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Performance Analysis of in filled RC Frames in Earthquake Region Using STAAD.Pro

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Abstract: *Now a days construction of RC frame structure is common due to the simplicity in construction. Infill walls are mainly used for partition and insulation purpose rather than structural purpose. However, during earthquake these infill contributes to the response of the structure and the behavior of the infill frame building is different from that predicted for bare frame structure. Infill behave like a compression strut between column and beam .For this purpose linear dynamic analysis have been performed on masonry infill RC frame structure to study influence of variation of strength of structure with n without infill wall , effect of infill on dynamic parameter like natural period , story drift, story shear, displacement and hinge status . In this effect of infill on high rise building is studied. All analysis is carried out by software STAAD PRO v8i. modelling and analysis of building is carried out on STAAD PRO v8i . For the analysis G+10 RCC framed building is modeled. In this analysis the width of strut is calculated manually as per the expression given in the FEMA-356. Study shows that the influence of infill on the structure is significant. It increases the stiffness of the structure and makes the structure capable to withstand an earthquake region as compare to the bare frame.*
Keywords: *Infill walls, Seismic force, Soft story, Natural period , STAAD Pro.*

I. Introdution

It has always been a human aspiration to create taller and taller structures. The reinforced cement concrete moment resisting frames in filled with unreinforced brick masonry walls are very common in India and in other developing countries. Masonry is a commonly used construction material in the world for reason that includes accessibility, functionality, and cost. When masonry in fills are considered to interact with their surrounding frames, the lateral load capacity of the structure largely increases.

The survey of buildings damaged in earthquakes further reinforces this understanding. The positive aspects of the presence of infill are higher strength and higher stiffness of the infill frames. In high rise buildings, the ordinarily occurring vertical loads, dead or live, do not pose much of a problem, but the lateral loads due to wind or earthquake tremors are a matter of great concern and need special consideration in the design of buildings. These lateral forces can produce the critical stress in a structure, set up undesirable vibrations and in addition, cause lateral sway of the structure which can reach a stage of discomfort to the occupants.

In many countries situated in seismic regions, reinforced concrete frames are in filled fully or partially by brick masonry panels with or without openings. Although the infill panels significantly enhance both the stiffness and strength of the frame, their contribution is often not taken into account because of the lack of knowledge of the composite behavior of the frame and the infill. Infill wall can be modelled in several forms such as, equivalent diagonal strut approach and finite element method et

1.1. Objectives:

- To study the different IS codes such as IS 1893:2002 , IS4928:1993 etc.
- Design of masonry infill frame and the bare frame by using the STAAD model .
- Analysis of masonry infill and bared frame model of STAAD .
- Comparing the design results with STAAD results .

II. Literature Review

1. Siamak Sattar and Abbie B. Liel (2010)

This study assesses the seismic performance of masonry-infilled RC frames, including a set of 4 and 8-story buildings with different infill configurations. Infill panels are modeled by two nonlinear strut elements, which only have compressive strength. Nonlinear models of the frame-wall system are subjected to incremental dynamic analysis in order to assess seismic performance. Results of pushover analysis show an increase in initial stiffness, strength, and energy dissipation of the infilled frame, compared to the bare frame, despite the wall's brittle failure modes. Likewise, dynamic analysis results indicate that fully-infilled frame has the lowest collapse risk and the bare frames are found to be the most vulnerable to earthquake-induced collapse.

2. Wakchaure M.R, Ped S. P (2012)

Due to infill walls in the High Rise Building top storey displacement is reduces. Base shear is increased. The presence of non-structural masonry infill walls can modify the seismic behavior of R.C.C.Framed High Rise building to large extent. Arrangement of infill wall also alters the displacement and base shear the top of building displacements gets reduces. In case of infill having irregularities in elevation such as soft storey that is damage was occur at level where change in infill pattern is occur. The effect of slenderness ratio emphasion displacement of frame. As the aspect ratio goes on increasing the displacement, base shear and column forces increases**.**

3. M. S. Razzaghi and M. Javidnia (2015)

Nonlinear response history analyses were performed to investigate the effects of the arrangements of the infill walls in seismic performance of infill walls in RC dual frames. To this end an existing RC building which was damaged during the 23 October 2011 Van earthquake was considered. The building was numerically modeled in its actual situation and 17 other arrangements of the infill walls. In addition to the van earthquake, the response histories of all of the models were estimated due to the three other ground motions. Results of this study revealed that infill walls play a vital role in seismic performance of the RC buildings. It was shown that noticeable changes may occur in seismic performance (e.g., experienced damage state, energy dissipation, etc.,) of the same structure with different arrangements of the infill walls. In other words, neglecting the effects of the infill walls in nonlinear dynamic analysis may lead to noticeable misunderstanding the seismic performance of the structure.

