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Effect of Soft Story on High Rise Building

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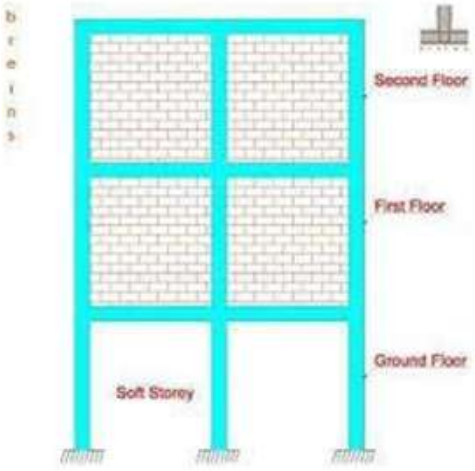
Abstract— *As the country develops the population density and demand for land increases, it is important to provide open ground story in both type of buildings that is commercial and residential. These open story's without brick infill reduce the stiffness of the load carrying member and progressive increase in load exhibit higher stresses in the load carrying member and these members columns fail as the plastic hinges are formed on predefined positions. Therefore, the collapse of this soft story during earthquake has caused structural engineer store think the design of a soft story. The present analytical study finds out some provisions to soft story which can reduce the damage during earthquake. In this project we are modelling a G+12 RCC framed structure of a commercial building to see the effect of high rise building under the behavior of earthquake and the effect of soft story which is to be checked. Analysis of building is to be done using ETABS, Soft story check is to be done on ground floor, fourth floor and eighth floor.*

Keywords— Stiffness, Displacement, Natural time period, Soft story.

I. INTRODUCTION

Reinforced concrete frame buildings are becoming progressively common in India. Many RCC buildings constructed in having a feature open the ground level story for the purpose of parking, i.e. partition walls are not provided in between the columns in the ground story. Soft story is the one which the lateral stiffness is less than 70 percent of that in the story above or less than 80 percent of the average lateral stiffness of the three story above. A soft story known as weak story is a story in a building that has substantially less resistance or stiffness or inadequate ductility (energy absorption capacity) to resist the earthquake induced building stresses.



Soft story buildings are characterized by having a story that includes a lots of open area. Parking garages, for instance, are typically soft stories, as lot of open space is required Figure shows the image of a soft story. Soft story in a high rise building play an important role on its seismic performance. At the soft story level, there is a discontinuity in the rigidity of the structure due to lack of infill walls or due to variation in floor height. It is this continuity which is the cause of structural failure of multi stored buildings under earthquake loads. Severe structural harm suffered by many modern buildings throughout recent earthquakes illustrates the importance of avoiding unexpected changes in lateral stiffness and strength.

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Recent earthquakes that occurred have shown that an oversized variety of existing reinforced concrete buildings square measure at risk of injury or maybe collapse throughout a powerful Earthquake. whereas injury and collapse because of soft story square measure most frequently discovered in buildings, they can also be developed in alternative kinds of structures. The lower level containing the Concrete columns behaved as a soft story in this the columns were unable to produce adequate shear resistance throughout the earthquake.

II. OBJECTIVE

1. To study the behavior of soft story under seismic effect.
2. To study the failure of the structure due to earthquake.
3. To check for soft story effect.
4. To analyze the Reinforced concrete frame of G+12 having soft story at different levels.
5. To study the provision to soft story in seismic analysis of RCC building.

III. PROBLEM STATEMENT

Many building structures having soft stories, suffered major structural harm and collapsed within the recent earthquakes. Massive open areas with less infill and exterior walls in ground floor compared to higher floors are the reason behind damages. In such buildings, the stiffness of the lateral load resisting systems at those stories is kind of less than the stories above or below. During an earthquake, if abnormal inter-story drifts between adjacent stories occur, the lateral forces cannot be well distributed along the height of the structure. This situation causes the lateral forces to focus on the story having massive displacement.

IV. METHODOLOGY

1. Modelling a G+12 RCC framed structure of a commercial building to see the effect of high rise building under the behavior of earthquake and the effect of soft story which is to be checked.
2. Analysis of building is to be done using ETABS 17
3. Structure is considered in Mumbai region.
4. Design parameters such as response factor, importance factor are also considered as per zone III.
5. The natural period of the building is calculated by the expression, given in IS: 1893-2016, thus, the natural periods for all the models in this method is the same.
6. The lateral load calculation and its distribution along the height is done as per IS: 1893-2016
7. Soft story check is to be done on ground floor, second floor, fourth floor and eighth floor.
8. The analysis is to be done using equivalent static method.
9. Using the software, the story displacement will be found by using ETABS 17 where forces are assumed.
10. Based on the force and displacement, stiffness is calculated for respected levels where we are going to check soft story
11. Manual calculation of all the structural parameters is to be done using codal provision. Comparison of manual results and analytical result is to be done.

V. IS CODE PROVISIONS

Alternatively, the following design criteria are to be adopted after carrying out the earthquake analysis. Neglecting the effect of infill walls in other story's:

1. The column and beams of the soft story are to be designed for 2.5 times the story shears and moments calculated under seismic loads specified. IS 1893:2002 (CLAUSE NO: 7.10.3)
2. Besides the columns designed and detailed for the calculated story shears and moments, shear wall placed symmetrically in both directions of the building as far away from the centers of the building as feasible to be designed exclusively for 1.5 times the lateral story shear force calculated as before. IS 1893:2002 (CLAUSE NO: 7.10.3)

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