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# Comparative Study of Seismic Analysis of R.C.C. Framed Structure with Full Infilled walls, without Infilled walls and Partially Infilled walls

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***Abstract: Since long, masonry infill is being used to fill up the voids between the horizontal and vertical structural elements such as beams and columns. They are treated as non-structural elements and they are not considered during the analysis and design of the structure such an approach can lead to an unsafe design. But, when laterally loaded they tends to interact with the RC frame, changing the structural behavior. However, infill walls contribute to lateral stiffness and seismic resistance to the building. In this study an approach is made in which seismic analysis of Reinforced Concrete frame structure is done considering full infilled walls, without infilled walls and partially infilled walls. In this analysis, a G+ 15 story R. C. frame structure is considered in seismic zone IV and V on medium soil strata by performing response spectrum analysis using STAAD PRO software. On the basis of this work results has been obtained. Results for Maximum Nodal Displacement in both the horizontal directions, Maximum Reactions, Maximum Base Shear and Maximum Moments are compared for different models.***
***Keywords: RC frame[1], Infill walls[2], response spectrum[3], medium soil[4], seismic zone[5], STAAD PRO[6].***

## I. INTRODUCTION

In multi-story buildings, the RC frame structures are constructed initially due to ease of construction and rapid work in progress. The masonry infilled RC frame buildings are commonly constructed for commercial, residential and industrial buildings in seismic regions. Infilled frames are composite structures formed by the combination of moment resisting plane frame and infill wall. The infills are mostly used as interior partition walls and external walls which are protecting from outside environment to the building. The masonry infill panels are generally not considered in the design process and treated as architectural (non-structural) components. Reinforced concrete (RC) frame buildings with masonry infill walls have been widely constructed for commercial, industrial and multi-story residential uses in seismic regions. Masonry infill typically consists of bricks or concrete blocks constructed between beams and columns of a reinforced concrete frame. The presence of masonry infill walls has a significant impact on the seismic response of a reinforced concrete frame building, increasing structural strength and stiffness. Properly designed infills can increase the overall strength, lateral resistance and energy dissipation of the structure. An infill wall reduces the lateral deflections and bending moments in the frame, thereby decreasing the probability of collapse. Recent studies have shown that the use of masonry infill panel has a significant effect not only on the strength and stiffness but also on the energy dissipation mechanism of the overall structure. Neglecting the effects of masonry infill can lead to inadequate assessment of structural damage of infill frame structures subjected to intense ground motions. In the early 1950s, further developments were made and a new structural system was introduced that was shear wall frame system, employment of new system made possible the use of reinforced concrete in apartments and office buildings high up to 30 stories. In such structure system shear walls are provided in the core of building and were small in size. Small dimension of shear wall was unable to withstand the lateral loads acting on the tall buildings therefore still the construction of building taller than 30 stories was uneconomical. Smaller dimensions of shear wall were unable to provide the overall stiffness and stability for the buildings over 30 stories at the same time increasing demand for space in the growing cities and the socio-economic situations results in the immense need for the construction of tall buildings.

### *A. Infilled Walls*

Infill walling is the generic name given to a panel that is built in between the floors of the primary structural frame of a building in other words Infill panel walls are a form of cladding built between the structural members of a building. The structural frame provides support for the cladding system, and the cladding provides separation of the internal and external environments. Infill walls are considered to be non-load bearing, but they resist wind loads.

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*B. Response Spectrum Analysis*

This approach permits the multiple modes of response of a building to be taken into account. This is required in many building codes for all except for very simple or very complex structures. The response of a structure can be defined as a combination of many special shapes (modes) that in a vibrating string correspond to the "harmonics". Computer analysis can be used to determine these modes for a structure. For each mode, a response is read from the design spectrum, based on the modal frequency and the modal mass, and they are then combined to provide an estimate of the total response of the structure. In this we have to calculate the magnitude of forces in all directions i.e. X, Y & Z and then see the effects on the building. Response spectrum can be interpreted as the locus of maximum response of a SDOF system for given damping ratio. Response spectra thus helps in obtaining the peak structural responses under linear range, which can be used for obtaining lateral forces developed in structure due to earthquake thus facilitates in earthquake-resistant design of structures. Response-spectrum analysis (RSA) is a linear-dynamic statistical analysis method which measures the contribution from each natural mode of vibration to indicate the likely maximum seismic response of an essentially elastic structure. Response-spectrum analysis provides insight into dynamic behavior by measuring pseudo-spectral acceleration, velocity, or displacement as a function of structural period for a given time history and level of damping.

## II. OBJECTIVE OF THE STUDY

The main objective of this work is to do the comparative study of seismic analysis of R.C.C. framed structure with full infilled walls, without infilled walls and partially infilled walls in seismic zone IV and V. The same structure is analyzed by STAAD pro. software.

Following are the objectives of this work

1) To study the Maximum Nodal Displacement in both the horizontal directions, Maximum Reactions, Maximum Base Shear and Maximum Moments for both the structures.
2) To study the effect of full infilled walls ,partially infilled walls and without infilled walls on the overall structure and Maximum Moments for both the structures.

