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Comparative Study on Seismic Analysis of Multistorey Building Using STAD Pro - A Review

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Abstract: This literature review provides a comprehensive analysis of the behavior of buildings with concave corners in earthquake-prone areas. The study emphasizes the impact of irregularities in building planning, particularly in concave corners, on the structural performance during seismic events. Findings from various research studies highlight the necessity for detailed and comprehensive analyses, including both linear and non-linear dynamic analyses, to accurately understand the behavior and response of such structures. The research underscores the significance of regular building configuration to enhance earthquake resilience, especially in regions susceptible to seismic activity. Buildings with concave corners are found to be more vulnerable to earthquake damage compared to structures with regular configurations. Additionally, larger structures and longer overhangs are shown to result in increased stress and pressure on the reentrant corner region. Overall, the literature review emphasizes the importance of further research in the field of concave corner irregularities to develop effective seismic design and mitigation strategies. A deeper understanding of the behavior and response of buildings with concave corners will contribute to the development of safer and more resilient structures in earthquake-prone areas. Comprehensive and advanced analyses are recommended to accurately assess the performance of such buildings and to establish guidelines for their proper design and construction.

Keywords: Earthquake-prone areas, Structural performance, Irregularities in building planning, Seismic design & Linear and non-linear dynamic analyses

I. INTRODUCTION

The complexity of housing and business has changed in recent years, compared to years ago. In the past, residential and commercial buildings were mostly rectangular and thus followed the traditional exterior [1]. As technology develops, these models now have many shapes and many different features. These irregularities include, but are not limited to, mechanical discontinuities, diaphragm discontinuities, torsion effects, and concave angles (ASCE 2010) that make it difficult to comply with lateral load requirements [2]. These complex diaphragms require more in-depth analysis to determine the ultimate lateral load. In this study, only the earthquake resistant building problem was studied [3].

A. RCC Building

Historically, before the twentieth century, even today's structures, structures with concave corners were seen to be severely damaged after loads such as earthquakes. After the 1923 Kanto Earthquake, the 1925 Santa Barbara Earthquake, the 1964 Alaska Earthquake, and the 1985 Mexico City Earthquake, damage was evident in the angle of the building [4]. In some of these major events, the damage was first observed in the concave lines and then spread to other parts of the building. The exterior damage to the roof diaphragm and upper floors of the Mexico City Telecommunications Ministry building after the 1985 earthquake is shown in Figure

Fig.1:Damage to Reentrant corner and Upper stories of the Ministry of Telecommunications Building in Mexico City after the 1985 earthquake [4].

Now there are many different ways to create models with concave corners. One way is to consider the different wings of the model independently and separately and analyze each one. Treating the wings independently and separately simplifies the whole structure and makes the analysis more. In addition, in this case, each wing must be able to support itself under vertical and lateral loads [5].

II. LITERATURE REVIEW

A. General

This section reviews the different documents and briefly mentions their functions to introduce other functions. This study is about back row and other earthquake resistant buildings.

B. Literature Review

Agarwal, P. et al. showed that although damage to corners after external events has been recorded for more than a century, research to better understand and determine the magnitude of forces at corners has only been done in the last two decades. As it is difficult to determine the magnitude of the force analytically, as mentioned earlier, models are designed and tested in wind tunnels or shaking tables to study forces at concave corners.

Ahmad J. Durrani et al. Investigation of the Behavior of Designed Light Frame Wooden Structures Under Lateral Loads. Part of the research is figuring out how the diaphragm works with concave angles. An equal load is applied to the structure using air at the edge of the outer slab. Within the scope of the investigation, one of the weight tests was performed. Check the concave corner of the sample after the final load test. It has been reported that no damage has occurred. They concluded that if the angle of the diaphragm is less than 1, it can withstand side loads without end beams.

