IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Review Paper On Progressive Collapse Analysis Of Elliptical Shell Structure

[1]Ruturaj Kesekar, [2]Shubham Pote, [3]Vipul Bhosale, [4]Abhijit Raut, [5]*Prof. Rachana vaidya*

1,2,3,4 Under Graduate Student, Department Of Civil Engineering, Alard College Of Engineering And Management, Marunji, Pune 411057

5 Professor, Department Of Civil Engineering, Alard College Of Engineering And Management, Marunji, Maharashtra, Pune India

Abstract: when one of the structural members fails, which in turn triggers the failure of subsequent structural sections, a progressive collapse will occur. Because of this, the structure will either completely or partially collapse due to its current state. Failure of a vertical structural element is the primary cause of progressive collapse in structures and typically occurs at the structure's peak. There is a risk that explosive charges, accidents, or even deliberate damage could cause the column to fail and fall. To carry out the analysis, first, the columns at each of the various places are removed one at a time in line with the criteria set by the General Service Administration (GSA), and then the values of the radius and the column Determination of Capacity Ratio (DCR) are calculated. According to the data, it was concluded that the column that was situated further away from the center had a greater risk of suffering from a slow and steady collapse.

Keywords: Progressive collapse, GSA, Column, Beam, Slab, DCR, Structural analysis, Element's.

1. INTRODUCTION

The design phase for the maximum forces or tension follows the first design phase for a building. However, if the load that is applied to the whole structure or one structural element is more than this service load or stress limit value, then the structure will fail or the structural element will fail. The building or any element, such as beams and columns, can fail when the load exceeds the service loads, leading to the failure of neighboring elements and the failure of the entire structure. The failure of primary vertical elements of a structure, which may fail adjoining elements, consequently, leads to a partial or total collapse of the structure. Damage to a horizontal member like a beam is less concerning than the failure of a vertical member or structural member like a column. When an impact from an impulsive load causes damage to a vertical member such as a column, the loads are transferred to other components of the member that are adjacent to or near the damaged component. If the injured element's nearby parts can withstand the increased load, then the damaged element itself will be able to withstand the load; if they are unable to, then it will not. If one of the neighboring structural elements fails a second time, the load-bearing capacity of the surrounding elements must be sufficient. If it is not, the failure will gradually get worse, which could result in many failures that will harm the structure. A reinforced concrete structure (R.C.C.) consists of various components such as columns, beams, slabs, foundations, and more. These structural members are also known as the structure's retaining elements. Although two categories of loads might affect a structure, these categories are known as continuous loads (DL) and dynamic loads (LL). Both live and dead loads, such as the weight of occupants, furniture, and other objects, as well as wind and seismic loads, affect the structure. self-weight of the structure is also known as the weight of permanent structural members like a column beam etc. The active load includes all other loads.

The phenomenon known as collapse occurs when an interior load-bearing section of a structure fails owing to some cause, such as an explosion or a vehicle accident, which prevents the structure or component from retaining its structural integrity.

Efforts often focused on enhancing redundancy and alternate load paths to prevent system collapse from single component failure. In reality, redundancy is just one technique for reducing a system's vulnerability to disproportionate collapse. It's feasible that in many situations, improved continuity and connectedness across the structure (which can conventions both redundancy and local resistance) together with stronger local resistance for critical components will be more advantageous than increased redundancy. By utilizing the correct combination of increased redundancy, local resistance, and connectivity, it should be possible to significantly decrease the likelihood of structures experiencing disproportionate Collapse

II. METHOD'S

2.1 Selection of Building

For analysis, we have selected two types of building plans. Here we selected an elliptical shape building for analysis.

2.2 Identification of Structural Members

The line plan of the proposed building is selected. Data is introduced in the software. If their multistoried buildings having different floor plans existed then details of odd and even floor plans are introduced for calculations. As per requirements.

2.3 Analysis of Data

After data information is provided to the software, it analyzes data and gives the following information

Support reaction, Shear force, bending moments, torsional moment data, drift and overturning moment at each floor level. The critical members of the structure are found out

2.4 Identification of Critical Member

From the Analysis data, the critical members of the structure are found out.

2.5 Safe Condition is calculated using E-Tab

After knowing the critical member, Removal of such members and progressive collapse methods are initiated and safe condition is obtained for the given plan.