The methodology work is explained as follows

a) *Step1:* Selection of building geometry, bays and story
b) *Step 2:* Select the property of frame sections for building frame
c) *Step 3:* Select the support conditions for different loading conditions:
d) *Step 4:* Select loading condition such as dead load, live load and combination of loads:
e) *Step 5:* Structural analysis of building frames for above loading conditions with / without diaphragm modal.
f) *Step 6:* Comparative analysis of results in terms of Maximum Nodal Displacement in both the horizontal directions, Maximum Reactions, Maximum Base Shear and Maximum Moments.
g) *Step 7:* Critical study of results.

Table 1: Model Description

| Software used | Configuration of Building | Model Dimensions | Story | Remarks |
|---|---|---|---|---|
| STAAD Pro. | Rectangular with Full Infilled walls | 40m x 30m | 16 | Seismic forces ofZONE IV and V as per IS: 1893:2002. |
| STAAD Pro. | Rectangular with Partial Infilled walls | 40m x 30m | 16 | Seismic load of ZONE IV and V as per IS: 1893:2002. |
| STAAD Pro. | Rectangular without Infilled walls | 40m x 30m | 16 | Seismic load of ZONE IV and V as per IS: 1893:2002. |

*A. Results Comparison*

The above cases are described in the following formats, as shown below

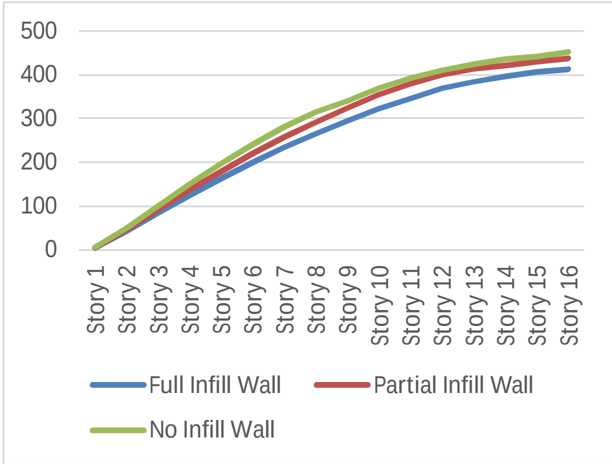


Chart -1: Figure showing maximum Storey displacement in X direction in zone IV in all stories

As we know the displacement at the base of the structure at all nodes for all cases is zero

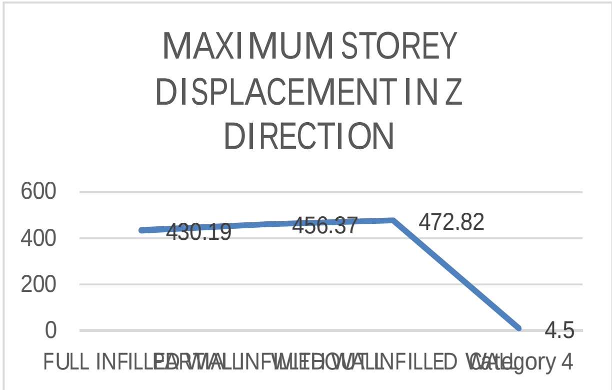


Chart-2: Figure showing maximum Storey displacement in Z direction in zone V in the structures

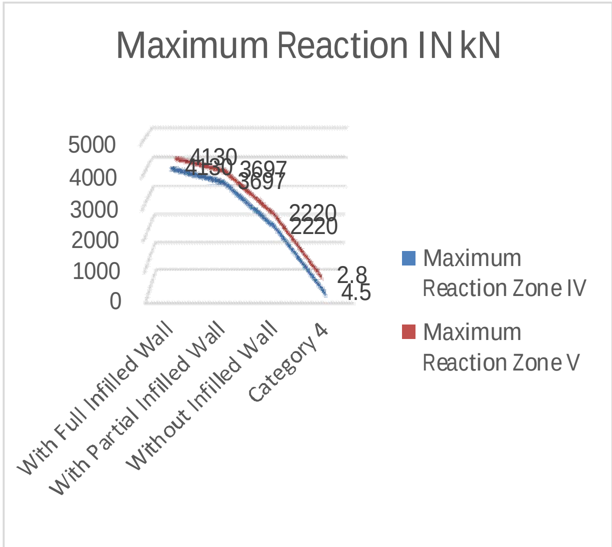


Chart-3: Figure showing Maximum Reactions Variations with respect to zones (3D View)

## III. CONCLUSIONS

In the above study response spectrum method of seismic analysis was considered for analyzing a G+15 (16 story structure) in the presence and absence of infilled wall.

Following conclusions are drawn from the above study:

*A.* Maximum Reactions increases as we provide partial infill wall and full infill wall in the structure and are minimum for No infill wall structure.