Akshay Nagpur et al. Based on the scientific study of building spans and offsets, he concluded that the angles of their structures are less than 1.0 m. Their results confirm some of the information presented in the study. The authors at Caltech's Seismology Lab conducted a study of damage to a 19-story irregular steel-frame building that was affected by a nearby earthquake. The aim of his study is to compare 3 19-storey irregular steel frame buildings with performances of buildings that do not comply with wind drift constraints with those that provide. Two of the structures have concave corner irregularities, and the third has planned torsional irregularities. Using UBC97, the authors assume that all samples are located in the 4th seismic zone with the same soil type and choose three different types of ground data to compare the results. It concluded that, whether or not wind restrictions were complied with, buildings would not meet the life safety standards for existing buildings specified by FEMA-356. He concluded that his findings were similar to those found in samples after the 1994 Northridge earthquake. Although the tension levels of the corners were not part of his main research, he suggested them. The authors concluded that stress is concentrated in large areas, especially near the corner. The results did not confirm the stress increase at the corner because the increased stress at the corner was found in only one of the two models that included the corner. A more rigorous and detailed analysis is required to eliminate the possibility of stress at concave corners.

Amin Alavi, *et al.* studied the effects of wind-induced pressure on buildings of various geometries. The aim of their research is to determine the effectiveness of regular building structures where the wind pressure distribution changes according to the wind direction. The purpose of Section study is to provide information about the distribution of wind pressure in different sizes of wind directions and the coefficients of average and maximum pressure.

Anil K. Chopra *et al.* work consisted of two L-shaped and two T-shaped models of different heights and lengths. The high threads are happily laid out in different patterns, scattering all over the pattern. The model was tested using wind tunnels to simulate the real world it would encounter if it were in an open area. In their results, they stated that, unlike only rectangular models, symmetry was observed in the vertical direction of the wind pressure coefficient distribution, which is not found in irregular models. Instead, they noted that when the angle of the structure is reached, the pressure increases due to the effect of airflow and subsequent cessation of airflow. A study by Babak Rajaee Rad et al. He concluded that the size of the pressure and the size of the stopping point depend on the size of the structure and the angle of the wind. The results of these tests concluded that the size of the entrance angle, depending on the size of the building, has an effect on the forces present in the entrance corner area. According to other regulations, if the entry angle is below a certain size, it can withstand lateral loads without being damaged.

Babita Elizabath *et al.* results confirmed past research that gave the limits for the largest entering corners a model can have, while no significant damage was found to the rotating corners on the loading side. In this study, they found that the size of the structure and the direction of the wind were directly related to the size of the stopping point and the height of the angle. The greater the height of the structure or the length of the overhang, the greater the standing area and pressure.

Although both of these studies had more suggestions about the effect of rear loading on rotating corners, they did not account for forces in the corner structure. The author addresses this issue more in his research, but concludes that his results are inaccurate and detailed methods are required to understand the cause of stress in the reentrant corner region.

Devesh P. Soni has found that regular building planning is an important issue to address for buildings in earthquake-prone areas. This article is about concave corner irregularities. For buildings with concave corners, there are many studies that consider several shapes such as L, H, T and analyze them using linear dynamic analysis. A comprehensive study of concave angles using nonlinear analysis is required.

Dhiman Basu showed that buildings with concave corners were compared with buildings with regular configuration plans and the behavior of concave corners in different seismic zones was studied by analyzing in the time history. An ordinary house with right angles is chosen. When modeling, for ease of comparison, the position of the notch pattern and the purpose of the design pattern are approximately equal. Linear and non-linear dynamic analyzes were performed. The results obtained by Divyashree . M, *et al.* for the two models are compared for maximum displacement, storey drift and modal time. Demolition buildings are more prone to change than older buildings. The baseline response curve of this model is presented to understand the difference in behavior due to inequality. In addition, the performance of built-in structures in various earthquake zones was investigated. Buildings with concave lines are more susceptible to earthquake damage and less susceptible to earthquakes. Therefore, the building must be regularly installed to withstand significant earthquakes.

III. CONCLUSIONS

The literature review provides valuable insights into the behavior of buildings with concave corners in earthquake-prone areas. Several studies have confirmed that irregularities in building planning, particularly in concave corners, can significantly affect the structural performance during seismic events. The research highlights the need for comprehensive and detailed analyses, including both linear and non-linear dynamic analyses, to understand the behavior and response of such structures accurately.

The studies emphasize the importance of regular building configuration to enhance earthquake resilience, especially in regions prone to seismic activity. Buildings with concave corners are found to be more susceptible to damage during earthquakes compared to those with regular configurations. The research also points out that larger structures and longer overhangs can lead to increased stress and pressure on the reentrant corner region.

