Seismic Analysis of RC Building With and Without Infill Wall

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Abstract: *Today all over the world Framed concrete structures are the most constructed structures due to ease of construction and rapid progress of work. Generally masonry which is done but brick work is done in these frames which act as an infill panels in the framed structure. Lateral stiffness is provided by infill wall to the structure. Its behaviour is very different from the bare frame structure.This paper report comprises of seismic analysis of a six storied R.C. building with symmetrical plan. Analysis is performed for Bare frame, Frame with infill wall. Building is analyzed using Equivalent static method .The building is modeled as a 3D space frame with six degrees of freedom at each node using the software STAAD-Pro V8i.Results are obtained by comparing base shear and maximum displacement in X & Z directions*

Key Words: Concrete, Earthquake, Infill, Multistory,

1.INTRODUCTION

Masonry infill walls are generally used as partitions in all over the world. Field evidence has shown that continuous infill masonry walls can significantly reduce the vulnerability of a reinforced concrete structure. In order to study and test this procedure, a full-scale three-story flat-plate structure was strengthened with infill brick walls and tested under displacement reversals. The results obtained from this test were compared with results from a previous experiment in which the same building was tested again without infill walls. In the primary test, punching shear failure was experienced by the structure at a slab-column connection. The addition of infill walls significantly helped to prevent slab collapse and increased the rigidity and capacity of the structure. The drift capacity of major repaired structure was 1.5 %. A numerical model of the test structure was tested to match experimental results. Numerical calculations of the response of the strengthened structure to some several scaled ground motion record suggested that the measured drift capacity would not be reached during strong ground motion.

RC frames having unreinforced masonry infill walls are common in developing countries with regions of high seismicity. Often, almost all engineers do not consider masonry infill walls in the design process because the final distribution of such elements may be unknown to them, or because masonry walls are regarded as non-structural elements. Separation between masonry walls and frames is generally not provided and, as a consequence, walls and frames interact during strong ground motion.

2.ANALYSIS AND MODELLING

The building considered in this present study is G+6 Bare Frame structure,Frame structire with infill wall.Complete analysis is carried out for for Dead load,Live Load and Siesmic load using software STAAD-PRO V8i.All combinations as per IS 1893:2002

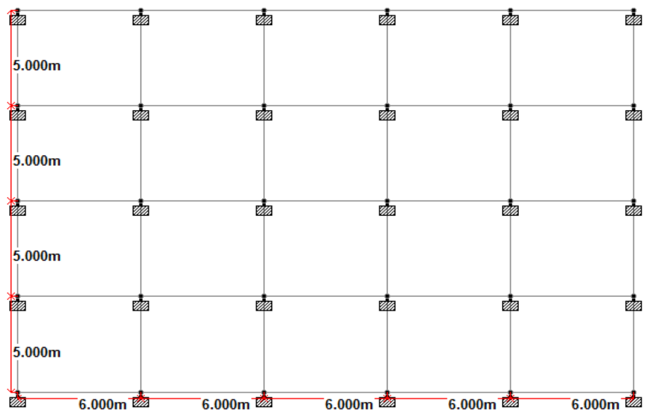

Fig1:Plan of G+6 Structure

2.1BUILDING PROPERTIES

Site Properties:

Details of building:: G+6

Outer wall thickness:: 230mm

Inner wall thickness:: 230mm

Floor height ::3 m

Depth of foundation :: 1500mm

Bearing capacity of Soil:: 150kN/m^2

Seismic Properties:

Seismic zone:: II

Zone factor::0.1

Importance factor:: 1.0

Response Reduction factor R:: 3

Soil Type:: medium

Material Properties:

Material grades of M30& Fe415 were used for the design

Loading on structure:

Dead load :: self-weight of structure

Weight of 230mm wall

Live load:: Floor 3.5kN/m^2

Roof 1.5 kN/m^2

Wind load :: Not considered.

Preliminary Sizes of members:

Column:: 300mm x 500mm

Beam:: 300mm x 650mm

Slab thickness:: 125mm

2.2LOAD COMBINATIONS

Load combinations that are to be used for Limit state Design of reinforced concrete structure are listed below.

