COMPARATIVE ANALYSIS OF G+8 BUILDING WITH AND WITHOUT SHEAR WALL OPENINGS

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ABSTRACT Present days the seismic load and wind load are the major topics in the structural engineering. In order to solve the problems in population there is a need of developing the structural models in vertical sections then horizontal sections. The reinforced concrete shear wall is one of the most commonly used lateral load resisting in high rise building. The reinforced concrete shear wall building is high in plane stiffness and strength which can be used to simultaneously resist large horizontal load and support gravity load. Shear walls are one of the major concern for designing of earth quake resistant structure than remaining methods. Now a day's most of the civil engineers are considering the shear walls as the first option for the designing structures than other concepts depends upon the simple installation and more effective under seismic loading action rate.

In the present study a comparative analysis is made for building models for G+8 building with shear wall opening and without shear wall opening. The analysis results like deflection, storey shear, storey bending values are compared in seismic zone V condition by using Staad Pro v8i Software.

Key Words: shear wall, earth quake resistant structure, deflection, storey shear, storey bending, staad pro

1. INTRODUCTION

Multistory houses are being constructed quicker than any time in recent memory everywhere on the world, and they are more slim and influencing than any other time. Pivotal, collapsing, twist, and cross over shear all add to the deformity of tall structures. In the field of seismic architecture, a few new ideas and approaches have been presented as of late. RCC frameworks are intended to direct horizontal relocation when all is said in done. The most famous underlying design that gives horizontal solidness and adjustment against parallel burdens is shear walls. The conduct of shear walls in outline structures is like that of a section that is presented to a consolidated flexure and hub load. Therefore, these are otherwise called flexural agents. In seismically dynamic regions, shear walls should be all around planned and definite. Thus, the most dependable, secure, and ideal situation for a shear wall should be resolved. The impact of shear wall area on sidelong uprooting and story float in RC outlines is analyzed in this article. STAAD Pro V8i was utilized to investigate the shear wall utilizing surface segments.

Numerous medium-ascent private structures in India use shear walls to give seismic tremor protection from supported substantial structures. These shear walls can have openings for windows, entryways, and vent spaces for utilitarian reasons. The number, area, and size of openings all affect the conduct of a construction just as shear wall pressure. Framed buildings with shear walls are generally utilized as the primary reason for skyscraper lodging systems.

There will be a lot of spaces for lifts, flights of stairs, and different things on account of this primary system. Plane pressure components and shaft components are regularly used to show the shear wall

and casings, separately, in the investigation of this sort of development. Boring levels of opportunity ought to be utilized in an arrangement strain factor to represent the collaboration between the shear wall focus and edges.

The bending moment at the end of a beam cannot be moved to the shear wall if this is not done. The openings can be very wide, as in the case of event halls, convention centres, and movie theatres. The number, position, height, and shape of openings have an impact on the structure's behavior in terms of deflection and stress in the members. These gaps have a significant impact on the analysis' quality and precision.

Reinforced Concrete (RC) Shear Wall

Reinforced concrete (RC) shear walls are uncommonly planned primary walls utilized in buildings to oppose even powers like breeze, tremors, and different powers in the wall's plane. Shear walls have a high in-plane solidness and versatility, permitting them to support gravity loads while suffering significant flat loads.

The thickness of supported substantial walls changes from 140 mm to 500 mm, contingent upon parallel powers like breeze and quakes, just as the structure's age and warm protection necessities. Figure 1 shows the overall arrangement of a shear wall.

Notwithstanding, such walls are destroyed at the road front or cellar level to take into consideration business or parking spots. The wall structure is typically even regarding in any event one arrangement pivot of balance in many examples.

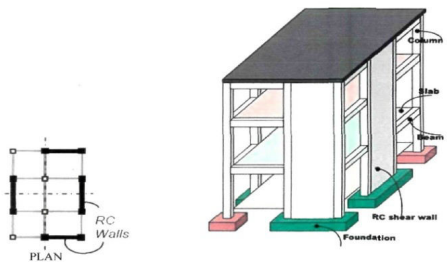

Figure 1 General Configuration of a Shear Wall

By moving the wind or earthquake load to the base, shear walls have lateral load resistance. They also provide lateral stiffness to the structure and support gravity loads. Shear walls can form an effective lateral force resistance mechanism when they are placed in advantageous locations inside the house.

Shear Wall with Openings

Shear wall are perforated with openings. The size and location of opening depends on the function of the building. Windows, corridors and door openings are sufficient for residential buildings whereas for special buildings like, hotels, function hall, cinema theaters and community halls larger openings are required to meet their requirements and also to provide access of cables and pipelines, openings are provided in Shear Wall. Openings may be staggered or vertically arranged. Size of opening is also responsible for seismic response of the system. Stress distribution is critical around the opening.

