STUDY OF THE REINFORCED CONCRETE FRAME WITH BRICKS MASONRY

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Abstract: In the building construction, framed structures are frequently used due to ease of construction and rapid progress of work. Masonry infill panels have been widely used as interior and exterior partition walls for aesthetic reasons and functional needs. When infill walls are omitted in a particular storey, a soft storey is formed compared to much stiffer other stories. The masonry infill has been modeled by equivalent struts. Normally in structural analysis it is considered that the Equivalent Static Analysis is more conservative against ground shaking for regular structures or structures of smaller height. In this paper the behavior of reinforced concrete (R.C.) frames with brick masonry infill for various parametric changes have been studied to observe their influences in deformation patterns of the frame. The present study is also aimed at findings out the effect of soft storey on frame structures due to horizontal loading. In both cases of wind and earthquake loads, if number of bay increases, then the deflection eventually decreases. As the story level of a building frame increases, deflection due to lateral loads naturally increases due to additional lateral loads. Deflection increases linearly if the span of bay increases linearly because of linearly increased loads. Deflection for a soft storey building frame is 1.4 to 2.0 times greater than that observed excluding the soft storey effect. Deflection for R.C. frames with 5 inch wall thickness is observed 10 to 20% higher than that for frames with 10 inch wall thickness.

Index Terms **- infill, soft story, Equivalent Static Analysis, equivalent struts, Saneinejad Theory, Mainstone.**

I. INTRODUCTION

The behavior of masonry in filled frame structures has been studied in the last four decades in attempts to develop a rational approach for design of such frames. Present code of practice does not include provision of taking into consideration the effect of infill. It can be understood that if the effect of infill is taken into account in the analysis and design of frame, the resulting structures may be significantly different. Therefore, a study is undertaken which will involve the finite element analysis of the behavior of High-Rise reinforced concrete (R.C.) frame with brick masonry infill. Again when a sudden change in stiffness takes place along the building height, the story at which this drastic change of stiffness occurs is called a soft story. According to BNBC [1] a soft story is the one in which the lateral stiffness is less than 70% of that in the story above or less than 80% of the average stiffness of the three stores above. The infill components increase the lateral stiffness and serve as a transfer medium of horizontal inertia forces. From this conception the floors that have no infill component has less stiffness regarding other floors. The major objectives of the research work are as follows:

• To find out the influence of masonry infill wall panel in Reinforced Concrete framed Structures in terms of deformation.
• To study the behavior of frame with brick masonry infill by modeling masonry infill as a diagonal strut. The Finite Element package ANSYS 5.6 [2] is to be used for the development of the model.
• The present study is aimed at findings out the effects of various parameters on frame structures due to horizontal loading.

II. METHODOLOGY

Finite element technique is a powerful and versatile tool for the analysis of problems of structural and continuum mechanics. In this study a linear finite element analysis has been performed using the package ANSYS to predict the inelastic behavior of R.C. high-rise frame with brick masonry infill. The finite element analysis of infilled frames includes modeling of beams and columns, modeling of masonry infill, calculations of wind and earthquake load according to BNBC code, generation of finite element mesh with infill. Finite Element Discretization The ultimate purpose of finite element analysis is to predict mathematically the behavior of actual engineering system. In complete modeling, BEAM44 3-D Elastic Beam element has been used to represent beams and columns. LINK10 3-D spar element has been used to model masonry infill as a diagonal strut against lateral load. This model has comprised all nodes, elements, material properties, geometrical properties, boundary conditions and other features that have used to represent the physical system. 2-D analysis has performed in this study. Since the analysis has been based on nonlinear elastic material response, it provides the information about the nature of stress distribution and deformation rather than the ultimate behavior of the structure. For appropriate modeling of R.C member two types of elements, one for concrete and other for reinforcement .

- Effect of number of story

In this analysis, a 3-bay building frame of 12 ft bay length has been used and analysis has been done for both wind and earthquake loads. As the no. of story level increases, there are additional lateral loads added for increased story level. As a result, the maximum top deflection of the frame increases gradually. Comparison of deflections of the frame for different conditions (without soft story effect/ with soft story effect) and for different no. of story have been graphically.

- Effect of various spans of bay (in both parallel and perpendicular to lateral loads)

In this analysis, a 10-story 3-bay building frame has been used and analysis has been done for both wind and earthquake loads. As span of bay increases in both directions, the lateral wind load increases at every story level because of contact surface of wind increases. As a result, deflection increases. Similar behavior appears for lateral earthquake loads because of dead loads of the structure increases with span of bay. So, the maximum top deflection of the frame increases gradually. Comparison of deflections

of the frame for different conditions (without soft story effect/ with soft story effect) and for different spans of bay has been graphically

- Effect of various spans of bay (in parallel to lateral loads)

In this analysis, a 10-story 3-bay building frame of constant bay size in perpendicular to lateral loads has been used and analysis has been done for both wind and earthquake loads. The lateral wind load remains same at each story level as the contact surface remains same. But as the bay size changes in parallel to wind direction, stiffness of the frame changes accordingly. But in case of earthquake, loads increases as the dead load of the frame increases with span of bay. Comparison of deflections of the frame for different conditions (without soft story effect/ with soft story effect) and for different spans of bay has been graphically

Comparison of deflections for two different theories of equivalent strut method

Case, two different theories of equivalent strut method that is Mainstone theory and Saneinejad theory are applied. The maximum top deflections of the frame for these two different methods are quite similar. Comparison of deflections of the frame for different conditions. In this analysis, a 10-story of 20 ft bay span building frame has been used for various no. of bays.

III. CONCLUTIONS AND RECOMMENDATION

The present study may be regarded as a preliminary work for an extensive research work on the effect of various parameters on in filled frames due to horizontal loading. Therefore, some guidelines for future theoretical and experimental study on this topic may be recommended. The recommendations are:

• Effect of dynamic loading on the behavior of masonry in filled R.C frame may be investigated.

• Instead of brick masonry infill other types of infill such as concrete block can also be considered for such type of investigation.

• This analysis may be performed by using nonlinear property of brick material. A cost-benefit analysis may be carried out to find out the relative economy that may be achieved if infill is considered as structural element.

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