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STUDY OF OPEN GROUND STOREY RC MULTISTOREY BUILDING CONSIDERING STRUT AND BRACING SYSTEM

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Abstract

Earthquake is an unavoidable natural disaster which causes large damage to the property and the lives. Most earthquake-related deaths are caused by the collapse of structures. Day by day demands of high-rise structures increases with the increase in population. However, to fulfill the need of parking spaces ground story of building is utilized which makes building more vulnerable under lateral loads. Past earthquakes show that the most of the damages in open ground storey are occurred in the ground storey columns and is called 'soft-storey collapses', 'store mechanism' or column mechanism'. These are due to the sudden lowering stiffness or strength in the open ground storey as compare to other infill stories. To prevent the soft storey failure IS 1893:2002 recommends a multiplication factor of 2.5. But the multiplication factor proposed by IS 1893:2002 and selected international codes are not consistent. In this present the study of RCC strut and different braced model have been done.

Keywords: *RCC; Seismic Analysis, Multistorey; Strut; Bracing.*

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1. Background

Earthquakes are one of the most devastating of all-natural hazards and are the most powerful natural disasters which are unavoidable. The hazards associated to earthquakes are referred to as seismic hazards. Most earthquake-related deaths are caused by the collapse of structures. Day by day need of space became very important in urban areas due to increase in population especially in developing countries like India. However, to fulfill the need of parking spaces ground story of building is utilized which makes building more vulnerable under lateral loads. These types of buildings having no infilled walls in ground storey, but in-filled in all upper stories, are called Open Ground Storey buildings. Many apartments or building constructed are falls in this category.

1.1 Open Ground Storey

The Open Ground storey becomes an essential part to cater the need of parking. Generally, building constructed with infill walls in upper story and ground storey has no infill walls are called open ground storey (OGS) buildings. Typical open ground storey building Infill walls in the upper storeys increases the stiffness of the building. Due to increase in the stiffness of upper storey, the base shear demand on the building increases in the open ground storey building. Both the frames and infill walls take the increased base shear in all upper storey of the building. However, infill walls are not present at ground story the increased base shear is resist entirely by the columns of the open ground storey building.

2. Literature Review

Liauw and Kwan [1], the nonrecursive behavior of non-integral filled frames (in which the fill and the frame are not linked together) is studied both experimentally and analytically. In theoretical studies, the finite element method is used and the non-requirements of the material and structural interface are taken into account. It has been shown that the redistribution of stresses against collapse is important, and that the resistance of a non-integral filled frame depends largely on the flexural strength of the frame. The effects of adjustment and initial reduction of friction at the interface are also theoretically studied. In addition, an empirical formula for estimating the homogeneous width is proposed.

Asteris [2], in a supplementary document, presents a new finite element technique for the analysis of brick-filled flat frames under lateral loads. In the present work, the effect of opening of masonry filling panel has been investigated in reducing the stiffness of the filled frame through this technique. A parametric study has been carried out as the criteria for opening the floor and percentage of masonry filling panel for the case of a floor compartment frame. The investigation has been completed in whole or in part in the case of multi-story frames. In particular, the redistribution of the effects of the action of the filled frame under lateral load has been studied. It has been shown that the redistribution of the shear force is severely affected by the presence and continuity of the filling panels. The presence of filler, in general, accounts for the lack of shear forces in the frame column. However, in the case of a soft floor-filled frame, the shear forces acting on the columns are much higher than those obtained from bare frame analysis.

Asteris [3], in this article, proposed a realistic criterion to describe the separation between frames and padding, to better simulate the complex behavior of filled frames under lateral loads. The basic feature of this analysis is that the fill / frame contact length and contact voltage are approximated as an integral part of the solution, and are not considered ad hoc. To implement the method, a specific computer program has been developed for the analysis of filled flat frames, under lateral load. Using this method, we have investigated the response of single-bay to single-bay masonry filled RC frames, under lateral loads at the beam level. Great magnitude of variation in contact length between padding and different frame members is clearly shown.

Asteris et. al., [4], this paper presents an evaluation of the behavior of the filled frame. The feasibility of possible immediate implementation of some recent developments is examined both in the analysis and the design of the filled frame for practical design. It is now widely recognized that masonry fill panels, used in reinforced concrete (R / C) frame structures, significantly improve the stiffness and strength of the surrounding frame. However, their contribution is often not taken into account as they do not have knowledge of the compound behavior of the surrounding frame and filler panel. Currently, the Seismic Design Guidelines (EC8 - Part 3, FEMA - 440, ASCE 41–06) have provisions for calculating the stiffness of concrete filled frames primarily by modeling the filler walls as "diagonal struts". However, such an arrangement is not provided for openness-filled frames. The present study, based on the results of available finite elements, proposes analytical equations to derive the reduction factor, which is the ratio of the effective width of a diagonal strut that represents an opening with a wall with solid filled RC frames. Does. This will allow the initial lateral stiffness of the filler to be calculated when an opening is present. The validity of the proposed equations is demonstrated by comparing our results with those performed by several researchers.

Asteris et. al. [5], the contribution at the level of the filler walls to the structural response of the filled frame structures is an important problem and many research initiatives have been investigated through experimental and numerical methods background. Consequently, the need to consider these research findings on structural performance has been recognized in the latest generation of structural performance codes. However, due to uncertainties related to the behavior of masonry at the material and structural level, these elements are generally ignored during analysis and practical structural design. They are considered openly only when it is suspected that their effect is detrimental to the overall structural response or to the behavior of individual load elements or when it is necessary to justify improvements in overall load capacity or overall structural performance. . In this document, a complete description of the various micromodels proposed for the analysis of filled frames is presented, and the advantages and disadvantages of each micropodel are described (this document follows our recent review article on the state of the art of mathematical cormodels .Filled frames, thus completing macro and micrometer observations in the field). Practical recommendations for the implementation of various models are also presented.

