"REVIEW ON SEISMIC BEHAVIOUR OF MULTISTOREY BUILDING WITH SOFT STOREY WITH AND WITHOUT INFILL WALL"

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ABSTRACT*:* *An earthquake is a spontaneous event and most devastating calamities where both life and economic losses occur. Most of the losses and tragedies are due to structural collapse or damage; hence we need to design the structure to withstand these earthquakes. In this study we focused on the Reinforced concrete frames with masonry infill walls is a common practice in countries like India, where the region is prone to seismic activity. The masonry infill walls are treated as a non-structural element in structural analysis and only the contribution of its mass is considered and its structural properties like strength and stiffness are generally not considered. The structures in high seismic areas are greatly vulnerable to severe damages. Apart from the gravity load structure has to withstand lateral load which may develop high stresses. Now day's reinforced concrete frames are most common in building construction practice around the globe. The vertical gap in reinforced concrete frames i.e. created by the columns and beams are generally filled in by brick or masonry and it is referred to as brick infill wall or panels. Many researchers have changed various parameters and analyzed the same. This paper presents a summary of these investigations and helps in understanding the behavior of Infill Walls.*

Keywords: Base shear, Infill configuration, Plan Irregularity, Stiffness, Storey Displacement

1. INTRODUCTION

The reinforced concrete (RC) frame buildings with masonry infill walls have been widely constructed for commercial, industrial, and multi-family residential uses in seismic-prone regions worldwide. A large number of buildings are constructed with masonry infills walls for architectural needs or aesthetic reasons, because of the complexity of the problem and absence of a realistic, yet simple analytical model, the combination of masonry infill panels is often neglected in the non-linear analysis of building structures. Such an assumption may lead to substantial inaccuracy in predicting the lateral stiffness, strength, and ductility of the structure.

The conduct of infilled outlines has been widely concentrated over the most recent forty years in endeavors to build up a judicious methodology for the plan of such edges. The strength and solidness of infill dividers are overlooked due to the possibility of a moderate plan. In down to earth, infill dividers give impressive strength and unbending nature to the structure and their nonappearance may cause disappointment in numerous multi-storeyed structures. Infills don't contribute towards opposing gravity stacks however contribute fundamentally in opposing sidelong loads. Infill solidness is generally disregarded in casing investigation, bringing about an under assessment of firmness and common recurrence and have energy dissemination attributes that add to improved seismic opposition.

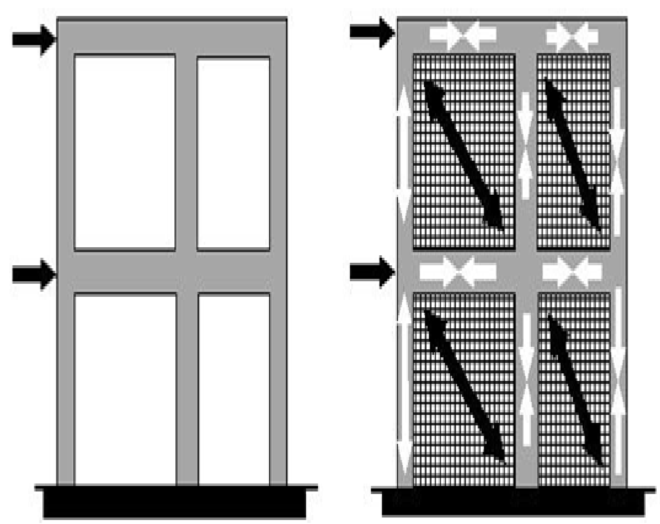

Figure 1: Seismic effect on frame structure

2. LITERATURE REVIEW

Our investigation dependent on that, to audit the different methodologies utilized for the study of infilled outline structures and to introduce a writing audit of various explores, particularly those taking a shot at assessing the different outcomes related to demonstrating various kinds of structures, reasons of gap appearance in auxiliary component brought about by infill dividers, the assessment of results and the investigation of the structures due to impact of dynamic burden. Brief information of the investigation work done by different researchers about the soft storey is given below-

Sunil N et al (2015) presented the "Seismic Performance Assessment of Soft Storey Structures by Using Pushover Analysis", the objectives of this study to distinguish between "soft" and "weak" stories. Soft stories are less stiff, or more flexible, than the storey above; weak stories have less strength. A soft or weak storey at any height creates a problem, but since the cumulative loads are greatest towards the base of the building, a discontinuity between the first and second floor tends to result in the most serious condition. For this purpose, a 2D reinforced concrete frame is modeled in ETABS, finite element software, and analyzed. The effects of seismic zones and types of soil as per IS 1893 (Part 1): 2002 have been studied. The silent conclusions of the study were using the strong column and week beam concept the base shear capacity of the structure increases and the vulnerability index ratio increases with an increase in stiffness of column compared to that of beams and structure on hard rock/ soil condition perform better.

Kumbhar S. S et. al. (2015) studied "Seismic Analysis of Masonry Infill in Multi Storey RC Buildings". This study involves the seismic analysis of RC frame buildings with different models that include bare frame, infilled frame, and open first storey frame. Different infill material like conventional clay bricks and AAC blocks masonry is taken into considerations. The parameters such as base shear, time period, and storey drift are studied. The software ETABS is used for the analysis of the entire frame models. The author concluded that the parameters which are considered for studied; found that infill did not take into account for analysis, but the infill effects on the increase of ductility, stiffness, and the flexural strength of the members.