1. 1.5(DL+LL)
2. 1.2(DL+LL±EQ-X)
3. 1.2(DL+LL±EQ-Y)
4. 1.5(DL±EQ-X)
5. 1.5(DL±EQ-Y)
6. 0.9DL±1.5EQ-X
7. 0.9DL±1.5EQ-Y

2.3MODELING

This building has been modeled as 3D Space frame model with six degree of freedom at each node using STAAD-Pro V8i, software for stimulation of behavior under gravity and seismic loading. The isometric 3D view and plan of the building model is shown as figure. The support condition is considered as fully fixed

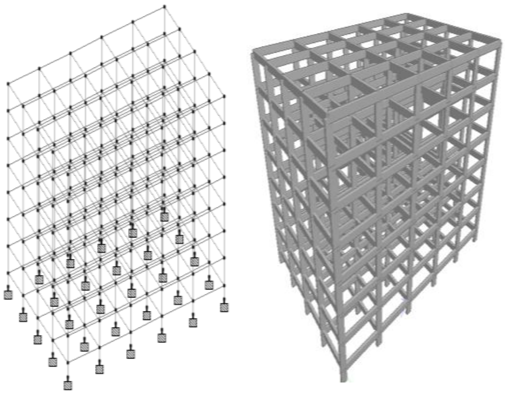

Fig.2: 3D View of G+6 Bare Frame Structure

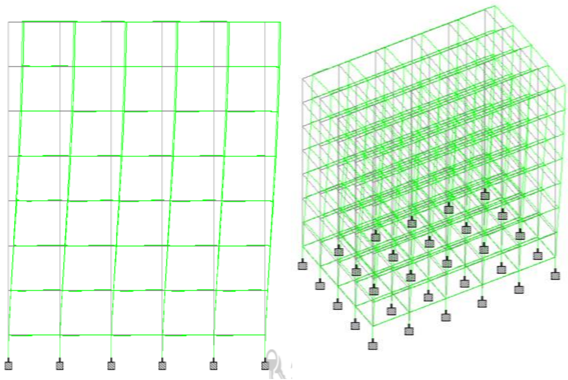

Fig.3:Deflected Shape of Bare Frame Structure in X-direction

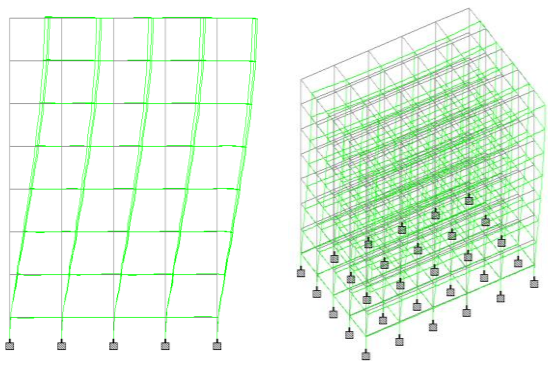

Fig.4: Deflected Shape of Bare Frame Structure in Z-direction

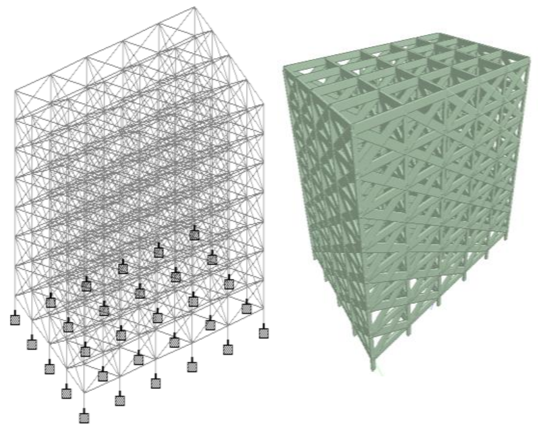

Fig.5: 3D View of G+6 Frame with Infill wall Structure

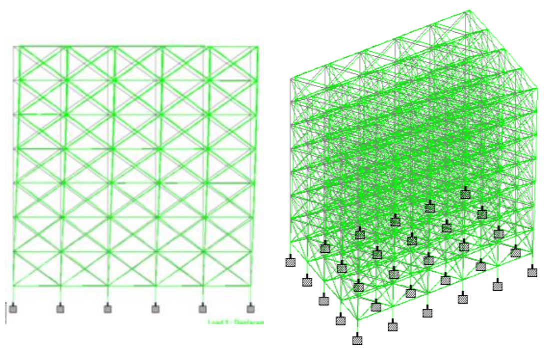

Fig.6: Deflected Shape of Frame with Infill wall Structure in X- direction

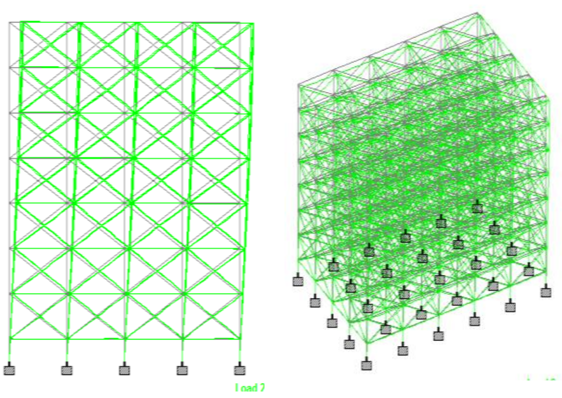

Fig.7:Deflected Shape of Frame with Infill wall Structure in Z- direction

3.RESULTS AND GRAPHS

Seismic Force in X-Direction (Zone II)	Bare Frame	Frame with Infill Wall
Time Period (Sec)	0.77482	0.36971
Sa/g	1.755	2.5
Base Shear (KN)	1845.63	2161.11

