Seismic and Progressive Collapse Evaluation Of Rcc Infilled With Aerated Asbestos Cement Block Masonary Infill Walls - E Tab

Mrs. Amruta Shete[1], Prof. D.M.Pandit[2]
[1]Dept of Civil Engineering
[2]Assistant Professor, Dept of Civil Engineering
[1, 2] Chh. Shahu College Of Engineering Kanchanwadi, Chh. Sambhajinagar – 431005

Abstract- *Using ETABS software, this abstract describes a study on the seismic and progressive collapse evaluation of reinforced concrete (RCC) structures infilled with aerated asbestos cement (AAC) block masonry infill walls. This investigation aims to investigate the behaviour of RCC structures with AAC block infill walls under seismic loading and to evaluate their susceptibility to progressive collapse. Examining the characteristics and properties of AAC blocks commonly used in RCC construction is the first step of the investigation. These blocks are a popular option for infill walls because they are lightweight and have excellent thermal insulation properties. Understanding the behaviour of AAC blocks under various bearing conditions is the focus of this research. Next, the displacement, drift, and base shear parameters in both the X and Y dimensions are analysed for various load cases. This study seeks to determine the structural response of RCC buildings with AAC block infill walls and evaluate their overall seismic stability and safety.*

Keywords- ETABS software, Seismic evaluation, Progressive collapse, Reinforced concrete, structures RCC structures, Aerated asbestos cement (AAC) block, Behaviour of RCC structures etc.

I. INTRODUCTION

1.1 GENERAL

Progressive collapse could be a scenario wherever native failure of a primary structural element ends up in the collapse of neighboring members that, in turn, ends up in further collapse. Explosive loading became a major drawback that has got to be addressed very often. Progressive collapse happens once a structure has its loading pattern or boundary conditions modified such structural parts are loaded on far side their capability and fail. The abnormal loads initiate the progressive collapse. Modern building style and construction practices enabled one to create lighter and additional optimize structural systems with significantly lower over design characteristics. Damage to the assets, loss of life and social panic are factors that need to be reduced if the threat of terrorist action cannot be stopped. Planning the structures to be totally blast and seismic resistant is not a sensible and economically possible. But current engineering and field knowledge will enhance the new and existing building to mitigate the results of an explosions and seismic activities. In this research work progressive collapse analysis on high rise building is performed and its validation in accordance with seismic and blast loading. Response of RCC frame structure under blast and seismic loading is analysed and DCR of low rise, medium rise and high rise building for blast and seismic loading is find out. Time history analysis is done in Staad pro to analyses the different parameters in progressive collapse.

1.2 DEFINITION OF PROGRESSIVE COLLAPSE

Progressive collapse is the collapse of all or a significant portion of a building triggered by damage or failure of a relatively small component of it. Progressive collapse is a phenomenon that happens when a part of a structural frame is lost due to a severe event such as an explosion, and the structure just above region of the original damage progressively collapses. The dynamic response of the structure misevaluated after calculating the loading phenomena on various surfaces of the structure as the record of pressure time history.

1.2.1 Minimize Harm for Progressive Collapse

1. Redundancy: The inclusion of redundant load pathways in the vertical load carrying system serves to guarantee that alternative load paths are available in the case of local failure of structural components.
2. Ties
3. Ductility
4. Adequate shear strength
5. Capacity for resisting load reversals

1.3 ANALYTICAL WORK

Analytical work consists of following.

1. **Pushover Analysis**: In the Pushover analysis (otherwise called as Nonlinear Static Analysis) first the structure has been analyzed with the gravity load, Wind load and Seismic load. Then column is removed from the location being considered and Nonlinear static has been once again carried out. From the analysis results demand at critical locations are obtained and from the original seismically designed section the capacity of the member is determined. Check for the DCR in each structural member was carried out. If the DCR of a member exceeds the acceptance criteria, the member was considered as failed. The demand capacity ratio calculated from linear static procedure helps to determine the potential for progressive collapse of building and the Robust indicator of the building was also obtained.
2. **Analysis loading: Gravity** loads were calculated as per IS 875 part 1 and assigned, Wind loads were calculated as per IS 875 part 3andassigned, Seismic loads were calculated as per IS 1893, Design load Combinations and service load combinations were given as per IS 875 part 5.
3. **Robustness Indicator:** Robustness indicator (R) is defined as the ability of building to survive the local failure to withstand the loading and does not cause any disproportionate damage. **(R = Vd / Vi)** Where, Vd is the Base shear of damaged building, VI is the Base shear of intact building. The value of Robustness indicator must be equal to **1,** then the structure is able to provide an alternative load path.

