Effect of Different Types of Infills on the Static and Dynamic Behavior of RC Framed Structures

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Abstract **- In India, masonry infilled reinforced concrete frame is one of the most common structural systems. Present paper describes the nature of RC frame building with G +2 story with different masonry infill materials like conventional brick masonry and AAC blocks masonry is taken into considerations. Effect on parameters like displacement, is taking into account. Analysis is carried to in both static and dynamic method using ABAQUS software. Result from study conducted show that infill walls, displacement are reduced.**

Key words: AAC block; Infill RC frame; Lateral displacement

I. INTRODUCTION

An earthquake is usually explained as-a wave-like movement produced-by focus in constant-turbulence (disturbance) beneath-the surface area of the earth (lithosphere) travelling along-the crust in the interior of the earth. The earthquake phenomenon can also be defined as the vibrations (sometimes catastrophic or violent) of the surface of the earth occurring because of the release of the energy from the crust in the interior of the earth. From past few years the earthquake attacks have been raised. The ones having lower intensity are less harmful and cause less damage to the structure. The ones that have higher intensity if occurred in a densely populated area will cause more damage and loss of life. So due to these effects we need to focus more on the seismic study and construct a building that will be able to stand various intensities of the ground motion when earthquake occurs.

A. Analysis method:

As per, the Indian Standard code for Earthquake IS: 1893-2002, seismic analysis can be performed by following methods.

- Static Method (Equivalent Static Linear Method)
- Dynamic Methods (Time history method)

B. Types of infills

- Conventional Brick Infill Structures
- Autoclaved Aerated Concrete (AAC) Block Infill Structure

II. OBJECTIVES

- To study the behavior of the RC frames with brick infills by modeling infill.
- To identify the Maximum stress, strain and displacement of bare frame and bare frame with infills.
- To study the effect of soft story on the performance of masonry infilled RC framed structure.
- To evaluate the response of bare frame model and infilled frame model subjected to seismic loads as per IS 1893-2016 Codal provisions.
- To Strengthening the failure masonry wall by retrofitting using ABAQUS software.
- To compare the results between manual calculations and the software outputs.

III. METHODOLOGY

A. Modeling:

In order to understand the behavior of bare-frame and infill frame**,** a three story-frame with two bays width of 3m each is considered in one direction and one bay width of 3m in the other direction for the present study. In the first part of the study that is comparison between the bare frame and infill frame both in static and dynamic analysis, we consider two models one bare frame model and another infilled frame model and study the seismic performance of the two models. The second part of the study we prepare three different models fully infilled with soft story consideration at alternate floors (for example consideration of soft story at ground floor for the first model and for the next considering the soft story at first floor) and study the seismic performance of all the four models and then comparing the results.

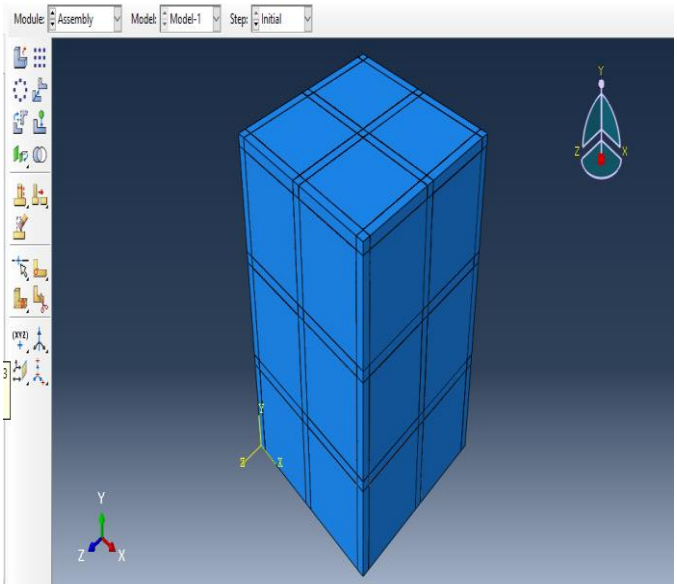

Fig.1 frame with fully infill

B. Frame properties:

TABLE I. BRICK MATERIAL PROPERTY

Type of infill	Density (kg/m^3)	Poisson's ratio	Elasticity (kN/m^2)	Thickness of wall (m)
brick infill	2000	0.2	3.6	0.23
AAC brick infill	1000	0.25	2	0.23