4. Luis Decanini , Fabrizio Mollaioli , Andrea Mura, Rodolfo Saragoni (2004)

In this paper the influence of masonry infills on the seismic performance reinforced concrete frames was investigated. The infill panels, modelled with equivalent strut elements carrying only compressive loads, were implemented in a simplified shear-type model in order to obtain also a spectral representation of the seismic demands of the frame structures systems at global and local level. Three type of masonry infills, classified as weak (t1), intermediate (t2), and strong (t3), were considered in the analyses. It was found that the presence of infill walls, gradually stiffer and more resistant, results in a significant decrease in the value of top displacement, as natural consequence o the stiffening of the structure. It was found that the influence of Cy is significant for the lowest frames, from 2 to 8 stories for the bare frames, and from 2 to 12 stories for the infilled t1, t2 and t3 frames.

Finally, the performance of the infilled frames, for a given type of infills, can be improved increasing the strength capacity of the bare frame rather than increasing its ductility capacity, as far as for limited ductility demand the infills may undergo to significant inelastic deformation demands.

5. Marco Valente (2012)

The displacement-based assessment procedure adopted in this study allowed to investigate the influence of masonry infills on the seismic performance of a ductile RC structure and provided results consistent with the experimental evidence and with nonlinear dynamic analyses. Due to the increase of stiffness provided by the infills, the attainment of the different Limit States was anticipated in terms of drift in case of infilled structure with respect to the bare counterpart. The presence of masonry infills and opening considerably changed the distribution of damage throughout the structure. The maximum drift demand on the bare structure was registered at the second storey. On the contrary, the drift demand on the fully infilled structure concentrated at the first storey. Masonry infills significantly contributed to the lateral stiffness and load resistance of the structure, but a decrease of strength was observed after the failure of infills. Severe damage for high seismic intensity levels may be expected for non-ductile structures because of the strength reduction due to the damage of the infills. According to the simplified assessment procedure, the influence of infills on the seismic response of the ductile RC structure investigated in this study was beneficial, though the drop of strength after the peak. The deformation capacity was large enough to accommodate the demand and a significant reduction of damage was registered compared to the bare structure.

6. K. Thinley & H. Hao (2015)

In this, study is aimed at realistically assessing the performance of masonry infilled RC buildings in Thimphu using the ground motions predicted at generic soil sites in Thimphu. Three typical masonry RC buildings that represent the masonry infilled RC buildings constructed before and after the adoption of Indian

Seismic Code are considered. The nonlinear analysis and performance assessment software Perform 3D is used for the nonlinear analysis of the buildings. The numerical model is first calibrated with experimental results and then applied for the response prediction of the typical masonry infilled RC buildings. The performance of the buildings are assessed based on the interstorey drift and using the performance limit states proposed by Ghobarah (2004). The buildings are also assessed for the recorded ground motion of the recent Nepal earthquake to understand the performance of buildings under such earthquake.

7. Khubaib Ilyas Khan M. and Saim Raza (2015)

Following conclusions can be drawn from this research

Performance of the infilled frames is dependent on the material and geometric properties of the infill and frame and on how well they perform in integrity with each other.

For infilled RC frame structures the fundamental time period, roof displacement and interstorey drift ratios decrease with the increase in number of bays due to increase in the lateral stiffness. However percentage decrease in these parameters decreases as the number of bays increases. Base shear and infill stresses increase with the increase in number of bays representing higher resistance to the lateral loading at the base and attracting more forces respectively.

The fundamental time period, roof displacement, infill stresses, base shear and interstorey drift ratios increase with the increase in number of storeys due to increase in the mass of the structure and larger height to base width ratio (aspect ratio of the structure).

8. Momin Mohmedakil M , P.G.Patel (2012)

The dynamic seismic earthquake behaviour of the two types of infill material as ALC block & bricks was investigated. The performance of ALC block infill was superior to that of Conventional brick infill in RC frame. Therefore, The ALC block material can basically be used to replace conventional bricks as infill material for RC frames built in the earthquake prone region.

9. Sagar , M.R.Suresh (2016)

The infill walls are primarily diverts the behavior of the frame structure and it is essential to take the part and to observe the walls of infill for seismic analysis of structure .infill increases the initial stiffness of the structure . for more accurate analysis and for the assignment of the structure to seismic charging , it is advisable to design by forced base approach and check the adequacy from pushover analysis .

10. Nasratullah Zahir[1], Dr. Vivek Garg[2] (2017)

The results obtain from the analysis indicates that story shear increase for infill frame models compare to bare frame model by equivalent static method and response spectrum method. This increase in ratio is found to be more at roof compared to base of structure. The story shear values obtained by Smith and Holmes models are found to be more compared to Paulay and infill panel models. The result for floor displacement and story drift obtained by equivalent static method indicate that the displacement and drift for infill frame is considerably decreases compare to bare frame. The time period for infill frame is dramatically decreases compare to bare frame by response spectrum method. The vertical support reaction results obtained from the analysis indicates that the support reaction for infill frame is increasing in outer columns and decreases in inner columns by equivalent static method. The vertical support reaction for infill frame is found to be more in response spectrum method compared to static method.

III. Research Methodology

The proposed work is planned to be carried out in the following manner.

- ❖ Study of IS code IS 1893:2002 , IS4326:1993 etc.
- ❖ Study of Design parameters used in STAAD.
- ❖ Preparation of STAAD models for the RC frames with n without masonry infill.
- ❖ Analysis and Design of masonry in filled RC frame.
- ❖ Preparation of Comparative Statement on the basis of Design.

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