1.5 Progressive collapse

Progressive collapse, a structural failure, is triggered by a localized structural injury and eventually develops a chain reaction resulting in breakdown of a major portion of the structural system. It is a dynamic event initiated by a release of internal energy due to the instantaneous loss of a structural affiliate disturbing the initial load equilibrium and thus, the structure vibrates until either a new equilibrium position is found or it collapses.

According to GSA, it is a situation where local failure of a primary structural component leads to the collapse of adjoining members that, in turn, leads to additional collapse. Hence, the total damage is disproportionate to the original cause. In case of Cable-stayed bridges, the loss of cables should be measured as a possible local failure since the cross sections of cables are usually small, and therefore provide low resistances against accidental lateral loads stemming from vehicle impact or accidental actions. The loss of cables can lead to overloading and rupture of adjacent cables. In addition, the stiffening girder shows compressive behavior and a cable loss reduces its bracing against buckling.[7]

Progressive collapse is a persistent spread and enlargement of initial local failure of structures characterized by a discrepancy between the initial failure and its resulting extensive collapse. Although great efforts have been contributed to the progressive collapse of building structures, comparably small attention has been paid to the bridge structures, especially the cable-stayed bridges. This study demonstrates modelling and analysis of a typical cable stayed bridge through a nonlinear dynamic procedure. Furthermore, the response of the structural model is discussed for multiple types of critical cable loss cases.

One of the main causes of the progressive collapse in structures are occurring failure in some elements due to loading beyond the capacity which may be initiated by unpredictable events like terrorist attacks, vehicle collision, etc. But an alternative problem, which can also contribute to consequent destruction, is failure of some critical elements because of fatigue or construction error during ultimate events. As an example, in Tacoma Narrow bridge event, the whole structure was resisting severe winds for about one week, but failure of some cables due to the unknown reason initiated and spread this

Failure to other cables and entire middle span collapsed. This predefined situation can also occur during sever earthquake, which have large vertical earthquake components. This factor has direct influence on the amount of axial loads within the cables and might cause overloading in adjacent elements to ruptured cable/cables.

Most credible codes and recommendations have many instructions to avoid progressive collapse in structures and their recommendations can be outlined in two general divisions:

1 Direct method which includes: specific local resistance method (SLR) and alternative load path method (ALP).
2 Indirect method which consists of the tie method and compartmentalization.

The most presented instructions are the SLR method, where the elements should resist against their predictable forces during their service time. On the other hand, the ALP method is more precise and extensive, but it has lacked usage due to lack of widespread knowledge. Therefore, analysis in this study will be carried out based on this method (ALP). So firstly, according to ALP method, the critical cables will be identified and then, the simulation of this removal during three earthquakes will be presented. At the end, base isolation will be introduced to the structure and behavior of the bridge with and without these instruments will be investigated.

1.6 Reasons for the Progressive Collapse

i. Unexpected events such as collision with overweight vehicles, explosions and earthquake
ii. Degradation of the structure performance including corrosion and creep iii] Improper design or wrong construction methods

1.7 Demand Capacity Ratio

The demand to capacity ratio (DCR) is used in the GSA (2003) guidelines to evaluate the results of linear analysis, and the limit of DCR values is dependent on the cross-sectional dimensions and the construction materials. In all cases, these limit values are higher than 1.0, in order to account for the structure's ability to redistribute stresses. According to the GSA guideline, the DCR limit value for the cable should be 1.0.

DCR = FC/FU

Where,

Fc - The axial cable force given by linear analysis Fu - The ultimate tension capacity

The various combinations of cable arrangement and pylon type are shown in following table

1.8 Autoclaved aerated concrete AAC

AAC is a high-quality lightweight, load-bearing and extremely well insulating building material produced as standard blocks, mega blocks or panels. AAC has already successfully been used in Europe since early last century and is now among the mostly used wall building materials in Europe with rapidly growing market shares in many countries, especially in Asia, America and CIS. AAC is also known as ALC (Autoclaved Lightweight Concrete), Aircrete, Airstone, Thermostone, Gas Concrete, Cellular Concrete, Porous Concrete and under many brand names like Ytong® or Hebel®, HplusH® or Porit®.

AAC is the material of choice for building applications, such as residential, commercial, industrial and agricultural buildings, hotels, schools and hospitals, etc., - an excellent building material for all climatic conditions. It is used for all walls, external or internal, loadbearing or non-loadbearing walls, basement walls, infill walls to framed structures, party walls, fire break walls, etc.