Desai et. al., [6] The study includes the comparison of base shear of G+3 RCC structure. The calculation of static base shear for a structure with masonry and without masonry in different zones are carried out and then compared. The comparison of fundamental natural period of a structure in different zones are also done. The effect of earthquake on a structure is designed by using the codes IS 1893:2002 (Part–1).

Singh and Verma [7], Infill panels are only used in RC frame structure as partition walls and as external walls. These are considered as non-structural elements and can provide with considerable stiffness to the building improving the performance under-ground motions. In this paper two methods are used to analyze the behavior of Infill walls i.e. Equivalent Lateral Force method and Response Spectrum Method. Two models are considered one without infill and another with infill. The one with infill has been modeled as an equivalent diagonal strut element using Hendry formula. Both the models are analyzed with Pushover analysis. The software used is STAAD Pro and the results obtained are compared in terms of strength and stiffness with bare frame.

Goel [8], This paper deals with the analysis of RC frame with different infill material one is AAC (Autoclaved Aerated Concrete) and the other is Conventional concrete block. This paper has used the STAAD Pro software for analysis. The methodology used in this paper is Equivalent Static Force Analysis. Comparison of these two materials with different parameters such as Base Shear, End Displacement and Deflection of frames are depicted in this paper.

Murty and Jain [9], masonry Infills contribute significant lateral stiffness, strength, overall ductility and energy dissipation capacity. With suitable arrangements to provide reinforcement in masonry that is well anchored in frame column, it is possible i=to also improve the out-of-plane response of such infills. Infills interfere with the lateral deformation of RC frame; separation of frame and infill takes place along one diagonal and compression strut forms along another. Therefore, infills add lateral stiffness to the building.

Davis et. Al., [10], most of the multi-storeyed buildings in India have reinforced concrete frames with brick masonry in the form of fillings. The use of non-reinforced masonry fill walls may not contribute to resist gravity loads, but it can significantly improve the stiffness and strength of the frame under earthquake or wind, resulting in a lower assessment of stiffness and natural frequency. is. It has been observed from experiments that the filler has energy dissipation characteristics that contribute to improve seismic resistance. In this article, two typical buildings located in the medium seismic zones of India are considered. The difference between the two buildings is that one vertical irregularity exists with the irregularity of the plane (soft floor) and the other with symmetric. The fillers were prepared using the same strut approach. Static analysis (for gravity and lateral loads), response spectrum analysis and nonlinear thrust analysis (the function of hinge properties for the beams and column sections) were performed. It has been observed that the seismic demand at the level of the soft floor is quite large when considering the stiffness of the landfill with greater shear and larger displacement of the base. However, this effect is not significant in symmetric building (without soft floor). The seismic performance was compared in the impulse analysis for the two cases. The results are described in detail in this document.

Wakchaure and Ped [11], the effect of a masonry fill panel on the response of RC frames subjected to seismic action has been widely recognized and the subject of many experimental investigations, while noting many attempts to model it analytically. Is received. In a building analysis, the walls of the filler are formulated in a similar strut approach, there are many formulas derived by researchers and scientists for strut width and modeling. The padding behaves like a compression strut between the column and the beam and the compression forces are transferred from one node to another. In this study, the effect of masonry walls on tall buildings is studied. A linear dynamic analysis is performed in tall buildings with different arrangements. For G + 9 analysis, R.C.C. The finished building is modeled. Earthquake weather is applied to the model. The width of the plane is calculated using the equivalent strut method. Several cases of analysis have been raised. All analyzes are performed using ETABS software. Base shear, floor displacement, story drift are calculated and compared across all models. The results suggest that the filling walls reduce displacement, increase the length of time and the cut of the base. Therefore, for the seismic evaluation of reinforced concrete frames at this time it is necessary to consider the effect of masonry filling.

Karemore and Rayadu [12], on the urban floor of the frame building, are usually placed open (i.e. soft floors) for parking lots or reception halls. The upper floor has brick fill panels that provide some stiffness to the upper floor of the structure, this increases the force, displacement, drift of the floor and demands for flexibility in the floor. OGS buildings (ie, open floors) usually collapse during earthquakes due to the smooth impact of the floor. Indian Standard IS 1893: 2002 allows the analysis of OGS buildings without taking into account the hardness of the landfill, but in compensation for stiffness imbalances, the growth factor 2.5 is multiplied by the shear force and bending moments. Beams and columns are calculated under bare frame seismic loads. (That is, ignoring the hardness of filling). However, many structural engineers experienced that the growth factor 2.5 OGS is not realistic for a building. The engineer believes that ignoring the stiffness of the fill leads to conservative design. This leads to the evaluation and revision of recommended growth factor code 2.5 for building open floors. The purpose of the document is to verify the applicability of growth factor 2.5 for the OGS building.

3. Conclusion

In this work, researchers' efforts through bare structure and frame structure over several decades are summarized and most commonly used. One of the main difficulties is to introduce strut and braided frames, which are universally accepted as an important influence in the response of frames in modeling structures, of the way in which the openings represent openings in strut models Absence. The open first storey building is considered as a vertical irregularly shaped building structure according to IS 1893: a 2002 analysis is required to consider the strength and rigidity of the strut, cross-braced and chevron braided and provided 2.5 s Multi-placement factor is applied. Design forces (bending moments and shear forces) in columns and beams of ground floors.

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