TABLE II. REINFORCEMNET MATERIAL PROPERTY

Concrete	M30	2400	0.15	27.386
Steel	Fe415	7850	0.3	200

TABLE III. CFRP MATERIAL PROPERTY

Material	Density (kg/m^3)	Poisson's ratio	Elasticity (kN/m^2)	Yield stress (kN/m^2)
CFRP	1800	0.23	228	344

C. Modeling:

In this section we discuss the end a results or consequences procured in the present work. This outcomes and applications are most suitable for the universal engineering practices. Behavior of the masonry-infill frames and bare-frames a under lateral loads and dynamic load is studied. Effects and significance of different parameters are studied-in detail.

TABLE IV. STRUCTURAL DETAILS

Structural members	Sizes of the members
Infill	230 mm
Beams	300mm x 300 mm
Columns	300mm x 300 mm
Slab	150mm

D. Dynamic analysis:

The dynamic analysis is done by using time history method and the earthquake data taken from journal paper.

- *Bare frame*

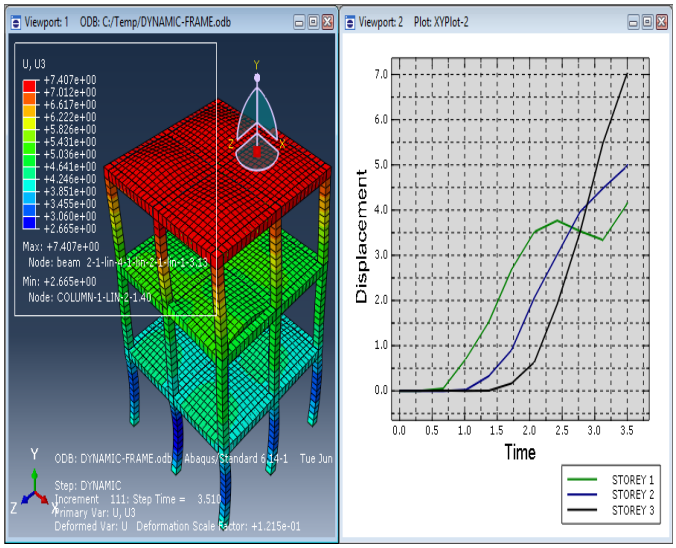

Fig.2 bare frame displacement curve

- *Bare frame with AAC infill*

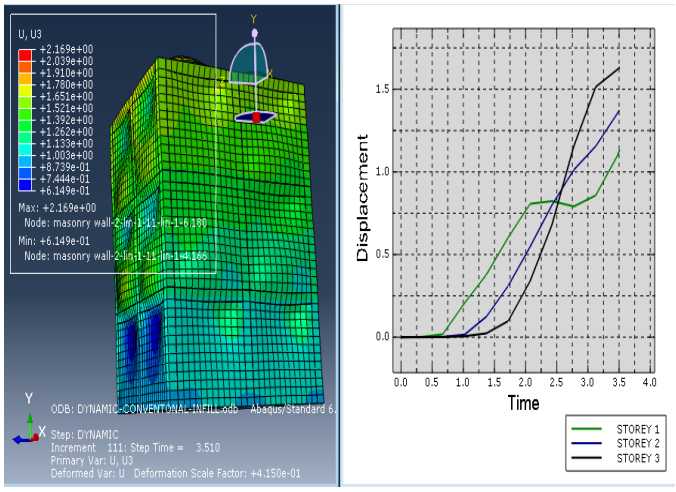

Fig.3 bare frame with AAC infill wall displacement curve

- *Bare frame with conventional infill*

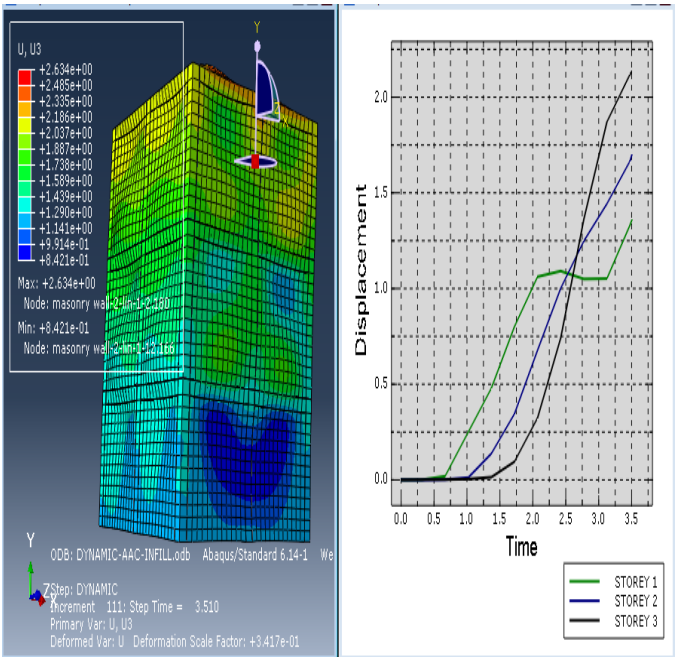

Fig.4 bare frame with conventional infill wall displacement curve

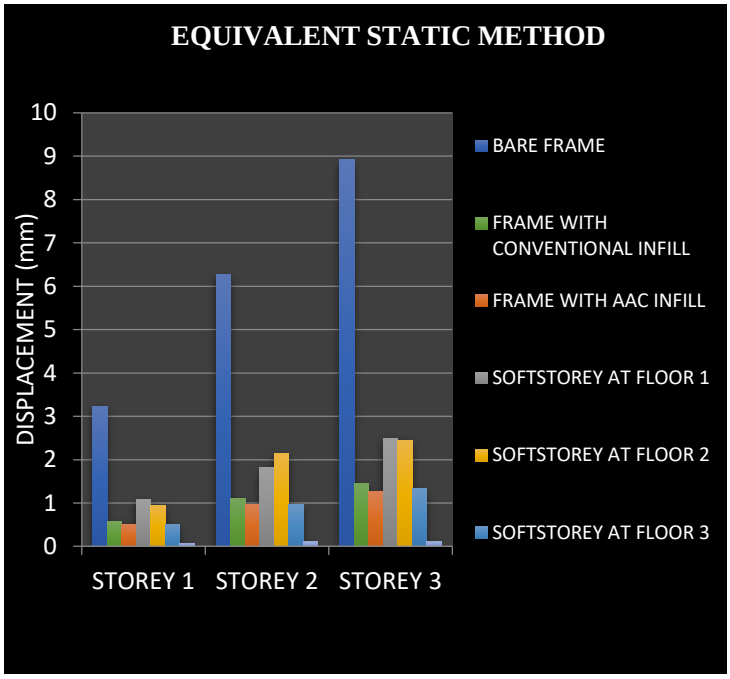

Fig.5 Story v/s Displacement graph

E. *Equivalent static method*:

The below value are caculated manually by using equivalent static method

TABLE V. STORY FORCE

Story force without infill	Story force with infill
50.47	87.63
22.44	89.92
5.619	22.23

TABLE VI. DISPLACEMENT VALUE OF STATIC METHOD

	Displacement in (mm)		
	Story 1	Story 2	Story 3
Bare frame	3.23409	6.26506	8.92424
Frame with AAC type of infill	0.512195	0.956982	1.26152
Frame with conventional type of infill	0.576911	1.09266	1.44873

CONCLUSIONS:

- From the results, it has been found that 18% displacement of structure with AAC block in all cases is found less than conventional brick masonry.
- In the Equivalent static method, bare frame model is considered the maximum displacement is very high in the range of 8.9 mm but after providing an infill to the bare frame it was seen that the maximum displacement is very less in the range of 1.26mm. Therefore with the infills there is of reduction in the displacement.
- In the Dynamic method (Time history method), bare frame model is considered the maximum displacement is very high in the range of 7.05 mm but after providing an infill to the bare frame it was seen that the maximum displacement is very less in the range of 1.63mm. Therefore with the infills there is reduction in the displacement.
- Infill increases the initial stiffness of the structure and also increases the base shear carrying capacity of the structure.

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