1.8.1 AAC blocks and panels

- AAC the cost saver for builders and home owners: high economy - increased comfort and functionality
- large size - low weight
- good workability
- perfect thermal insulation: 6 to10 times better than regular concrete = heat and aircon saver

1.8.2 A variety of positive features:

- Sound absorption: ideal for hotels, hospitals, commercials and multifamily
- good resistance against fire, hurricanes and earthquakes: saves life, property and insurance costs
- long durability: impervious to rot or pest, used already for more than 80 years
- high load-bearing strength - the material of choice for all walls: ex- and internal, load- and non-load-bearing, basement, fire break walls, etc.
- environmentally friendly: non-toxic, no wastage

II. LITERATURE REVIEW

Mehmet Emin Arslan et.al (2019) "An experimental study on cyclic behavior of aerated concrete block masonry walls retrofitted with different methods" Due to the insufficiency of the ductility, stability and low tensile stress capacity of the masonry shear walls responsible for carrying lateral loads, traditional brickwork masonry structures considered to be designed only under vertical service loads have been badly affected by the past severe earthquakes. The vulnerability of the existing masonry buildings can be decreased considerably by employing efficient retrofitting methods. This research work primarily aims to investigate experimentally cyclic behavior of aerated concrete block masonry walls before and after application of a special fiber retrofitting system. The investigated retrofitting system consists of multi-axial hybrid fabric made of alkali resistant glass polypropylene fibers for earthquake protection and white cement based plaster mortar with natural hydraulic lime. Another type of mortar with different material content was also tested to assess the adherence effect to the seismic retrofitting textile. The experimental results of this study were given with respect to force-displacement curves comparatively for all considered test specimens. It is concluded that the strength and the ductility capacity increased considerably by applying of the seismic textile, especially for two-sided retrofitting application with expanded glass granular made plastering.

Tariq Ahmad Sheikh , J.M. Banday (2021) "Study on non-linear static behavior of 2D low-rise RCC framed structure subjected to progressive collapse" In thisstudy, the progressive collapse behavior (full load and displacement control methods) of low-rise models representing 2-bay2storey and 3-bay3storey reinforced concrete framed structures located in high seismic zone, designed by Indian codes (IS 456:2000 and IS 1893-2016) for envelope loading combination are assessed with and without U.S. General Services Administration (GSA) guidelines. For displacement-controlled mechanism, a target displacement of 2%, 4% and 5% of the height of structure are considered. Non-linear static behavior of the structure is investigated through (a) Hinge formation pattern (b) Displacement of Joints adjacent to removed column along x-axis and z-axis (c) and Pushdown capacity curves. The results indicate that the Hinge formation patterns are similar for envelope loading combination and GSA loading combination, and the accuracy of the displacementcontrolled method is much remarkable compared to full load method, therefore a standard formula is obligatory for calculating the target displacement to control progressive collapse, based on structural requirements unlike the dynamic increase factor calculations based on the structural capacity. With increase in each span and height of structure consecutively, pushdown capacity curves indicate that the base shear increases approximately by two times whereas the displacement in downward direction reduces by 59% and 62.4% for corner column removal and middle column removal cases respectively.

Prashant Sunagar, Shivaraj G Nayak et.al (2022) "Progressive Collapse Analysis of T shape RCC Building" Structure collapse, on the other hand, is a very complicated phenomenon involving considerable nonlinearity and a variety of mechanical interactions. It should be thoroughly examined through experiments and numerical simulations to prevent the occurrence from occurring. When initial local failure of a small portion of the structure takes place it leads to the spread of that local damage to neighbor elements in the chain reaction manner. Finally, collapse takes place. This is known as Progressive collapse. This progressive collapse takes place when vertical load carrying members such as columns failed due to manmade or natural accidental loads. Therefore in this study progressive collapse analysis of a building is carried by removing columns. In the analysis different column removal cases are considered. As per GSA guidelines, Demand Capacity ratio(DCR) of beams are calculated. From this DCR value Evaluate the stability of the structure against progressive collapse. In the present study "T"shape building is considered which consists of 11 storey with bay sizes as 4 meter in the X and Y direction, height of every storey is 3 meters and height from the plinth to the floor is assumed 3.5 meters. The measurements of the beams are fixed throughout the storey, but column dimensions decrease as the floor rises, therefore the structure is considered to have geometrical irregularity. The loading is calculated in accordance with G.S.A guidelines. The design was created using the ETABS software and the I.S 456-2000 code. Different parameters such as Demand-capacity ratio, Dynamic factor, Interaction ratio, Axial Force, Bending moment are discussed.

Binil M G, Dr. H. J. Puttabasave Gowda (2021) "Progressive Collapse Analysis of Reinforced Concrete Framed Structure" When the structure is exposed to natural hazards like Tsunami, earthquake, over pressure of wind etc or due to manmade hazards like fire, gas explosion, impact of vehicles, terrorist attacks etc these affects the stability of the structure. The process in which local failure leading to global failure is called Progressive Collapse. In the present study a T shaped RCC structure with 11 storeys is considered for Progressive Collapse analysis. The columns are removed one by one at interior, exterior and corner regions as per the GSA guidelines. Linear static analysis is carried out using ETABS software Ver. 15.2. The Demand Capacity Ratio (DCR) and Interaction ratio is calculated in the critical region of the structure associated with the column removal. The study concluded that the most critical case for progressive failure is found to be interior column removal case at the base and least critical is found to be corner column removal case at the base.

