Seismic Performance Evaluation of Reinforced Concrete Structures With Aerated Asbestos Cement Block Masonry Infill Walls: A Comprehensive Review

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Abstract- *The evaluation of the relevant literature takes into account a number of studies that are connected to the progressive collapse analysis of various kinds of buildings. Particular attention is paid to situations that include seismic activities, masonry infill walls, and column removal. In these research, computer models, software tools like as ETABS, and experimental investigations are used to determine how structures behave in the face of extraordinary occurrences like earthquakes and explosions. The objective of the study is to study the AAC blocks used in RCC building. The findings of these research provide important new insights that may be used to strengthen the resistance of buildings to progressive collapse and to make them safer overall. This article provides a complete summary of the research that has been done in this sector by taking into consideration a number of aspects, including seismic loads, infill walls, and column removal.*

Keywords- Seismic evaluation, Reinforced concrete, structures RCC structures, Aerated asbestos cement (AAC) block, RCC

I. INTRODUCTION

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 enable done 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 Staadpro to analyses the different parameters in progressive collapse.

1.2 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.

1.2.1 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

1.2.2 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

1.3 AAC blocks advantages and disadvantages

In today's times when the world is realising the importance of environmental conservation, the construction sector has also witnessed technological advancements, including the use of innovative and sustainable construction materials. Here are some of the advantages of AAC bricks:

- **Better workability and faster construction**

AAC blocks are about 50% lighter and 10 times larger than traditional bricks. This unique property facilitates easy installation and gives the desired flexibility that makes adjustments, cutting, shaping, etc., quite easy. AAC blocks have fewer joints and consistent dimensions, thereby, ensuring ease of laying and making the construction process faster. Lastly, the lightweight blocks are easy to transport, which helps to save on the overall logistics and shipping costs, as compared to the costs involved in the transportation of traditional bricks.

- **Earthquake-resistant**

Generally, buildings are designed to handle vertical forces, such as self-weight and gravity. However, there are also horizontal forces, such as those caused by earthquakes. The AAC blocks gain a high level of strength during the manufacturing process, giving durability to the finished structure. Thus, structures made with AAC bricks are capable of handling higher seismic loads, compared to structures with conventional bricks.

- **Thermal insulation and energy-efficiency**

The material contains small air pockets and hydrogen is used to foam the concrete, thus, giving it an excellent heat insulation property that allows temperatures to be warm in winters and cool in summers. Therefore, it can significantly lower your air-conditioning costs by about 25%. AAC blocks are energy-efficient across their lifecycle, as their production involves less energy consumption.

- **Fire-resistant**

The AAC block material is non-combustible and provides fire resistance of up to six hours, depending on the block thickness and up to 1,200 degrees Celsius, compared to other building materials. Thus, it also has importance from a fire safety point of view.

- **Sustainable and affordable**

AAC blocks are made from natural and non-toxic raw materials and their manufacturing process generates minimum waste. Some of the waste or offcuts generated can be recycled or used in aggregates. As it is made from non-biodegradable materials, it makes the building durable and stable, preventing rot or mold. Furthermore, being lightweight, energy-efficient and easy to install, AAC blocks also minimise labour costs.

- **High compressive strength**

The average compressive strength of the AAC block is 3 to 5 N/mm2. Thus, it is much stronger and better than bricks of the same density.

- **Pest-resistant**

AAC blocks are prepared from inorganic materials, which help in protecting the structure from pests such as termites, rodents, etc.

- **Soundproof**

The lightweight and porous structure of AAC blocks enables high sound reduction. For this reason, the AAC block material is widely used in the construction of studios, hotels, hospitals, etc.

- **Moisture-proof**

Moisture can severely damage a structure. The macro-pores inside AAC blocks ensure low absorption of water. Thus, they provide better moisture protection.

When it comes to small-scale building projects, red bricks may still find their importance. However, for large-scale residential, commercial and infrastructure projects, AAC blocks provide greater benefits and play a significant role in controlling the environmental damage caused due to construction using outdated building materials.

