

A REVIEW ON R.C.C. STRUCTURE WITH FULLY, PARTIALLY AND WITHOUT INFILLED WALL IN DIFFERENT SEISMIC ZONES OF INDIA

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Abstract: Since long masonry infill are 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 behaviour. 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. For this study STAAD PRO software is used.

Keywords: RC frame, infill walls, response spectrum, seismic zone, STAAD PRO.

1. 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.

1.1 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.

2. LITERATURE SURVEY

- Mohammad H. Jinya et al. (2014), they used ETABS software along with G+9 R.C.C framed building models, seismic coefficient method (SCM) and time-history method (THM) has been performed for analysis as per IS 1893:2002 and story displacement, base shear, story drift, axial force with and without soft story considering effect of infill walls with different percentage of opening are the parameters considered in this study. From their analysis it can be concluded that diagonal strut will change the seismic performance of RC building. Axial force in column increased, story displacement and story drift are decreased and base shear is increase with higher stiffness of infill. If in the ground level at least periphery wall is provided then soft story effect can be minimized. It can also be concluded, the increase in the percentage of opening leads to a decrease in the lateral stiffness.

- Narendra A. Kaple et al. (2016), prepared G+6 R.C.C framed building models on ETABS software and Seismic coefficient method and Response Spectrum analysis has been performed on the building for analysis as per IS 1893:2002 and results obtained from the analysis are compared in terms of strength and stiffness for bare frame and infill wall. When the bare frame model is subjected to lateral load, mass of each floor acts independently resulting each floor to displacement with

respect to adjacent floors. Thus, the building frame behaves in the flexible manner causing distribution of horizontal shear across floors. In presence of infill wall (panel), the relative drift between adjacent floors is restricted causing mass of the upper floors to act together as a single mass, Deflection in case of bare frame is very large, when compared to solid brick infill conditions, the presence of walls in upper storeys (i.e. for Model4) makes them much stiffer than bottom ground storey.

- Kiran Tidke et al. (2016), studied the effect of masonry infill wall on a G+7 R.C. frame building, Analysis is carried by SAP2000 software considering Response spectrum and time history analysis. Parameters such as Base shear, Max. storey drift, Displacement are calculated and compared for all models. They concluded that RC frame with masonry infill with and without soft storey is having highest value of base shear than bare frame the presence of infill wall can affect the seismic behaviour of frame structure to large extent, and the infill wall increases the strength of stiffness of structure. The maximum storey drift of infill wall without soft storey is 0.0325% and infill wall with one soft storey is 0.0063% less compared to bare frame. The displacement of infill wall without soft storey is 0.4785% and infill wall with one, two soft storeys is 0.3845%, 0.2447% respectively less compared to bare frame.

- Ozkaynak, Hasan et al. (2018), carried out experimental study on the determination of damping characteristics of bare, masonry infilled, and carbon fibre reinforced polymer (CFRP) retrofitted infilled reinforced concrete (RC) frames. Results of the experimental studies are evaluated in two phases: i) equivalent damping is determined for experimentally-obtained cycles from quasi-static and pseudo-dynamic tests, ii) an iterative procedure is developed based on the energy balance formulation to determine the equivalent damping ratio. The equivalent damping for bare frame varies between 8 to 11% depending on the damage level. The equivalent damping ratio derived for infilled frame is 13%. Therefore, the effect of infill walls on damping can be clearly seen from the results.

- Mircea Barnaure et al. (2016), analyses the differences in the behaviour of bare and infilled frames through numerical modelling. Nonlinear push-over analyses of infilled frames are carried out under in plane vertical and lateral loading. The results shows that masonry infills alter the seismic behaviour of reinforced concrete frames. For all the analyse situations, masonry infills determined an increase in stiffness for the building and lower maximum story drifts.

3. METHODOLOGY

In this research work, the analysis based on linear static method is used to investigate **floating column structures with and without bracing system and infill wall** under seismic parameters as per IS-standards. In order to study the seismic severity zone IV is considered of India.

- **Following procedure is adopted for analysis of high-rise structures:**

Step1: Selection of building geometry, bays and story.

Step2: Select the property of frame sections for building frame

Step3: Select the support conditions for different loading conditions:

Step4: Select loading condition such as dead load, live load, Seismic loads and combination of loads.

Step5: Structural analysis of building frames for above loading conditions.

Step6: Analysis results in terms of Maximum Reactions, Maximum Story Displacement and Maximum Base Shear.

Step7: Critical study of results.

- **PREFERRED LOAD COMBINATIONS:**

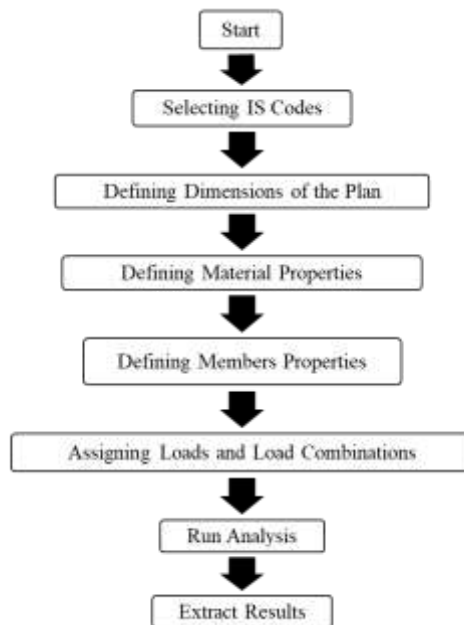
According to IS 1893 (Part 1): 2002, Clause 6.3.1.2 the following load combinations of gravity and lateral loads with approximate Partial safety factors for limit state design of reinforced concrete structures and prestressed concrete structures are-

- 1) 1.5 (D.L. + I.L.)
- 2) 1.2 (D.L. + I.L. ± E.L.)
- 3) 1.5 (D.L. ± E.L.)
- 4) 0.9 D.L. ± 1.5 E.L

Cases under consideration:

Software used	Configuration of Building	Model Dimensions	Story	Remarks
STAAD Pro.	Rectangular with Full Infilled walls	40m x 30m	16	Seismic forces of ZONE 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.

3.1 FLOW CHART DIAGRAM



4. RESULT AND DISCUSSION

From above literature, many researchers gave his results on the seismic analysis of Infill wall structures and analyse it using seismic loads. Following conclusions are drawn from the above review:

- Infill wall structure helps to resist high storey displacement, large storey drift.
- Infill wall structure shows increase in lateral stability of structure.

In this work, we have made approximations on the geometrical plan of structures, which are going to be drawn on the STAAD PRO. software interface. These structures are being analysed further on the basis of Seismic loads as per the provisions given in IS: 1893: 2002/05. Seismic analysis results will be evaluated on the basis of following sub-heads, i.e. the Maximum Reactions, Maximum Story Displacement and Maximum Base Shear.

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