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Review on Comparison of Different Types of Bracing System Used in Tall Building

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ABSTRACT *When a tall building is subjected to lateral or torsional deflections under the action of fluctuating wind loads, the resulting oscillatory movement can induce a wide range of responses in the building's occupants from mild discomfort to acute nausea. As a result, lateral stiffness is a major consideration in the design of tall buildings. Bracing is a highly efficient and economical method of resisting lateral forces in a frame structure because the diagonals work in axial stress and therefore call for minimum member sizes in providing the stiffness and strength against horizontal shear. In this review study of different types of bracing systems have been investigated for the use in tall building in order to provide lateral stiffness and finally we conclude the best suited option from them.*

INTRODUCTION

TYPES OF BRACINGS

Bracing can be categorized into the following types:

Diagonal bracing

This type of bracing is preferred when the availability of the opening spaces in a bay of frame are required. Diagonal bracing is obstructive in nature as it blocks the location of opening which ultimately affects the esthetic of the building elevation. It also sometimes hinders the passage for use. Diagonal bracing can be single diagonal or double diagonal.

K-bracing

The full diagonal bracing is not used in areas where a passage is required. In such cases, k-bracings are preferred over diagonal bracing because there is a room to provide opening for doors and windows.

Eccentric bracing

Besides K-bracing, there is another type in which door and window openings can be allowed known as eccentric bracing. Such type of bracing arrangement cause the bending of the horizontal members of the web of braced bent. Generally these types of braced bents resist the lateral forces by bending action of beams and columns. These provide less lateral stiffness hence less efficient as compared to diagonal bracing.

1. ANALYSYS AND DESIGN OF VARIOUS BRACING SYSTEM IN HIGH RISE STEEL STRUCTURES.

In this study, the behavior of the bracing system is analyze by using different types ofbracing systems e.g. X bracing, V bracing, Inverted V bracings, Knee bracings. These bracings are analyzed and designed by using STAAD. Pro V8i software. For this analysis the G+9 storey building with different bracing system has been analyzed and designed as per Indian Standard Code 800-2007 by using UC and UB(British) sections for the wind, earthquake and gravity loads also their combinations. In this case study the conclusion is that the displacement of Inverted V bracing frame is less as compare to other bracing systems hence

1. It is Inverted V bracing better in the stiffness than other.

2. The weight of the Inverted V bracing is also less than others, hence it is economical.

3. By using the Inverted V bracing it possible to accommodate required openings such as for windows and doorswhich are very difficult in some other bracing system like X bracing, because X-bracings run across theentire wall area.

2. INFLUENCE OF DIAGONAL BRACES IN RCC MULTI-STORIED FRAMES UNDER WIND LOADS: A CASE STUDY

Tall structures are more flexible and susceptible to vibrations by wind induced forces. In the analysis and design of high-rise structures estimation of wind loads and the inter storey drifts are the two main criteria to be positively ascertained for the safe and comfortable living of the inhabitants. Estimation of wind loads is more precisewith gust factor method. Inter storey drift can be controlled through suitablestructural system. The present investigation deals with the calculation of wind loads using static and gust factor method for a sixteen storey high rise building and results are compared with respect to drift. Structure is analysed in STAAD Pro, with wind loads calculated by gust factor method as per IS 875-Part III with and without X- bracings at all the four corners from bottom to top.The conclusion is that In high rise buildings the stability can be achieved by suitably adding the dimensions of

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the corner columns with corner diagonal X-bracings. Provision of X- bracings reduces the amount of drift and bending moments in the structure.

3. RESPONSE OF A 3-DIMENSIONAL 2 X 3 BAYS TEN STOREY RC FRAME WITH STEEL BRACINGS AS LATERAL LOAD RESISTING SYSTEMS SUBJECTED TO SEISMIC LOAD

A natural hazard like Earthquake causes damage to or collapse of buildings if not designed for lateral loads resulting due to Earthquake. Hence for seismic resistance for high rise structures it is important to provide exclusive Lateral Load Resisting System (LLRS) which will supplement the behaviour of moment resisting frames in resisting the lateral load. Some of the LLRS commonly used are shear walls, infill frames and steel bracings. In the present study, an attempt is made to study the difference in structural behaviour of 3-dimensional (3D) two-bays - three-bays, 10 storey basic moment resisting RC frames when provided with steel bracings as LLRS. The detailed investigations are carried out for zone V of Seismic zone of India, considering primary loads and their combinations. Three models are analysed consisting of one basic moment resisting RC frame and other two include basic moment resisting RC frame with external and internal steel bracings. The results obtained from the linear dynamic analysis are thoroughly investigated for maximum values of joint displacements, support reactions, beam forces and forces in steel bracings. The results indicate better resistance to lateral load of the frames in the presence of steel bracings.

4. COMPARISON OF DIFFERENT BRACING SYSTEMS FOR TALL BUILDINGS

In this research study, five different types of bracing systems have been investigated for the use in tall building in order to provide lateral stiffness and finally the optimized design in terms of lesser structural weight and lesser lateral displacement has been exposed. For this purpose a sixty storey regular shaped building is selected and analysed for wind and gravity load combinations along both major and minor axes. The conclusion is that, K type bracing results in smaller lateral displacement compared to other types.

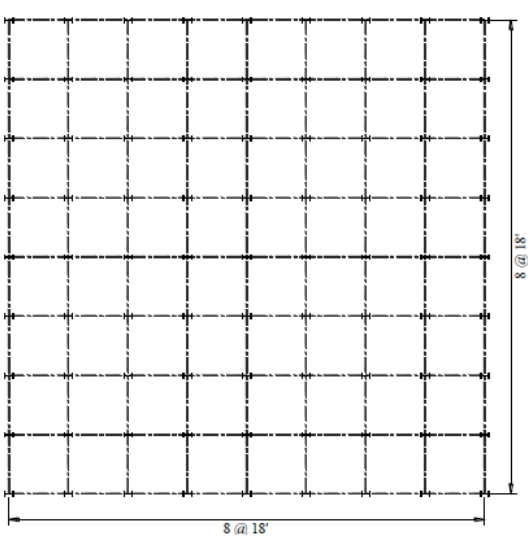

Fig 1:Plan of Building

Bracing Type	Weight (Kips)			
	Option 1	Option 2	Option 3	Option 4
Single Diagonal	31134	31749	32371	32195
Double diagonal	28848	28895	29177	28148
K/Chevron	30620	30697	31473	31384
V	30512	30173	30739	30607
Knee	31320	31794	32465	32780

Table 1: Weight comparison of different types of Bracing used in tall Building

Where,
Option 1: 1st & 8th bay braced
Option 2: 2nd and 7th bay braced
Option 3: 3rd and 6th bay braced
Option 4: 4th and 5th bay braced

CONCLUSION

After studying these research paper we conclude that V type of bracing system is best suited option because it reduces the weight of the structure as well as by using this type of bracing system the problem of opening can be eliminated which can't be eliminated in case of diagonal bracing like X type, Z type & K type of bracing system & displacement of structure is less in case of V type of bracing system.

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