Yara M. Mahmoud, Maha M. Hassan et.al (2018) "Assessment of progressive collapse of steel structures under seismic loads" Progressive collapse involves a series of failures that lead to partial or total collapse of a structure. It is generally initiated by loss of one or more vertical load carrying elements. This loss is caused by abnormal loads such as bombings, gas explosion, earthquakes...etc. Progressive collapse due to seismic actions has not received much attention in spite of its importance and repeated occurrences. In the current study, it is intended to investigate the progressive collapse potential of steel moment resisting and braced frames designed according to Egyptian local standards due to damage caused by seismic actions. One first-storey column is fully removed at arbitrary locations within the building using alternate path method recommended in the UFC guidelines in order to study consequences and check safety of adjacent members. 3-D nonlinear dynamic analyses are employed using SAP2000 is employed in the performed parametric study.

RoholaRahnavarda et.al (2018)‘Nonlinear analysis on progressive collapse of tall steel composite Buildings’ Progressive collapse is defined as the expansion of an initial local failure of an element into another element of the structure and ultimately leading to the collapse of the whole structure or a large part of it in a disproportionate way. Three dimensional modeling, using the finite element method was developed and investigated to understand the progressive collapse of high rise buildings with composite steel frames. The nonlinear dynamic analysis examined the behavior of the building under two column removal scenarios. Two different types of lateral resistance systems were selected to be analysis and compared. The buildings included regular and irregular plans. The response of the building was studied in detail, and measures are recommended to reduce progressive collapse in future designs. The results of this study shows that side case removal in moment frame and moment with centrically braced frame systems was more critical and destructive compared with corner case removal. Comparing the models, for the two different lateral resistance systems, the dynamic response of columns were different, but were not remarkable.

III. METHODOLOGY

3.1 Flowchart

The entire flow of activities involved in achieving the objectives of the project involves following crucial stages:

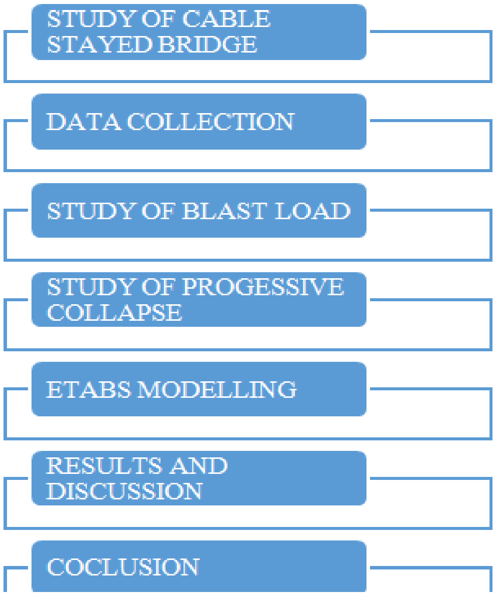


Fig no. 1 Flowchart

3.2 Methods of Seismic Analysis of Building

3.2.1 General

Earthquakes area unit nature’s greatest hazards to life on this planet. The hazards obligatory by earthquakes area unit distinctive in several respects, and consequently going to mitigate earthquake hazards needs a novel engineering approach. a crucial distinction of the earthquake drawback is that the hazard to life is associated virtually entirely with manmade structure expect for earthquake triggered landslides, the sole earthquake impact that causes in depth loss of life area unit collapse of bridges, buildings, dams, and alternative works of man. This facet of earthquake hazard may be countered solely by styles and construction of earthquake resistant structure. The optimum engineering approach is to style the structure therefore on avoid collapse in most doable earthquake, so guaranteeing against loss of life however acceptive the chance of harm.

Various methods for determining seismic forces in structures fall into two distinct categories:

I. Equivalent static force analysis
II. Dynamic Analysis

3.2.2 Equivalent static force analysis:

Earthquakes area unit nature’s greatest hazards to life on this planet. The hazards obligatory by earthquakes area unit distinctive in several respects, and consequently going to mitigate earthquake hazards needs a novel engineering approach. a crucial distinction of the earthquake drawback is that the hazard to life is associated virtuallyentirely with manmade structure expect for earthquake triggered landslides, the sole earthquake impact that causes in depth loss of life area unit collapse of bridges, buildings, dams, and alternative works of man. This facet of earthquake hazard may be countered solely by styles and construction of earthquake resistant structure. The optimum engineering approach is to style the structure therefore on avoid collapse in most doable earthquake, so guaranteeing against loss of life however acceptive the chance of harm.Basically, they give total horizontal force (Base Shear) V, on a structure:
Where,m is mass of structure

