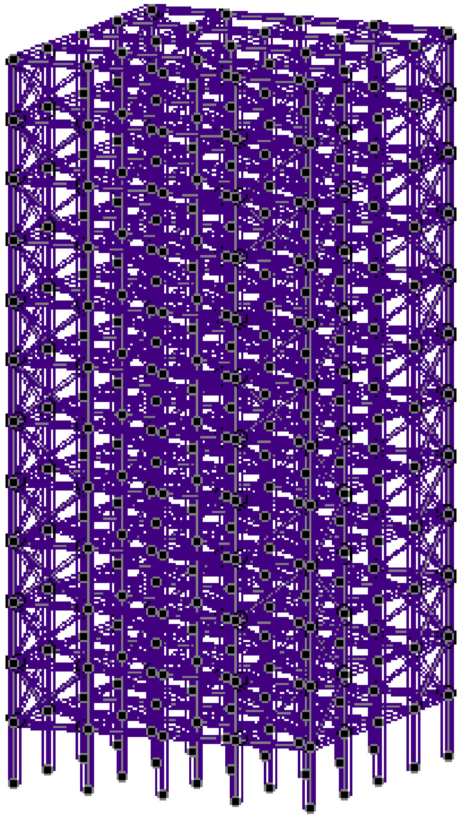

Figure.3 Aluminum Bracing with Shear link

III. RESULTSAND DISCUSSION

Figure .4. Bending Moment (Kn-m) in Z direction.

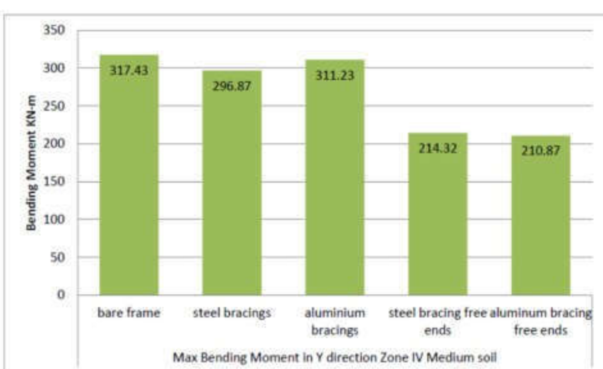

Figure 5. bending moment (kN-m) in Y direction.

Figure 5.6 Axial Force (kN)

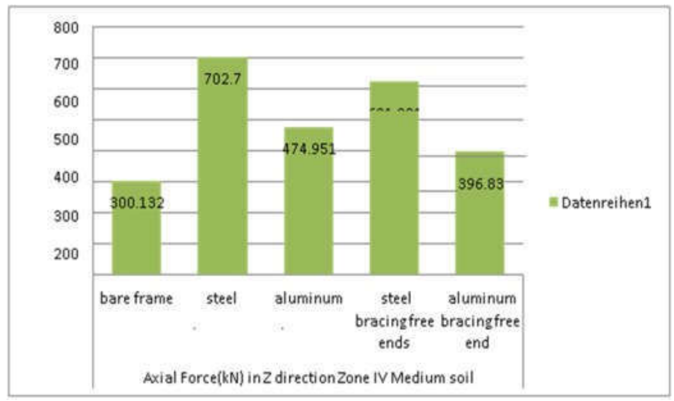

Figure 7. Axial Force (kN)

