Optimized Arrangement of Knee Bracing In Steel Frame

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Abstract- *Braced frames provide resistance to lateral forces acting on a structure. The members of a braced frame act as a truss system and are subjected primarily to axial stress Depending on the diagonal force, length, required stiffness, and clearances, the diagonal members can be made of double angles, channels, tees, tubes, or even wide flange shapes. Besides performance, the shape of the diagonal is often based on connection considerations. The braces are often placed around service cores and elevators, where frame diagonals may be enclosed within permanent walls. Knee braced frames (KBFs) are the modified form of the structural system in which which consists of a conventional diagonal braces, with one end connected to a knee anchor instead of beam-column joint. Under a severe earthquake, the knee anchor yields in flexure to dissipate energy and thus acts as "fuse-like" element to prevent any structural damage to principal members. Thevarious analyses are performed by using structural analysis software i.e. STAAD Pro. For different angle of knee bracing. The analysis results are compared to obtain optimum and accurate design. To compare the performance of all knee braced frame with XKBF (without knee) and moment resting (MR) frame. Parameters- Capacity curves, performance point, displacement, ductility factor been targeted to study in detail.*

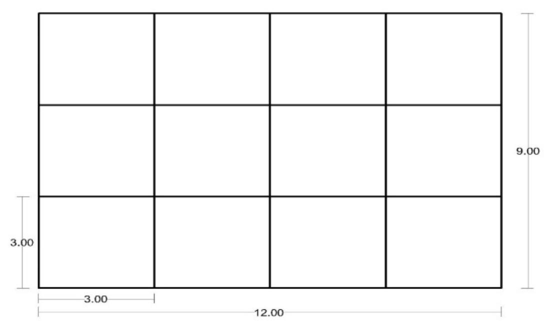
Keywords- knee Bracing,optimization, braced frame,Staad Pro.

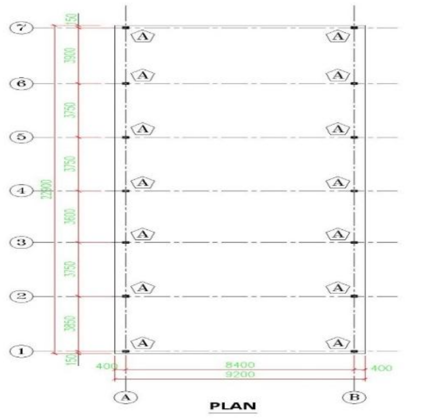
I. INTRODUCTION

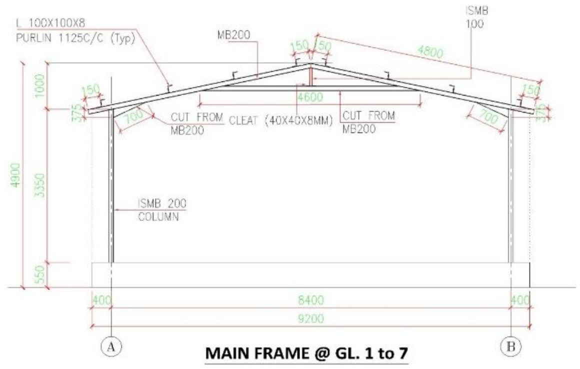
There are many different systems structural engineers use to control the displacement in a building, some of which are moment frames andbraced frames. Through experience, designers gain an insight into how each of these systems behaves and which is the best to use under different conditions. The fundamental challenge for the structural engineer in designing earthquake-resistant structures is to design buildings with both adequate ductility and sufficient stiffness. Traditional lateral force resisting systems such as the moment resisting frame and the concentrically braced frame are both conventional structural schemes that have been implemented for many years, but result in only moderate performance levels. The lacking stiffness of a moment resisting frame as well as the limited ductility of a concentrically braced frame gave impetus for engineers to direct significant research efforts into the development of new lateral resisting systems that embody a more stable hysteretic behavior, adequate ductility, control of damage, and energy dissipating capacity.

II. MODELLING

Different design calculation were observed and plan were decide to study for multistory building in staad pro with all load combination.. Load calculation were check in Stadd Pro. Plan for calculation is as shown in figure.







Parameters of design:-

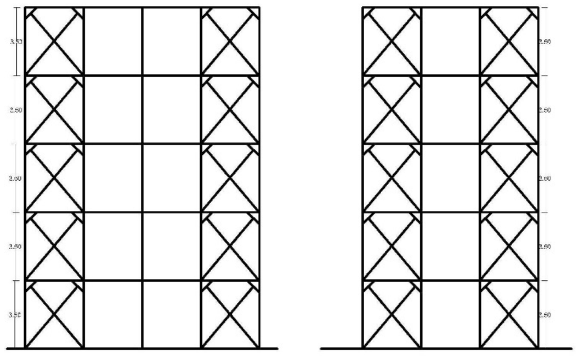
Sr no	Parameters for truss design	
1	Building	12 * 9
2	Bay size	3*3
3	Knee element	45 degree
4	Typical storey height	3.5 m
5	Frame Material	Structural steel
6	Grade of steel	250 N/mm2
7	Damping	2%
8	Topography factor (k3)	1
9	Vz	Vb*K1*K2*K3
10	Pd	0.6(Vz*Vz)

III. ANALYSIS

Total 95 models are made in stadd pro. For span and pitch variation. Different load combination considered are as follow.

1.5 DL + 1.5 LL
1.5 DL + 1.5 WL
1.2 DL + 1.2 LL +1.2 WL
0.9 DL +1.5WL.

For long span structure not all geometry will give great results. With all maximum parameters we can find out suitable geometry for design purpose. After selection of that design of truss member will take place with angle,tube,and channel material. I have consider all three material in which truss gave better results.



XY planeZY plane

IV. RESULTS AND DISCUSSION

In linear static analysis for seismic load displacement Knee braced systems with 30 knee angle shows least displacement.

Capacity curves of single diagonal knee braced frame (X-knee braced frame, and chevron knee braced frame of MR frame respectively. Base shear capacity is found to be increase with increase in number of storey.

V. CONCLUSION

Followings are the major conclusion of the study:-

1. In linear static analysis for seismic load displacement Knee braced systems with 30 knee angle shows least displacement (frame- 3m x 3.5m).
2. Capacity curves of all knee braced frames having 45◦ (frame-3m x 3.5m) knee element angle shows higher base shear capacity and higher performance point than of 30◦ and 60◦ knee element angle for all storeyknee braced Frames.
3. Amount of material consumed in XKBF is higher than that of other knee braced frame systems considered.

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