*B.* The value of Reaction does not depend on seismic zone so it is same for Full infilled wall structure, Partial infilled wall structure and No infilled wall structure in seismic zone IV and V and Full Infilled wall structure has more reaction than Partial and Without or No Infilled wall structure.

*C.* Base Shear shows no change for all the three cases and only depends upon the zone.

*D.* With the increase in seismic zone from IV to V base shear increases from an amount of 50% in all the structures.

*E.* With the increase in seismic zone from IV to V maximum storey displacement increases from an amount of 66.67% in X and Z direction both.

*F.* The values of Maximum Overturning Moments are more for infilled wall structure because the weight of the structure is more in full infill wall structure as compared to partial and no infilled wall structure for both the seismic zones.

*G.* The maximum displacement at all the stories decreases by an amount of approximately 10 % if we provide Partial infill wall and by an amount of approximately 20 % if we provide Full infill wall as compared to the structure having No infill wall..

*H.* Maximum storey displacements are minimum for Full infill wall structure and increases as we provide partial infill wall structure and are maximum for no infill wall structure. Hence, we can conclude infill wall plays an important role if maximum storey displacement parameter has given more importance.

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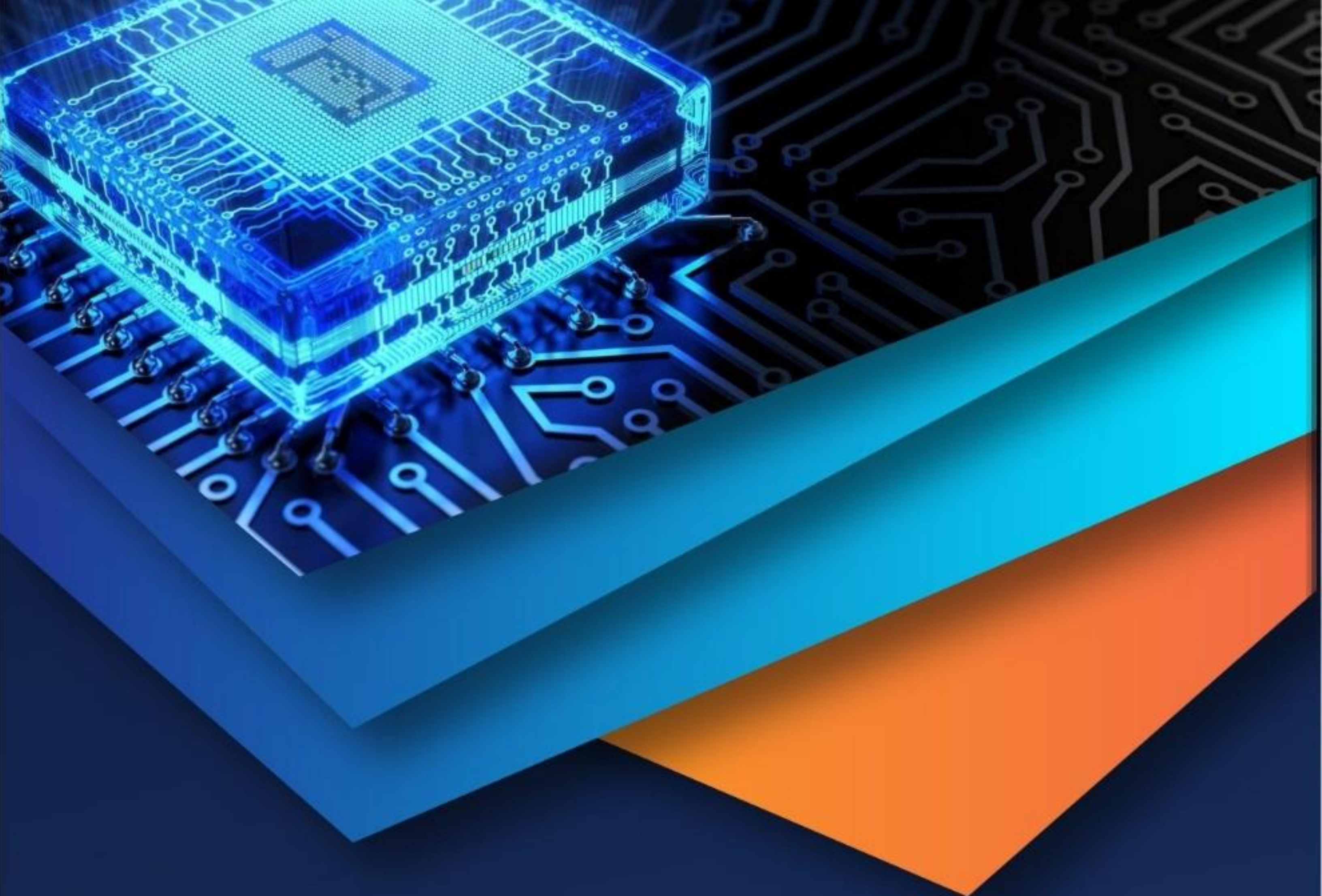


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