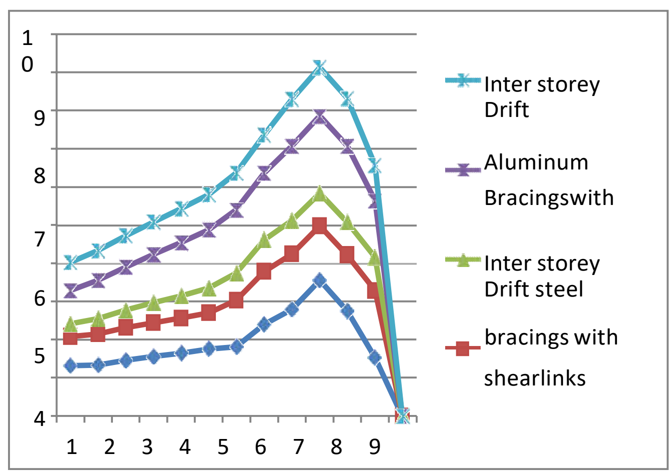

Figure 8 Storey drift

IV. CONCLUSIONS

1. From the study we can conclude that when the following structure models were considered and their seismic analysis was done, i. e frame structure with steel bracings & steel bracings with shear links. aluminum bracings & aluminum bracings with shear link, the

structure aluminum bracings are found efficient in comparison to others in reducing Maximum B.M, Shear Force, Axial Force.

2. Vertical shear links have fat and stable hysteresis loops. These components act as a minor structural member and like a ductile fuse. they dissipate the seismic energy, increase the structures ductility and prevent the damage to the main structural elements such as beams, columns and bracing by preventing other members to reach yield point. further when aluminum and steel shear links was used B.M. were reduced used the performance of structure with aluminum bracings and aluminum shear links is best.
3. The seismic forces are best resisted by Aluminum bracings with shear links in case of Bending Moment, Shear forces, Axial force and storey Displacement but in steel and aluminum bracing with free ends case results shows that steel structure is providing least value of drift, but aluminum structure value is relatively same as steel bracing with free end case values. Aluminum bracing with free ends show less displacement in x directional as compared to steel displacement.

REFERENCES

[1] E. Fehling, W. Pauli and J. G. Bauwkamp, “Use of vertical shear-Link in eccentrically braced frames” Earthquake Engineering , 10th World Conference 1992 Balkema , Rotterdam.

[2] Y. Mahrozadeh, “The application of shear panels in passive control conventional steel structures” Master's thesis, Faculty of Engineering, Tehran University, 2005, Tehran, Iran.

[3] S. M. Zahrai, “Behavior of Vertical Link Beam in Steel Structures. Building & Housing Research Center, BHRC Publication No.R-515, 2009.

[4] P. Dusicka, A. M. Itani and I. G. Buckle, “Evaluation of Conventional and Specialty Steels in Shear Link Hysteretic Energy Dissipaters.” Proceedings of the 13th World Conference on Earthquake Engineering, Vancouver B.C, Canada, 2004.

[5] P. Dusicka, A. M. Itani, “Behavior of Built-Up Shear Links Under Large Cyclic Deformations.” Proceedings of the 2002 Annual Meeting of the Structural Stability Research Council, Structural Stability Research Council, Gainesville, FL.

[6] M. D. Engelhardt, E. P. Popov, “Experimental performance of long links in eccentrically braced frames.” J. Struct. Engrg., ASCE,1992, Vol. 118, No.11, PP. 3067-3088.

[7] American Institute of Steel Construction, AISC 2002, “Load and resistance factor design.” Manual of Steel Construction.

[8] International building code, IBC2003, Whitier, California.

[9] J. G. Boukamp, M. G. Vetr, “Design of Eccentrically Braced Test Frame With Vertical Shear Link Proceedings of the 2nd Int”, Con, On Earthquake Resistant Construction and Design, Berlin, June, 1994.

[10] M. G. Vetr, "Seismic behavior and design and analysis of crosswise braced frames with vertical shear joint" Journal of Earthquake Engineering and Seismology, Tehran, 1999.

[11] J. G. Boukamp, M.G. Vetr, “Design of Eccentrically Braced Test Frame with Vertical Shear Link.” Proceeding of the Second Int., Con. On Earthquake Resistant Construction and Design, Berlin, 1994.

[12] American Institute of Steel Construction, AISC 2002, “Load and resistance factor design.” Manual of Steel Construction.