Table 1: Time Period, Sa/g, Base shear in X- direction (Zone II)

Seismic Force in Z-Direction (Zone II)	Bare Frame	Frame with Infill Wall
Time Period (Sec)	0.77482	0.4528
Sa/g	1.755	2.5
Base Shear (KN)	1845.63	2161.11

Table 2: Time Period, Sa/g, Base shear in Z- direction (Zone II)

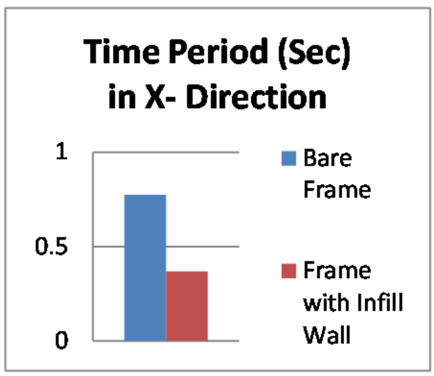

Chart-1:Comparision of time period in X – direction

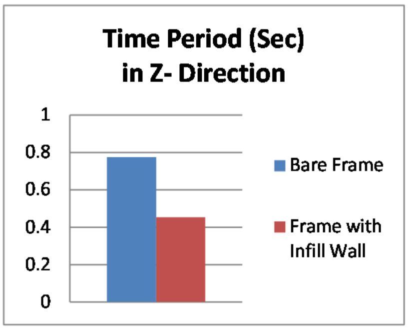

Chart-2:Comparision of time period in Z – direction

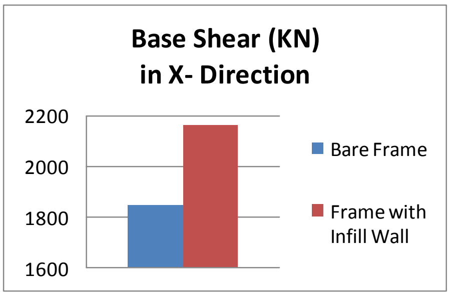

Chart-3:Comparision of Base Shear in X – direction

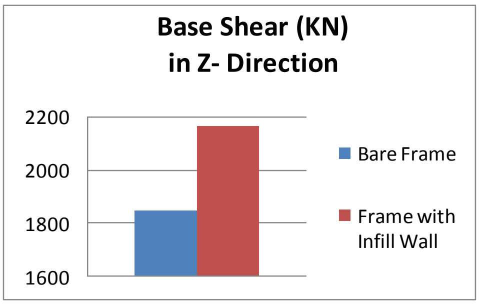

Chart-4: Comparision of Base Shear in Z – direction

Seismic Force in X- Direction (Zone II)	Bare Frame	Frame with Infill Wall
Maximum Displacement (mm)	20.46	9.87

Table 3: Maximum Displacement in X- direction (Zone II)

Seismic Force in Z- Direction (Zone II)	Bare Frame	Frame with Infill Wall
Maximum Displacement (mm)	36.534	12.37

Table 4: Maximum Displacement in Z- direction (Zone II)

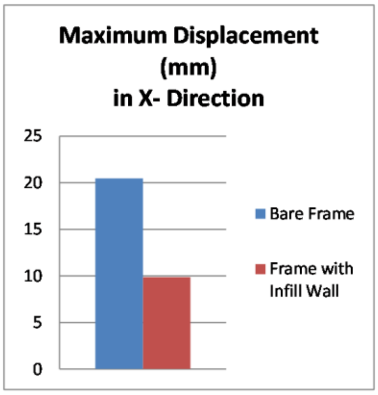

Chart-5: Comparision of Maximum Displacement in X– direction

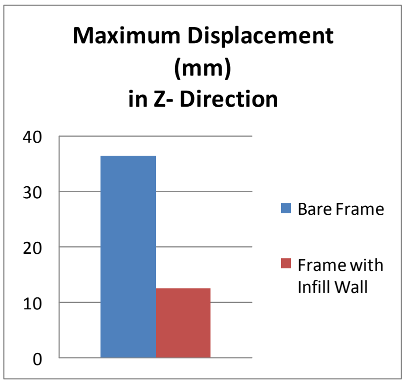

Chart-6: Comparision of Maximum Displacement in Z– direction

4.CONCLUSIONS

1.Different expressions are provided by the indian standard for the estimation of the natural period of the building structure considering or omitting the stiffness of the infill wall.
2.The consideration of stiffness of masonry infill greatly increases the stiffness of the structure and therefore reduces the natural period and consequently increase the response acceleration and therefore the seismic forces (i.e. base shear and correspondingly the lateral forces at each storey.
3.Infill masonry structure reduces lateral forces.

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