



Review Paper On Progressive Collapse Analysis Of Circular Shell Structure

¹Ruturaj Kesekar, ²Shubham Pote, ³Vipul Bhosale, ⁴Abhijit Raut, ⁵Prof. 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 411057

Abstract: Progressive collapse is the propagation of initial failure from one component to another, ultimately leading to the complete collapse of a structure. "It is due to vehicle impacts, fires, earthquakes, and other natural or human-made hazards "Collapse leads to huge proportions of inappropriate triggers in the structures which make structures unequipped for withstanding loads and it prompts the collapse of the structure. The study displays the use of FEM-based software (ETABS) to analyse the special moment resisting frame of a 5-story building in Zone V as per GSA guidelines. It involves linear dynamic and non-linear analysis of the medium soil. The calculation of story drift and story shears is essential for determining the potential for the progressive collapse of a structure. It is seen that the outcomes from non-linear static examination are substantially more significant than straight powerful investigation.

Keywords: *Progressive Collapse, Vertical Structure, General Service Administration, Determination of Capacity Ratio, Structural Members.*

I. INTRODUCTION

The structural integrity of buildings is paramount to ensuring the safety of occupants and minimizing damage in the event of unforeseen circumstances. However, buildings are susceptible to various catastrophic events, including natural disasters, accidents, and intentional acts of violence, which can lead to progressive collapse – the collapse of a significant portion of a structure due to the failure of a smaller part. This phenomenon, often disproportionate to the triggering event, presents a critical challenge in structural engineering. The study of progressive collapse gained significant attention following the tragic Ronan Point collapse in 1968, prompting a reevaluation of building design practices to prevent such occurrences. Efforts focused on enhancing Certainly, alternative load paths, and local resistance to mitigate the risk of progressive collapse. However, the effectiveness of these measures varies, and ongoing research seeks to refine design strategies and preventive techniques. This thesis investigates the behaviour of structures under progressive collapse scenarios, with a focus on analyzing simple connections and evaluating the dynamic effects of unexpected structural element loss. Utilizing numerical simulations and analytical approaches, the study aims to enhance understanding of structural responses to abnormal loading conditions and develop effective strategies to increase structural integrity. The methodology involves selecting building models, identifying critical structural members, and conducting progressive collapse analyses using software tools like ETABS. By studying circular and circular building designs, the research aims to provide insights into the performance of different structural configurations under progressive collapse scenarios. Through case studies and literature reviews.

The paper explores existing research on progressive collapse, highlighting key findings, challenges, and areas for further investigation. Additionally, the future scope of structural analysis software like ETABS in civil engineering is discussed, emphasizing potential advancements in simulation capabilities and collaborative features. Ultimately, this thesis contributes to the ongoing efforts to mitigate the risk of progressive collapse in structures, informing design practices and enhancing the resilience of buildings against unforeseen events. The R.C.C. Structure is made up of several components like Footings, Columns, beams, slabs, retaining walls, etc., and so on. These structural factors are also appertained to as the structure's sustaining rudiments. Although there are primarily two categories of loads that might affect the structure, these categories are known as dead loads and live loads. Both self-loading and active load, which include the weight of moving people, furniture, and other objects, as well as wind load and seismic load, influence the structure. The active load includes all other loads "Collapse is a phenomenon that occurs when a load-bearing section of a structure fails due to factors such as an explosion or a vehicle accident, causing the structure or component to lose its structural integrity."

II. PREVIOUS RESEARCH

In the past, some structures were designed to resist normal loading conditions to abnormal loads. This was the inherent strength and continuity of most traditional forms of engineered construction. Recent advancements in building materials, innovative framing systems, and improved analysis techniques have led to structures with a significantly reduced margin of safety. Structures with minimal reserve capacity may not be able to withstand abnormal loading conditions. While certain construction types are more prone to progressive collapse, it has been observed that this type of failure can happen in almost any kind of construction. It is unsafe to assume that a structure designed for normal conditions will be able to handle abnormal or accidental load conditions.

2.1 The Approaches For Reducing The Risk Of Progressive Collapse May Be Categorized As Follows

1. Event Control.
2. Indirect Design.
3. Direct Design.

2.1.1 Event Control

In these collapse we are preventing, avoiding or protecting against incidents that could lead to such a progressive collapse. However, this approach does not enhance the structure's inherent resistance to progressive collapse and depends on factors beyond the designer's control, so its application may be quite restricted.

2.1.2 Indirect Design

Indirect design is utilized to enhance resistance against progressive collapse by specifying a minimum level of strength, continuity, and ductility.. The inclusion of tie forces for strength and continuity in a building code is beneficial for a standard structure, as long as the requirements are adequate to establish an alternative load path in case a section of the structure fails.

2.1.3 Direct Design

During the design process, direct design explicitly considers a structure's resistance to progressive collapse and its ability to absorb damage. The two primary methods of direct design are the specific local resistance method and the alternate approach path method. The first method approach to offer enough strength to withstand a high-level force or external forces.

The alternate path method focuses on how a structure behaves after damage, regardless of the cause. It relies on continuity and ductility to redistribute force within the structure, as opposed to the specific local resistance approach.

III. RESEARCH STRATEGY

Progressive Collapse Analysis Using (E-TAB)

3.1 Identify Problems

Study the characteristics of progressive collapse and determine the analysis approach. The necessary theoretical basis will be established by a comprehensive literature review.