III. DESIGN AND MODELLING

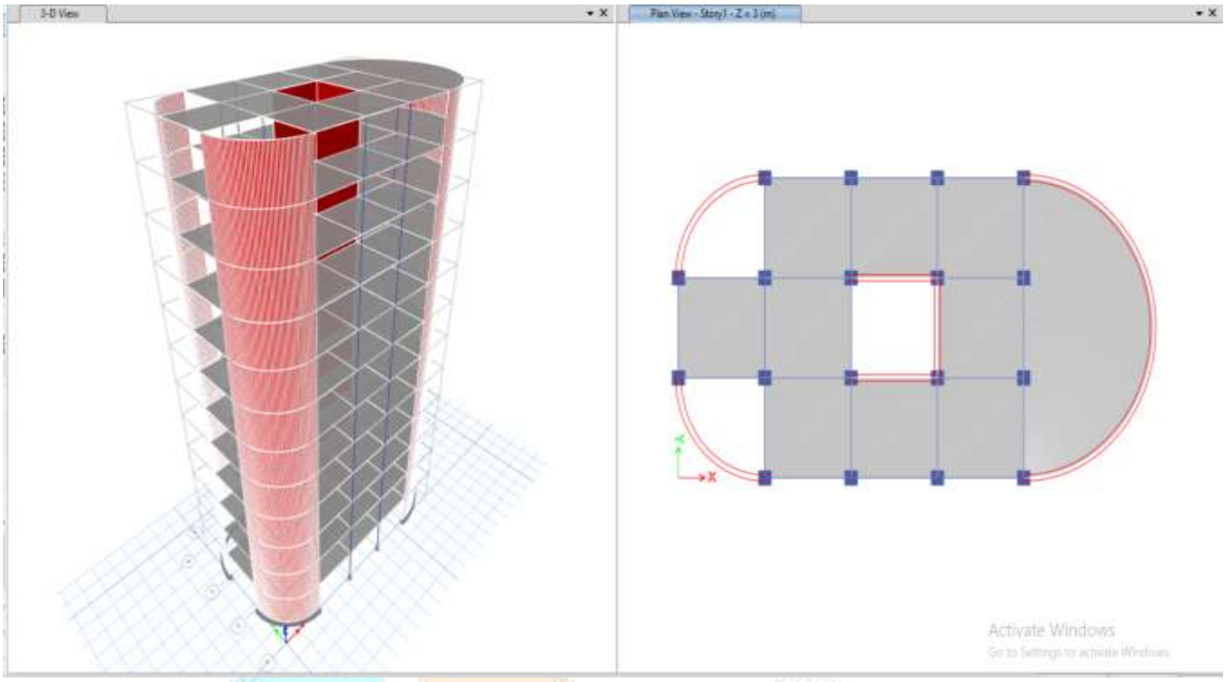

Figure 1: 3D Plan View of Elliptical Model

IV. APPLICATION OF E-TAB

4.1 Structural Analysis of elliptical model

E-tabs allow engineers to analyze various types of structures, including buildings, bridges, and towers, under different loading conditions such as wind, seismic, and live loads.

We are analyzing the following points from the elliptical model.

- Storey stiffness of elliptical model
- Support reaction of elliptical model
- Maximum shear force at each floor level.
- Maximum drift at each floor level.
- Maximum displacement at each floor level.
- Maximum overturning moment at each floor level.

4.1 Design Capabilities

The software provides tools for designing structural elements such as beams, columns, slabs, and footings according to relevant design codes and standards

4.1 Modeling

Engineers can create detailed 3D models of structures, including the ability to incorporate various materials and geometric configurations.

4.1 Report Generation

The software can generate comprehensive reports detailing the structural analysis and design results, which can be used for documentation and communication purposes.

4.1 BIM Compatibility

Some versions of E-tabs support Building Information Modeling (BIM), allowing engineers to integrate structural design data with other disciplines involved in the building design process.

V. ADVANTAGES AND DISADVANTAGES

5.1 ADVANTAGES

5.1.1 Efficiency

E-tabs streamline the structural analysis and design process, saving time and effort for engineers compared to manual methods.

5.1.2 Accuracy

The software employs advanced algorithms and analysis techniques, resulting in more precise calculations and design outcomes.

5.1.3 Versatility

E-tabs can analyze and design a wide range of structural elements and systems, from simple beams and columns to complex buildings and bridges.

5.1.4 Integration

It integrates well with other software platforms commonly used in civil engineering, such as CAD and BIM software, facilitating seamless data exchange and collaboration.