V is applied to the structure by a simple rule describing its vertical distribution. In a building this generally consist of horizontal point loads at each concentration of mass, most typically at floor level. The seismic forces and moments in the structure are then determined by any suitable analysis and the results added to those for the normal gravity load cases. An important feature of equivalent static load requirement in most codes of practice is that calculated seismic forces are considerably less than those which would actually occur in the larger earthquakes likely in the area concerned.

$$V=F1+F2+F3$$

3.2.3 Seismic Analysis using IS 1893 (Part1):2002

In this approach the earthquake force is applied on the structure using seismic coefficient method. In this method the design horizontal seismic coefficient A_b for the structure is given as

$$A_h = \frac{Z}{2}\cdot\frac{I_m}{R}\cdot\frac{S_a}{g}$$

Where, A_h is seismic horizontal acceleration (Generally in the range of 0.05g to 0.2g)

Z is zone factor as per different zones, IS 1893 (Part1):2002 has classified India in to four zones II to V. In zone II seismic intensity is low and very severe for zone v, I= importance factor, depending upon the functional use of the structures, R= Response reduction factor, depending on the perceived seismic damage performance of the structure, characterized by ductile or brittle deformations. However, the ratio I/R shall not be greater than 1.0 and Sa/g = Average response acceleration coefficient for rock or soil sites. This ratio depends upon the time period and site condition. For the calculation of the earthquake force soils are grouped into three groups as shows in table 3.2 below.

Table 3. *1* **Soil groups for calculations of seismic forces**

Group	Soil Type
Group 1	Hard soil
Group 2	Medium soil
Group 3	Soft soil

IV. PROBLEM STATEMENT

Design Data -

In order to ensure the safety and structural integrity of multi-storey buildings, it is essential to analyze their behavior under extreme loading conditions such as earthquakes and strong winds. Additionally, it is important to investigate the potential consequences of column removal in various regions and locations. Therefore, the objective of this study is to conduct a progressive collapse analysis of G+30 building models with RCC infilled with aerated asbestos cement block masonary infill walls using ETABS software. The findings of this analysis will contribute to enhancing the understanding of progressive collapse behavior and aid in the development of effective mitigation strategies for multi-storey buildings. G+30 storey structure of a regular building with 3.2 m floor to floor height has been analysed Seismic Analysis of Multi-storey R.C.C Buildings using ETABS software.
Preliminary data required for Analysis: -

Table : Parameters to Be Consider for Rectangular Geometry Analysis

Parameter	Values
Number of stories	G+30
Base to plinth	3.2m
Grade of concrete	M25
Grade of steel	Fe 415
Floor to Floor height	3 m
Total height of Building	94.5 m
Soil Type	Medium
Dead Load	Self-weight of structure
Floor finish load	1.5 kN/m2
Live load	5 kN/m2
Frame size	30m X 30m building size
Grid spacing	6 m grids in X-direction and Y-direction.
Size of column	450mm x 450 mm
Size of beam	300mm x 450 mm
Depth of slab	150 mm
Importance factor for office building	1
Damping percent	5 %

ETABS Models

From the problem statement mentioned in above chapter the following models are proposed:

MODEL 1	G+30 basic model
MODEL 2	G+30 basic model column removal- C1
MODEL 3	G+30 basic model column removal- C3
MODEL 4	G G+30 basic model column removal- C9
MODEL 5	G+30 basic model column removal- C10