1.4 AAC blocks disadvantages:

Although AAC blocks are widely used in masonry units of high-rise RCC (reinforced cement concrete) framed buildings, they can be expensive when used for small load-bearing structures. When using AAC blocks, it could be one of the disadvantages. Considering the high AAC block prices, buying a small number of blocks for such structures can cost more, as compared to ordering in bulk quantities for large projects. However, the material is lightweight and thus, contributes less to dead load and the requirement of structural steel can be minimised in RCC framed structures. Therefore, it can save on construction costs, when chosen for high-rise constructions.

Further, column foundations in RCC framed structures are designed for bearing the load of a building. In such structures, RCC foundations are arranged on which RCC columns are raised. Plinth beams are placed at the plinth level and AAC block masonry is raised on it. Thus, there is no need for AAC block masonry between the columns below the DPC level plinth beam. DPC or damp-proof course refers to material applied at the basement level, for restricting moisture flow through walls and floors.

Load bearing is used for low-rise structures. The thickness of the walls and finding the right size of AAC blocks, are crucial aspects, when it comes to load-bearing walls. Moreover, the placement of these blocks requires expertise. It is important that a qualified structural engineer design the walls.

II. LITERATURE REVIEW

Saumil S Patel, Vishal B Patel et.al (2016) “Comparative study of progressive collapse on rccmultistory building” The progressive collapse resistance of seismically designed RCC 4 storey building is investigated using computational simulation models.. Two types of models were analyzed : SMRF & OMRF buildings with & without masonry infill wall. The study is conducted on previously designed 4-storey prototype buildings by applying the alternate path method. In this methodology, critical columns and if present, are instantaneously removed from an analysis model and the ability of the model to successfully absorb member loss is investigated. Member removal in this manner is intended to represent a situation where an extreme event or abnormal load destroys the member.The simulation results show that while both systems benefit from placement of the Infill wall on frame members of the building, the frame with infill walls is less vulnerable to progressive collapse than the frame without Infill wall. Improvement in behavior is due to improved system due to Infill wall acts as compression strut and resists the deformation of the frame.

RohiniNagargoje ,Pratap Pansare et.al (2022) “Progressive Collapse Analysis With Seismic Loading Using E-TABS” 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, and 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-TABS CONNECTEDITION as per Indian Standard codes for four unique cases after corner section evacuation conditions. To contemplate collapse, normal sections are taken out each in turn, and preceded with examination and plan. The ultimate goal of this progressive collapse research on building is to develop better building evaluation and design guideline for structural engineers to use to prevent collapse in new and existing building. Future progressive collapse research recommendation is also presented.

Mr. Yograj Ashok Nimbhorkar, Dr.D.P.Joshi et.al (2019) “A Review on Progressive Collapse of Composites Structures” The objective of this study is to investigate the progressive collapse of composite structures. For this G+20 building has been taken. For this linear static analysis and linear dynamic analysis, of structure has been carried out. The behavioral changes have been investigated to the sudden collapse of structures. The composite structure is design based on Indian Standard code of practice is considered. The investigation is carried out using ETABS software. Progressive collapse is to be considered for analysis as given by the US General services administration (GSA). Percentage change in the values of demand capacity ratio, base shear and roof displacement considering progressive collapse effect of structures were carried out. This simple analysis is used to analysis the structures for different failure conditions and then optimize it for various threat scenarios.

SOMAYYEH KARIMIYAN (2021) “Study of progressive collapse distribution in reinforced concrete buildings due to simultaneous effects of earthquake loads and edge column removal” Progressive collapse phenomenon may occur due to various loads and many researchers have investigated the progressive collapse caused by only one source of loading.