3.2 Theory Review and Procedure Definition

Modify the identified theories for analyzing progressive collapse, including geometrical and material nonlinearities, stress stiffening, stiffness variation theories, etc. This procedure includes the selection of stress, strain, buckling, etc. that might be applied to progressive collapse analysis

3.3 Numerical Approaches and Computer Code Review

Review and assess the analytical capabilities of commercial computer codes for their suitability to apply reviewed and selected theories for simple and advanced structural models. This assessment will enable one to define the items that should be selected and modified in such analyses, and how to apply them, and also for progressive collapse analysis.

3.4 Modify and Develop Numerical Code

Necessary modifications of commercial computer codes will be developed, examined, and implemented. We will develop new numerical procedures if necessary.

3.5 Validation

The computer codes will be modified and then verified using simple structural models or hand calculations.

3.6 Parametric Study

After successfully finalizing the simple models, typical and more realistic structural models will be selected for a coefficient verification study. This parametric study can produce only the physical range of coefficients that should be assumed in progressive collapse analyses.

3.7 Structural Analysis

We are analyzing the following points from the circular model.

- Storey stiffness of the circular model
- Support reaction of the circular 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.

IV. DESIGN AND MODELLING

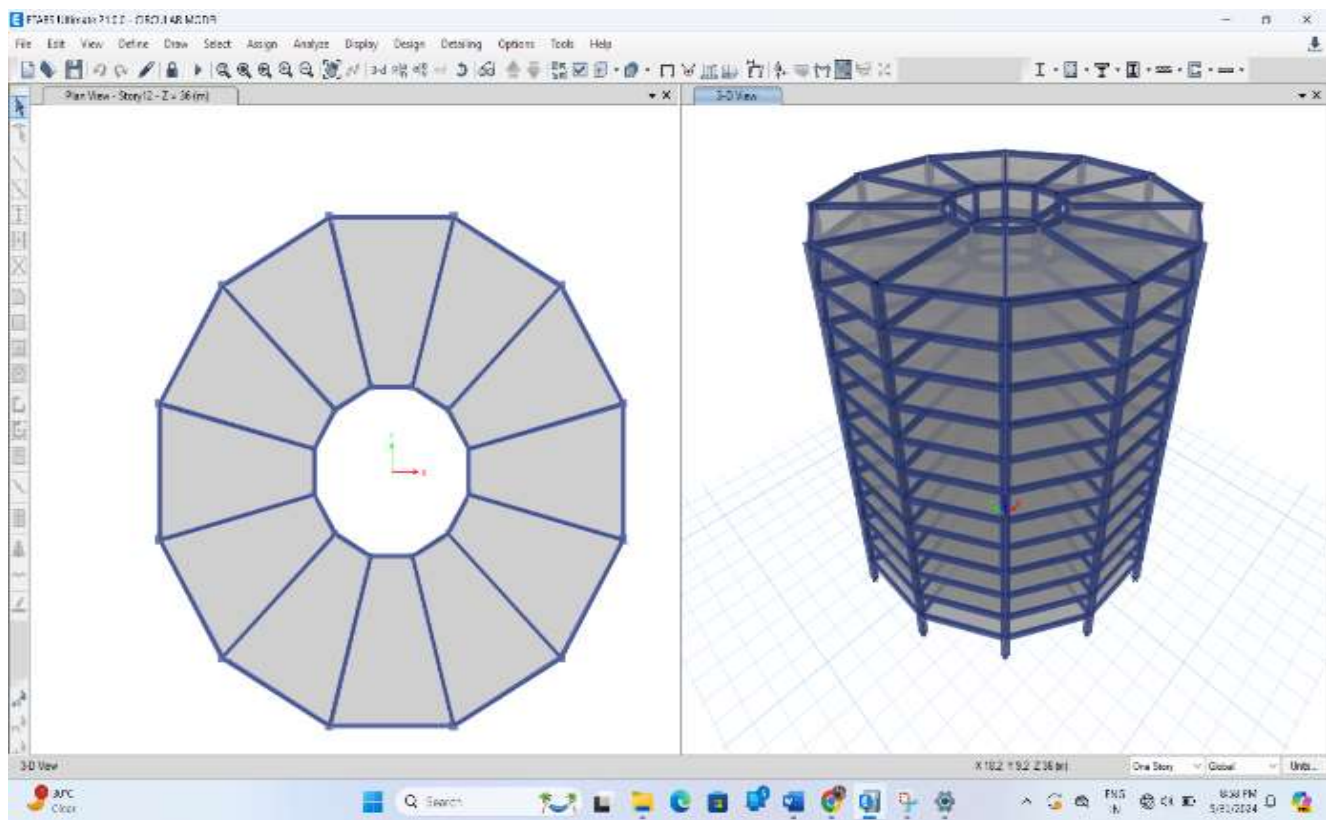


Figure 1: 3D Plan View of Circular Model

V. CONCLUSION

In conclusion, this thesis delves into the critical realm of progressive collapse in structures, emphasizing its paramount importance in ensuring the safety and resilience of buildings. By meticulously analyzing the behavior of structures under abnormal loading conditions and identifying key structural components, the study offers valuable insights into enhancing structural integrity and mitigating the risk of collapse. Through a comprehensive methodology involving the selection of building models, identification of critical members, and sophisticated analysis using tools like ETABS, the research sheds light on the performance of different structural configurations under progressive collapse scenarios. The results presented, including maximum storey displacement, drift, overturning moment, and base shear, provide significant data for assessing structural stability and safety under diverse loading conditions.

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