Modelling

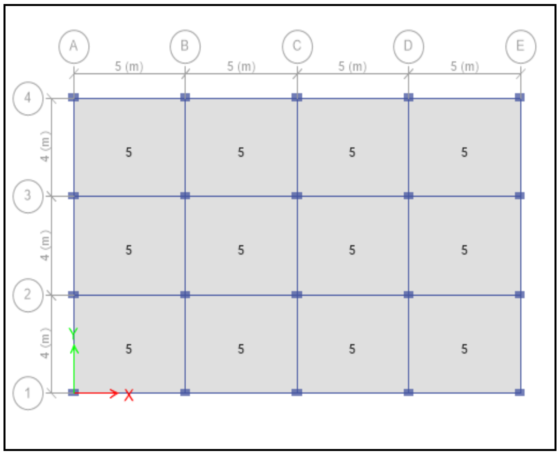


Fig: 2. plan view

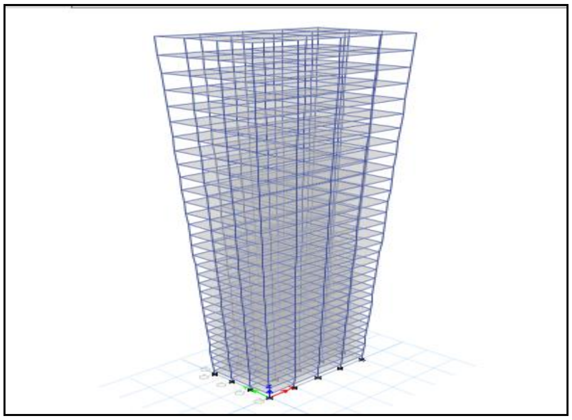


Fig: 3. 3D view of building

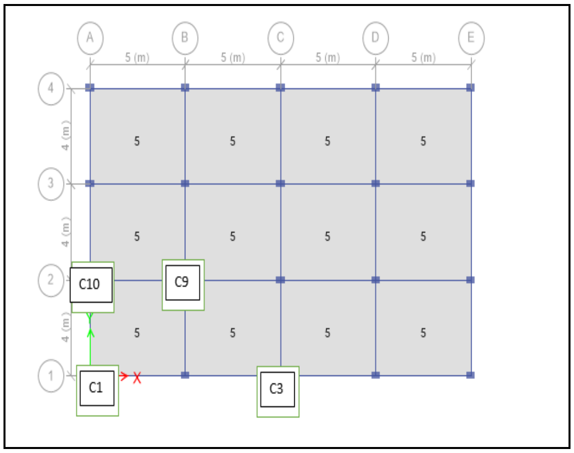
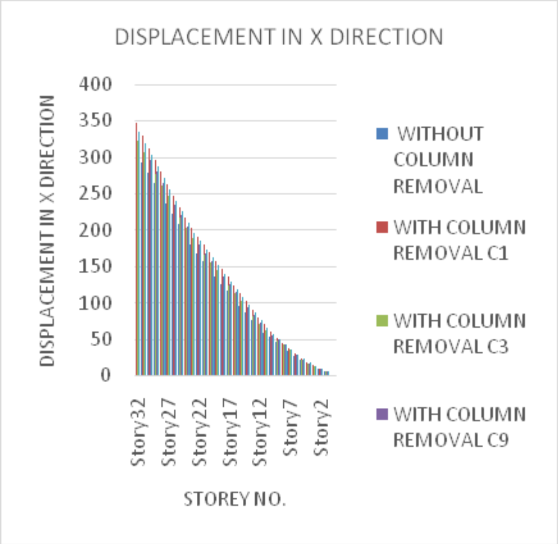


Fig: 4. Position for removing column

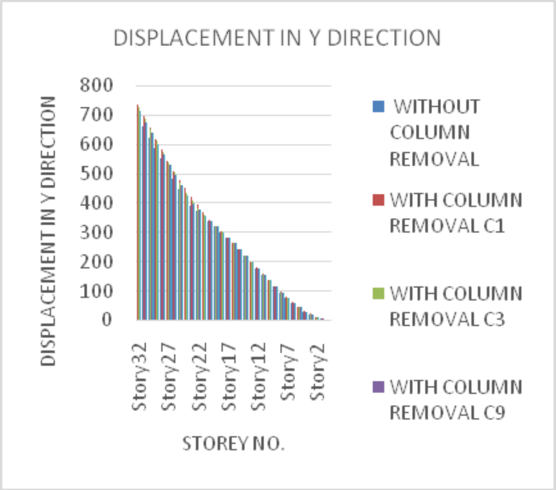
V. RESULT AND DISCUSSION

In this study various parameters were considered to assess the structural response of a G+30 building subjected to seismic forces. The building had a base-to-plinth height of 3.2 meters, constructed with M25 grade concrete and Fe 415 steel. Its floor-to-floor height was 3 meters, resulting in a total building height of 94.5 meters. The soil type was classified as medium. For seismic analysis, an importance factor of 1 was assigned to the office building, and a damping percentage of 5% was used. The results of this study include displacement data in the X and Y directions, storey drift values in X and Y directions, as well as base shear values in X and Y directions, all measured in millimeters for displacements and millikilonewtons (KN) for base shear. These findings will be discussed and analyzed in the subsequent sections to gain insights into the seismic and progressive collapse behavior of the structure under consideration.



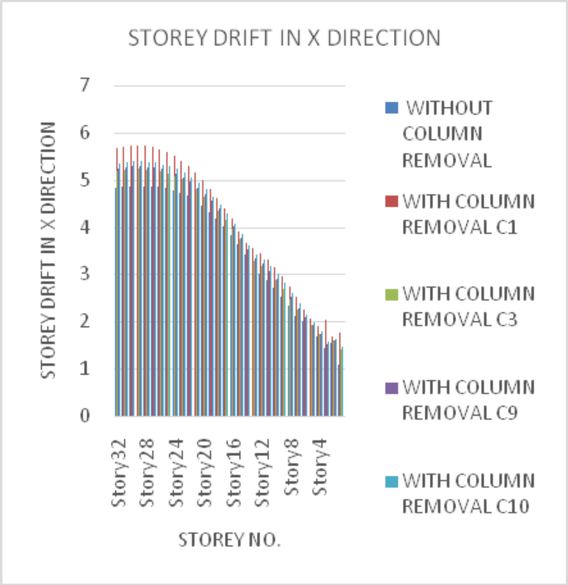
Graph: 1. Displacement in X direction in mm