Overall, the literature review underscores the significance of further research in the field of concave corner irregularities to develop effective seismic design and mitigation strategies. A better understanding of the behavior and response of buildings with concave corners will contribute to the development of safer and more resilient structures in earthquake-prone areas. Comprehensive and advanced analyses are recommended to accurately assess the performance of such buildings and to establish guidelines for their proper design and construction.

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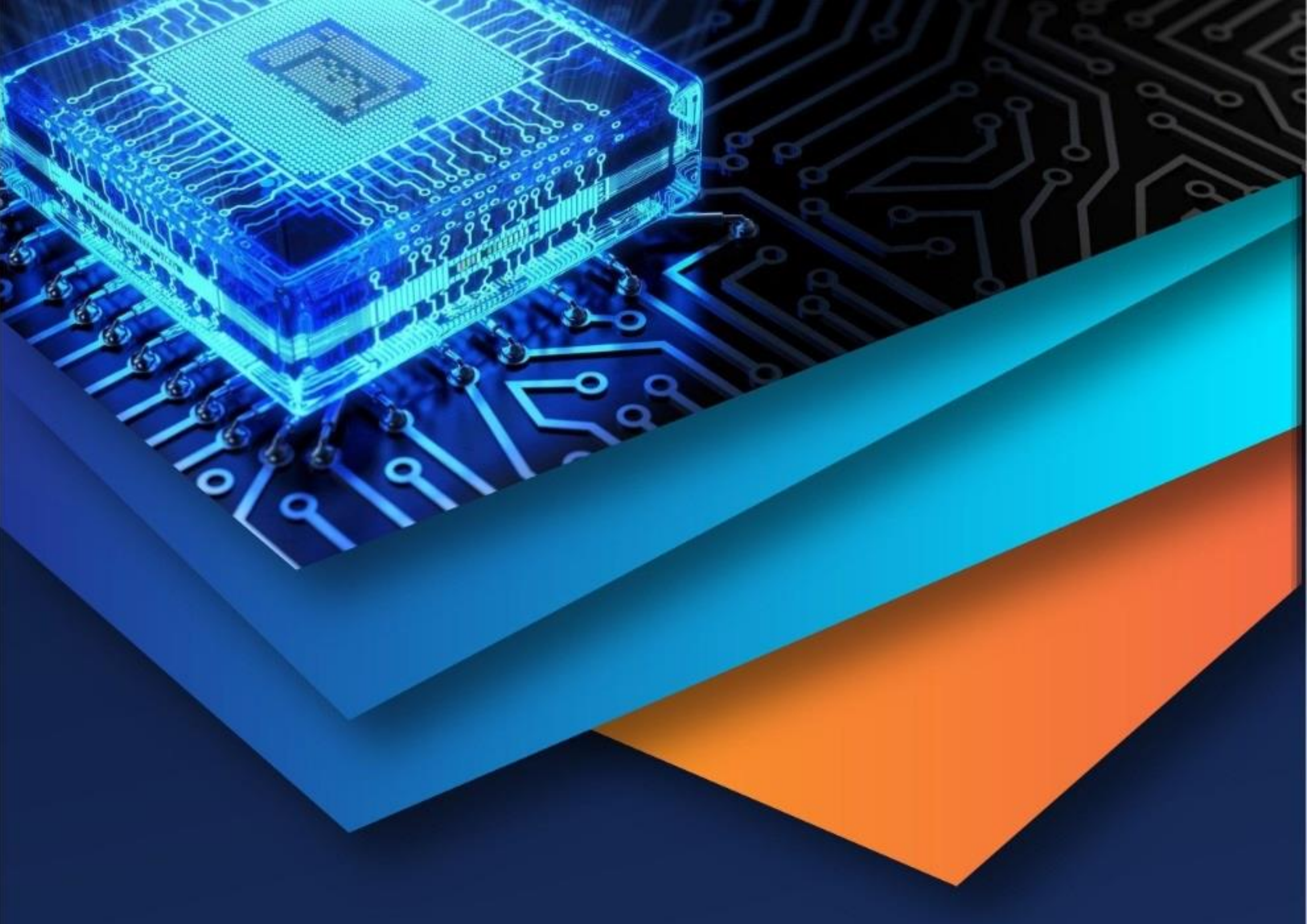

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