Novelty and distinction of this research in comparison with the other studies is that in the current study, the progressive collapse phenomenon has been studied due to the simultaneous effects of ground motion records and elimination of the column critical members. With the aid of the methods of the present research, prediction of collapse paths is schematically possible in progressive collapse phenomenon of structures, including the weak or defective column, in the presence of ground motion records. Accordingly, reinforcing and retrofitting the short and mid-rise structures become possible. Therefore, in this study, short- and mid-rise 3 and 5-storey RC structures with intermediate moment resisting frames were evaluated in presence of the simultaneous effects of the ground motion records and edge column elimination. Results show that collapse dissemination in the structures is specific, repetitive and similar and independent of the ground motions. So, it is possible to foresee the critical elements, collapse paths and its propagation in the similar structures, which can be used to provide practical procedures in the guidelines and standards for reinforcing or retrofitting the short- and mid-rise similar structures. Subsequently, the progressive collapse phenomenon in the structures reduces and eventually, it is possible to control and reducing damages in the similar structures.

M. SakthiSeethalakshmi, M. Prakash et.al (2016) "Effect of Masonry Infill Structure with Openings during Progressive Collapse by Removing a Middle Column" Background/Objectives: Progressive collapse occurs when primary structural element fails due to many reasons such as impact, bomb blast, earthquake, abnormal loading etc., resulting in the failure of adjoining structural elements, which in turn causes partial or total collapse of the structure consequently. It is studied widely in Reinforced Concrete (RC) framed structure. Methods/Statistical Analysis: The present study investigates the comparative behaviour of four bay, five storey RC bare frame, infilled frame and infilled frame with openings and to assess the effect of infill to resist the progressive collapse. A linear static analysis is carried out using finite element software using SAP 2000 and maximum moment (M), shear force (V), axial force (P), deflection (U) for both beams and columns generated before and after middle column removal are studied and compared. Findings: There is an average of 30% and 34% decrease in moments for infilled frames when compared to a bare frame. The percentage of decrease in moments increases to an average of 71% when the column is removed. Similarly, the deflection for infilled frames decreases by35% when compared with bare frame and only 17% increase when infills are provided with openings on removal of column there is average of 88% decrease in deflection for infilled frames when compared with bare frame. It shows that the presence of infilled frames will delay the progressive collapse when compared to bare frames. Application/Improvements: The study can be extended to the non-linear range and also to find its dynamic response.

Mehmet EminArslan 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 displacement controlled 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.

Y.A. Al-Sallouma, H. Abbas et.al (2017) "Progressive Collapse Analysis of a Typical RC High-Rise Tower" The world has recently witnessed tremendous increase in terrorist activities. This led to the requirement of blast resistant design of structures. The progressive collapse of structures, being the most severe consequence of blast generated waves, has been the subject of several studies. Although structural engineers are developing methodologies for the mitigation of progressive collapse, there is a lack of adequate tools that can be employed for simulating and predicting the progressive collapse response of structures with acceptable confidence. An attempt has been made in this paper to develop a practical and acceptable procedure for the progressive collapse analysis of reinforced concrete (RC) framed structures. The adequacy of the procedure has been demonstrated by studying the progressive collapse behavior of a typical RC framed high-rise building in Riyadh when exposed to blast generated waves.

Ahmed Elshaer, Hatem Mostafa et.al (2016) "Progressive Collapse Assessment of Multistory Reinforced Concrete Structures Subjected To Seismic Actions" Progressive collapse is a catastrophic partial or total failure of a structure that mostly occurs when a structure loses a primary component like a column. Some international standards have started to consider progressive collapse resistance in various approaches. In this study, the 'Unified Facilities Criterion' guidelines were used in assessing the structure; these guidelines represent one of the codes that discuss progressive collapse using sophisticated approaches. Three-dimensional nonlinear dynamic analyses using the 'Applied Element Method' were performed for a structure that lost a column during a seismic action. A parametric study was made to investigate the effect of different parameters on progressive collapse. In this study, a primary structural component was assumed lost during an earthquake. The studied parameters were the location of the removed column in plan, the level of the removed column, the case of loading, and the consideration of the slabs. For the study cases, it was concluded that the buildings designed according to the Egyptian code satisfies the progressive collapse requirements stated by 'Unified Facilities Criteria' (UFC) guidelines requirements with a safety factor of 1.97. Also, it was found that losing a column during a seismic action is more critical for progressive collapse than under gravity load. Finally, this study elaborated the importance of considering the slab in progressive collapse analysis of multistory buildings in order to include the significant catenary action developed by the slabs.