The graph presents the displacement values in the X direction for different stories of the building under various conditions, including without column removal and with column removal scenarios (C1, C3, C9, and C10). As we move from the top (Story 32) to the bottom (Story 1) of the building, there is a general trend of decreasing displacement in the X direction. This is expected since the higher stories experience less lateral movement compared to the lower stories during a seismic event. When we compare the displacements between the scenario without column removal and those with column removal (C1, C3, C9, and C10), we observe that the displacements tend to increase with column removal. This indicates that the removal of columns has a significant impact on the lateral stability of the building, leading to larger displacements during a seismic event. Among the scenarios with column removal, it appears that "C1" has the highest displacements at most story levels, followed by "C3," "C9," and "C10." This suggests that the specific location and number of columns removed can influence the building's response to seismic forces.



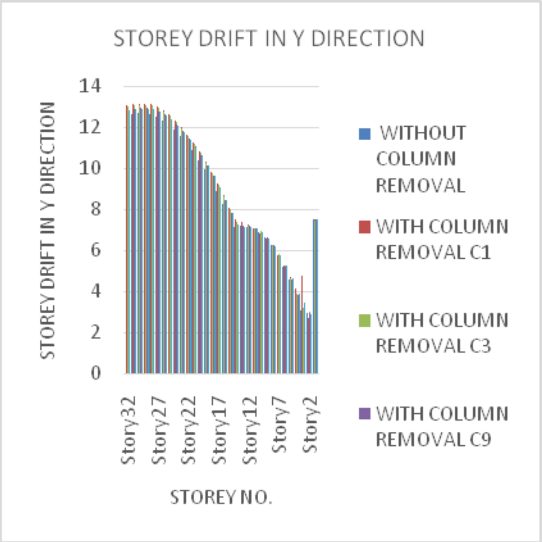
Graph:2. Displacement in Y direction in mm

Interpreting the results for the displacement values in the Y direction for different stories of the building under various scenarios, including without column removal and with column removal (C1, C3, C9, and C10): Similar to the X direction, there is a general trend of decreasing displacement in the Y direction as we move from the top (Story 32) to the bottom (Story 1) of the building. When comparing the displacements between the scenario without column removal and those with column removal, it's evident that the displacements generally increase with column removal. Among the scenarios with column removal (C1, C3, C9, and C10), "C1" often exhibits the highest displacements at most story levels, followed by "C3," "C9," and "C10."



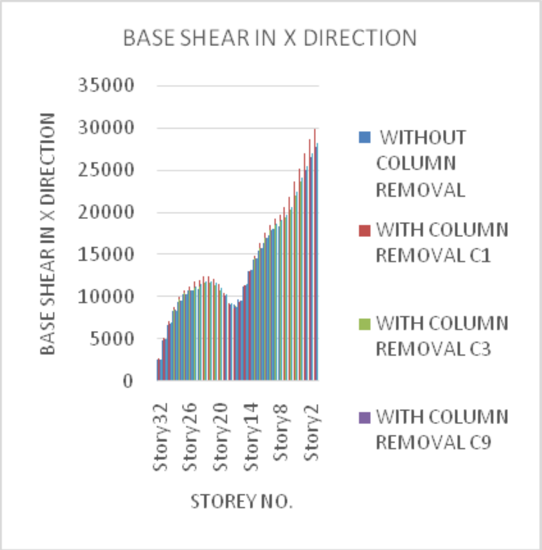
Graph: 3. Drift in X direction in mm

the storey drift in the X direction exhibits distinct variations under different scenarios, including without column removal and with column removal (C1, C3, C9, and C10). Without column removal, the storey drift is recorded at 4.831 mm. However, when columns are removed, we observe noticeable increases in storey drift. In particular, under scenario C1, the storey drift rises by approximately 17.45%, reaching 5.674 mm. In scenario C3, the drift increases by approximately 7.16% to 5.182 mm. Similarly, in scenarios C9 and C10, the storey drift experiences increments of approximately 8.64% and 10.62%, respectively, resulting in drift values of 5.237 mm and 5.341 mm. This analysis underscores the significant influence of column removal on storey drift in the X direction, with varying degrees of impact depending on the specific removal scenario.