2. METHODOLOGY

Equivalent static analysis

This approach depicts the effect of earthquake ground motion on a building by defining a sequence of forces acting on it, which is usually represented by a seismic layout reaction continuum. It is assumed that the building reacts in its fundamental mode. For this to be accurate, the building must have a low upward thrust and must not twist dramatically as the ground moves. Provided the herbal frequency of the house, the reaction is read from a layout response spectrum (either calculated or defined by using the building code).

Some construction codes extend the applicability of this strategy by using factors to account for safer homes with a few higher modes and low tiers of twisting. Many codes use correction considerations that minimise the design powers to account for the effects of the structure "yielding" (e.g., force reduction elements). Building seismic architecture takes into account the weight's complex presence. However, a similar static test might be sufficient for less complex, routine in plan setup, and it will provide more effective performance.

3. BUILDING SPECIFICATIONS AND MODELS

The following data is the specifications considered for designing of building in Staad Pro Software

Table 1: The preliminary data as is taken up for this study

Number of storeys	9 story building (G+8)
Plan size	17mX11m
Size of columns	500mmX230mm
Size of beams	400mmX2300mm
Shear wall thickness	120mm
Slab Thickness	150mm
Total height	27m
Floor to floor height	3m
Grade of concrete and steel	M30 grade and Fe600
Support condition	Fixed supports

Table 2: Loads considerations

Description	Consideration
Dead Load (DL) and Live load (LL)	As per IS 875 (Part 1) (1987) and IS 875 (Part 2) (1987)
Seismic load (SL)	As per IS 1893 (Part 1) (2002) Approach
DL	Self weight of the structure, Floor load and Wall loads
LL	Live load 3.5 KN/sq.m is considered for floor weight
Seismic zone	Zone: V (Z=0.36)
Rock/ soil type	Medium
Rock and Soil site factor	2
Response reduction factor	5
Importance factor	1
Damping	0.05%

Models in Staad pro Software

The below shown models are the G+8 storey buildings which are modeled and analyzed by using Staad pro V8i software. Both moels are considered in High seismic zone case (Zone V) having seismic coefficient value as 0.36 with medium soil condition effect.

The first model which is shown in Figure 2 is the 9 storey building which is considered without opening shear walls in zone V and the second model which is shown in figure 3 is the 9 storey building which is considered with opening of sear walls in both length and width direction for the building. The both models are analysed by using equivalent static analysis under seismic ground motion condition. The results like deflection, shear, bending values are compared for each building model.

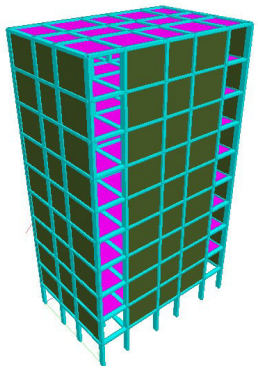

Figure 2: Building without openings

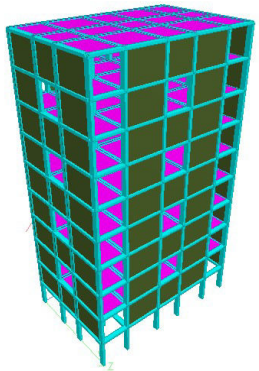

Figure 3: Building with openings

4. RESULTS AND ANALAYSIS

Storey deflection

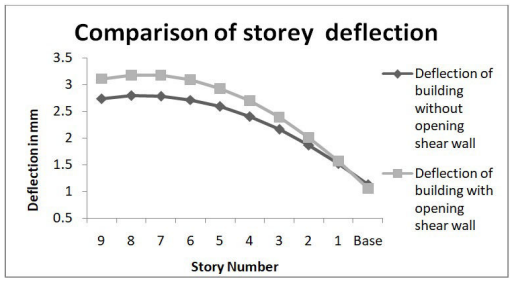

Figure 4: Comparison of storey deflection

Deflection is defined as the lateral displacement. Story drift is the drift of a multistory building relative to the level below. Inter story deflection is the difference between the roof and floor displacements of any given story as the buildings ways during the earthquake, normalized by the story height. For example, for a 10 foot high story, an inter story drift of 0.10 indicates that the roof is displaced one foot in relation to the floor below.

The higher the redirection, the almost certain it is that mischief will happen. Pinnacle inter story diversion esteems more prominent than 0.06 demonstrate extreme mischief, while values more noteworthy than 0.025 imply that the harm could be adequately serious to jeopardize human existence. Qualities more noteworthy than 0.10 mirror the probability of a structure falling.

In the zone V seismic express, the differentiation of story redirection esteems with and without shear wall openings is found in figure 4. From the above figure, it very well may be induced that having shear wall openings raises the redirection esteems when contrasted with the case without shear wall.