C. Rajesh et. al. (2014) studied "Seismic performance of RC framed buildings with & without infill walls "In this study two buildings of G+5 & G+9 stories are considered having the same floor height and similar properties of structures. Both the buildings are modeled as bare-frame i.e., buildings without considering infill walls between the vertical and horizontal elements of the building. These are analyzed for gravity loads and seismic loads in the software as per IS 1893(Part-1):2002 condition of analysis. Author Concluded that from the observation comparing the bare-frame model and equivalent diagonal strut models results for both gravity load analysis and seismic load analysis observed that without considering the stiffness of infill frame in bare model stiffness of the building is very less where are the strut models which considered the stiffness of infill as strut has more stiffness of the building and also economical in section area of steel.

Holmes (2012) studied experimentally on steel frames infilled with brick masonry and reinforced Concrete walls and developed a semi-empirical design method for laterally loaded infilled Frames based on equivalent strut concept. His tests suggested that reinforced concrete walls increase the strength of the frame by 400% whereas the brick masonry infills increase around 100%. He indicated that the presence of vertical load increased the strength by about 15% and that openings in walls might reduce strength up to 40% based on the composite behavior. The infill was considered to fail in compression. The load carried by infill at failure was calculated by multiplying the compressive strength of material by the area of an equivalent strut. He states that the width of the equivalent strut to be one-third of the diagonal length of infill, which resulted in the infill strength being independent of frame stiffness. The load carried by the frame was then calculated by assuming that the strut was shortened by an amount which was its length multiplied by the strain at failure in the infill material. Subsequently, many investigators developed the strut width value related to the length of contact between the wall and the columns and between the wall and the beams. In 1961 Holmes stated that width of diagonal is given by, $w = dz/3$Where, dz = Diagonal length of infill panel

C.V. R Murty et. al. (1997) studied "Seismic Response of RC Frame Buildings with Soft First Storeys" conclude that buildings Masonry infill wall panels increase strength, stiffness, overall ductility and energy dissipation of the building. More importantly, they help in drastically reducing the deformation and ductility demand on RC frame members explains the excellent performance of many such buildings in moderate earthquakes even when the buildings had not been designed or detailed for earthquake forces. Most multi-storey building constructions in the developing countries consist of RC frames with URM infills. They Concluded that the IS code methods are describing very insufficient guidelines about infill wall design procedures. Software like ETABs is used as a tool for analyzing the effect of infill on structural behavior. It is observed; ETABs provide overestimated values of the fundamental period. According to relative values of all parameters, it can be concluded that the provision of the infill wall enhances the performance in terms of displacement control, storey drift, and lateral stiffness.

Basavaraju Y. K. et. al. (2016) worked on "Seismic Performance of Multi Storey RC Frame Buildings with Soft Storey from Pushover Analysis" In this study, the behavior of multi-storeyed buildings will be studied for the various position of the soft storey along with the height. For this purpose, ETABS software has been used and typical two-dimensional RC frames are considered. Storey displacement, storey drift, base shear, roof displacement experienced, and status of performance point are the parameters used to quantify the performance of RC frames. It is inferred that soft storey structures are most vulnerable to earthquakes. They possess lower lateral load-carrying capacity and experience increased roof displacement.

Kiran Tidke et. al. (2016) studied "Seismic Analysis of Building with and without Infill Wall"; in this paper effect of masonry infill wall on the building is studied. Dynamic analysis of building with different arrangements is carried out. For analysis G+7 R.C. frame building is modeled. The width of the strut is calculated by the equivalent diagonal strut method. The analysis is carried out by SAP2000 software. Base shear, Max. Storey drift, Displacement is calculated and compared for all models. The author concluded that RC frames with masonry infill with and without a soft storey are having the highest value of base shear than the bare frame. Due to the presence of infill wall the seismic behavior of frame structure to a large extent stiffness of structure increases.

A. Koçak A et. al. (2013) studied on "Effect of infill wall and wall openings on the fundamental period of RC buildings", in this study; the contribution of infill walls to the stiffness of the structure was analyzed in reinforced concrete framed and load-bearing buildings. Also, the effect of openings in the infill walls to stiffness was examined. The author concluded that, the fundamental period of the structure and increase in the stiffness as can be seen from the studies above. On the other hand, some openings in the infill wall like a window, door openings affect the infill wall stiffness and increase the fundamental period of the building. Also, it is observed that some analytical equations in-country regulations and codes are mostly suitable for the structures close to the frame system with low infill wall stiffness.

3. CONCLUSION

From the analysis, seismic performance of RC framed buildings with and with-out infill wall observed the results of the change in the time period, base shear, and story drift of the buildings for all the structures. When compared the bare-frame model and equivalent diagonal strut models results for seismic load analysis observed that without considering the stiffness of infill frame in bare model stiffness of the building is very less where are the strut models which considered the stiffness of infill as strut has more stiffness of the building.

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