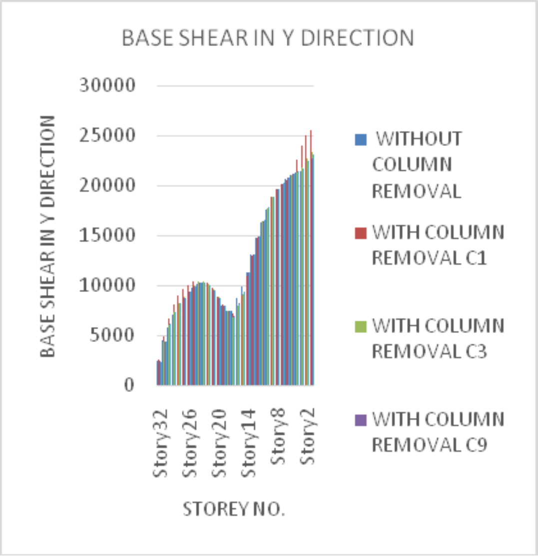
Graph: 4. Drift in Y direction in mm

the storey drift in the Y direction reveals notable variations across different scenarios, including without column removal and with column removal (C1, C3, C9, and C10). Without column removal, the storey drift is measured at 12.563 mm. However, when columns are removed, we observe distinct increases in storey drift. Under scenario C1, the storey drift experiences an approximate increment of 4.19%, reaching 13.045 mm. In scenario C3, the drift increases by approximately 3.56% to 12.979 mm. Similarly, in scenarios C9 and C10, the storey drift undergoes increments of approximately 2.20% and 1.79%, resulting in drift values of 12.827 mm and 12.789 mm, respectively.



Graph: 5. Base shear in X direction in KN

the base shear in the X direction is an essential parameter that demonstrates how lateral forces are distributed throughout the building. Without column removal, the base shear is calculated to be 2548.6563 kN. However, when columns are removed in different scenarios (C1, C3, C9, and C10), the base shear values vary significantly, reflecting the impact of column removal on the lateral stability of the structure. In scenario C1, the base shear increases to 2676.0234 kN, indicating an approximate 5.03% increase compared to the no-removal scenario. In scenario C3, the base shear rises to 2565.2056 kN, representing an approximate 0.53% increase In scenario C9, the base shear reaches 2574.8996 kN, showing an approximate 0.84% increase. In scenario C10, the base shear further increases to 2618.471 kN, signifying an approximate 2.77% increase.



Graph: 6. Base shear in Y direction in KN

In the context of base shear in the Y direction, this parameter is crucial for assessing the lateral forces acting on the structure. Without column removal, the base shear is calculated to be 2448.4355 kN. However, when columns are removed in different scenarios (C1, C3, C9, and C10), the base shear values exhibit substantial variations, emphasizing the influence of column removal on the distribution of lateral forces within the building: In scenario C1, the base shear increases to 2594.4783 kN, representing an approximate 5.97% increase compared to the no-removal scenario. In scenario C3, the base shear decreases to 2343.0996 kN, indicating an approximate 4.14% decrease. In scenario C9, the base shear increases to 2386.1026 kN, showing an approximate 2.55% increase. In scenario C10, the base shear decreases to 2348.4445 kN, signifying an approximate 4.03% decrease.

VI. CONCLUSION

In conclusion, the comprehensive analysis of seismic and progressive collapse evaluation for a high-rise RCC building infilled with aerated asbestos cement block masonry infill walls reveals valuable insights into its structural behavior under various scenarios. The study investigated displacement, storey drift, and base shear in both X and Y directions, providing a comprehensive understanding of the building's response to seismic forces and the impact of column removal.

The displacement results demonstrate a clear trend of decreasing lateral movement from the top to the bottom of the building, which is consistent with expectations. However, the removal of columns significantly affects the lateral stability, leading to increased displacements in both X and Y directions. Among the column removal scenarios, "C1" consistently exhibits the highest displacements, followed by "C3," "C9," and "C10," underscoring the influence of column location and number on the building's response.

Storey drift, a critical parameter in assessing structural integrity, also experiences substantial variations due to column removal. In the X direction, scenarios with column removal show notable increases in drift compared to the no-removal scenario, with "C1" experiencing the most significant increment. In the Y direction, the impact of column removal on storey drift is evident but relatively less pronounced than in the X direction.

The analysis of base shear in both X and Y directions highlights how lateral forces are distributed throughout the structure. Column removal scenarios result in significant variations in base shear values, reflecting the altered lateral stability. In particular, "C1" and "C3" exhibit notable increases in base shear in the X direction, while "C3" and "C10" show significant variations in the Y direction.

The findings of this study emphasize the critical importance of considering column removal scenarios in the seismic design and evaluation of high-rise buildings with infilled walls. These results can guide structural engineers and architects in making informed decisions about building design, retrofitting, and strengthening measures to enhance the seismic resilience of such structures. As future work, further investigation could explore additional parameters and scenarios to refine the understanding of structural behavior and contribute to the development of safer and more resilient building designs. Additionally, research in materials and construction techniques could offer innovative solutions for mitigating the effects of column removal in high-rise structures.

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