5.1.5 Visualization

The software provides visualization tools that allow engineers to view and understand the behavior of structures in 2D and 3D, aiding in decision-making and communication with stakeholders.

5.2 DISADVANTAGES

5.2.1 Learning Curve

E-tabs can have a steep learning curve for beginners, requiring time and effort to master their features and functionalities.

5.2.2 Cost

The software can be expensive, especially for smaller firms or individual engineers, which may limit its accessibility.

5.2.3 Complexity

While E-tabs offer powerful capabilities, their complexity can sometimes lead to errors or misinterpretations if not used correctly or if the input data is inaccurate.

5.2.4 Hardware Requirements

Running E-tabs efficiently may require high-performance hardware, which could be a constraint for some users or organizations with limited resources.

VI. CONCLUSION

This study examines the process of progressive collapse of a large-span single-layer latticed shell structure, including both shell and elliptical shell structures. The findings indicate that the building eventually collapsed under a load that was seven times greater than the force of gravity. The mid-span zone on the left side of the structure is the weak zone of the structure, where the first failure members of the structure and the nodes of maximum displacement are located, according to an analysis of dynamic response processes such as the vertical displacement of the nodes and the failure sequence of the members. Here is where there is a significant change in the reticulated shell structure's curvature. Starting from the position of the first member to fail, the failure sequence of members is primarily separated into two orientations.

VII. ACKNOWLEDGEMENT

While working on this paper to its final form, I would like to thank those who contributed to this research. "It is my pleasure to express my gratitude to all of them." I am indebted to my guide **Prof. Rachana Vaidya** and the head of the department **Prof. Rachana Vaidya**. It is quite difficult to express my gratitude in a few words. Last but not least; I am thankful to all my professors and non-teaching staff members in the department whose help provided me an advantage in completing the project. I would like to express my gratitude for the moral support of my parents and friends. I am thankful again to all the people who helped me with this paperwork.

VIII. REFERENCES

[1] Peiqi Ren, Yi Li, Hong Guan , Xinzheng Lu, Elsewhere, May 2022. Progressive collapse resistance of two typical high-rise RC frame shear wall structures.

[2] Jing Cui, Gang Hu, Yang Zhan and Rui Pang, MDPI, 10 November 2022. Investigation on Load Path of a Latticed Shell Structure under Localized Fire Based on Member Sensitivity.

[3] Mohammad El-Hajj Diab, André Orcesi, Cédric Desprez, Jérémy Bleyer, HAL Open Science, 16 February 2021. A Progressive Collapse Modeling Strategy Coupling The Yield Design Theory With Non-Linear Analysis.

[4] Ahmad Shehada, Said Elkholy, Bilal El-Ariss, Proceedings Of The 6th World Congress On Civil, Structural, And Environmental Engineering (CSEE'21) Virtual Conference – June 21. Numerical Progressive Collapse Analysis Of RC Framed Structures.

[5] Mehran Yaghoubi, Reza Aghayari, Seyed Shaker Hashemi, Journal of Rehabilitation in Civil Engineering, January 2021. Investigation of Progressive Collapse in Reinforced Concrete Buildings with Slab-Wall Structural System.

[6] Shen Li, Zhiqiang Hu and Simon Benson, Unpaid Journal 2021. Progressive Collapse Analysis of Ship Hull Girders Subjected to Extreme Cyclic Bending.

[7] David Stephens, Dennis Lamb, John Forthc, Jianqiao Yed, Konstantinos Daniel Tsavdaridisc, Unpaid Journal, 2020. An Evaluation Of Modelling Approaches And Column Removal Time On Progressive Collapse Of Building.

[8] Pouya Kaafi, Gholamreza Ghodrati Amiri, Journal Of Structural Engineering And Geotechnics, 10(2),1-8, Summer & Autumn 2020. Investigation Of The Progressive Collapse Potential In Steel Buildings With Composite Floor System.

[9] Haitao Zhou,, Yigang Zhang, Feng Fu, And Jinzhi Wu, Materials 2020. Collapse Mechanism Of Single-Layer Cylindrical Latticed Shell Under Severe Earthquake.

[10] Gui-bo Nie, Chen-xiao Zhang, Xu-dong Zhi, Jun-wu Dai, Science Direct, 4 May 2019. Collapse of the single-layered cylinder shell with model experimental study.