Storey Shear in X direction

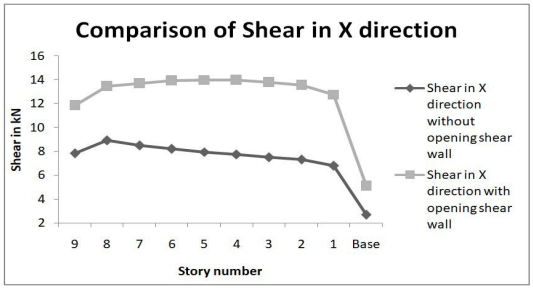

Figure 5: Storey Shear in X direction

VX, VY are the global organize frameworks for story shears. At the highest point of the story, just underneath the story level itself, and at the lower part of the story, simply over the story level beneath, the forces are enlisted.

Story level powers follow a similar image show as edge components, with the lower part of the story comparing to the I-end of the edge component and the highest point of the story relating to the j-end of the edge component. Global X=0, Global Y=0, and Global Z are the positions where story shears and upsetting minutes are regularly recognized.

The above Figure 5 shows the storey shear values for X direction by using with and without opening of shear walls from these results it was concluded that by providing shear wall with opening the shear in X direction increases when we compared with without opening condition in zone V condition.

Storey Shear in Y direction

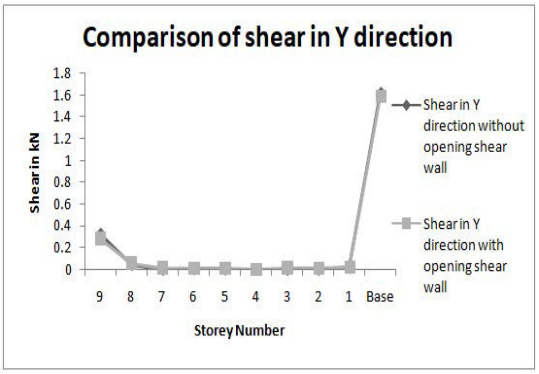

Figure 6: Storey Shear in Y direction

In case of storey shear in Y direction it has almost same intensities for both with and without shear wall openings condition and it has higher value of shear in base which is shown in the above figure 6 due to the more effect of seismic ground motion at ground in Zone V seismic condition.

Storey Bending in X direction

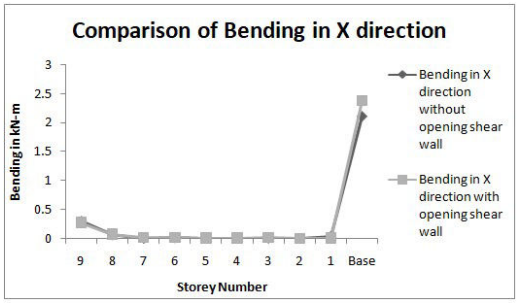

Figure 7: Storey Bending in X direction

A bending moment (BM) is an estimation of the bowing impact that can happen when a primary part is exposed to an outer power (or moment). The sufficiency of the power is increased by the distance of the power from the mark of help to decide the twisting second. A power or burden is applied to the floor joists that makes them twist. The bowing second should not reason pressure in the floor joists that is more prominent than their force, or they will fall.

The above figure 7 shows the storey bending values for with and without shear wall opening conditions in both the cases the values of bending are same in X direction condition due to more effect of ground action it has higher intensity in Base (Ground floor) than reaming storeys.

Storey Bending in Y direction

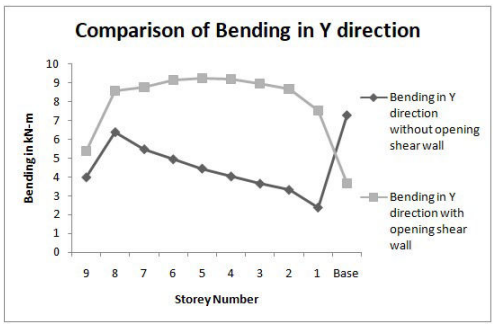

Figure 8: Storey Bending in Y direction

The above figure 8 shows the storey bending values for Y direction by using with and without opening of shear walls from these results it was concluded that by providing shear wall with opening the bending in Y direction increases when we compared with without opening condition in zone V condition.

5. CONCLSIONS

From the above study the following conclusions were made

1. The shear wall technique is the major components of building models for reducing the deflection, shear, bending action when we compared with other technologies like steel bracings, dampers, base isolation etc
2. The deflection values are higher if we provided openings for shear walls due to the effect of high seismic loading action rate in Zone V condition.
3. The shear in X direction is increasing if we provide openings for the shear walls for building design concepts in high seismic zone.
4. The shear in Y direction has almost same values for with and without opening of shear walls in seismic zone V from this point we can conclude that there is no effect of openings shear wall for shear for 11m length building models.
5. The bending values are almost same in case of X direction for both with and without shear wall conditions in linear static analysis.
6. The bending has higher values for opening shear wall than without opening shear wall case for zone V seismic loading condition.

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