Yogesh T. Birajdar et.al (2017) "Progressive Collapse Analysis of Multi-Storied RCC Building" The term "Progressive collapse" defined as ultimate failure or proportionality large failure of a portion of structure due to spread of local failure from element to element throughout the structure. I studied previous paper on progressive collapse, they have analyzemultistory building and get result of prevention of progressive collapse since the progressive collapse of Ronan point apartment building in 1968 and world trade centre (WTC), and to give idea about constructing building safer from progressive collapse. To use of general service administration guidelines (GSA, 2003) three dimensional (3D) model of building were developed to analyze and compare progressive collapse response by commercially available program ETABS. In number of previous paper multistory building analyze for progressive collapse of linear static and linear dynamic procedure by STAAD pro and ETABS software, they result conclude that comparison of DCR ration in different cases and different column removed cases and also displacement, time period, storey shear are concluded. The objectives of project work is to study various types of progressive collapse and its mechanisms and analyze (G+15) RC earthquake resisting building for seismic zone III as per IS 1983:2002 by using ETABS 2016 software for linear dynamic analysis procedure. Complete the mathematical modeling of multistory building and different types of loading combination and to find out time period, axial forces variation, bending moment variation, DCR for column and beam in different cases, and knowing the response of the structure for progressive collapse by using ETABs software.

Urjal Das et.al (2020) "Analysis of Building Subjected to the Blast Load: A Review" When a bomb blast occurs in and around the buildings can cause the calamitous damage to the buildings superstructure as well as the sub structure such as the collapsing of walls, cracks on beams, columns, slab and shutting down all the crucial lifesaving system. Explosions have two different effects i.e. Direct effects that consists of collapse, leftover materials or parts of buildings, fire and smolder etc. and the circumlocutory effects consists of inhibit or stop from timely evacuation. By combining these two effects additionally bringing up more causalities. In addition, when the gas-chemical blast occurs it gave us the most ruinous results i.e. dynamic load is much greater than that of the original design loads. So, to counteract this ruinous results of the gas-chemical blast, much more hard work have been prepared throughout the previous few decades to extend methods of structural analysis and design to oppose the blast loads. Complete understanding of blast phenomenon and also the dynamic response of all structural elements are both mostly required to study and design the structure under blast load. This study gives us all the informative overview of explosions effects on the structure when subjected to the blast loading by comparing the three different models with two different blast loads and also the two different standoff distance.

Harshada R. Patil, Dr.Atul B. Pujari (2022) “A Review on Seismic and Progressive Collapse Evaluation of Reinforced Concrete Structure In-Filled with Masonry Infill Wall” Buildings are subjected to a variety of natural hazards over their mean lives and around the globe structural multi-hazard analysis and design has become a hotbed of research. Earthquake and progressive collapse seem to be two of the major threats for these constructions. Consequently, limited research on the effects of seismic and progressive collapse designs on multi-story buildings has been done. A building's construction also contains a variety of structural and non-structural parts for various functions. When examining structural members, we as structural engineers, tend to focus on the structural members for resistance of buildings against any hazard and Non-structural components are often overlooked. However, several studies have shown that non-structural parts, such as infill walls, play a key role in increasing building resistance to natural disasters. As a result, the role of the infill wall against various risks must be investigated. The effect of infill walls in the case of progressive and seismic collapse of RC structures has received far less attention. In this study, it is decided to evaluate effect of different infill wall configuration in case of combine study of seismic and progressive collapse of reinforced concrete structures by using ETABS software. For this purpose four models 1) Bare Frame 2) Fully In-filled Frame 3) Open Ground Frame and 4) Open Ground & Intermediate Frame have been considered.

III. CONCLUSION

The reviewed literature presents a diverse array of studies aimed at understanding and mitigating progressive collapse in various structural scenarios. From the analysis of seismic effects on steel and concrete structures to the influence of masonry infill walls and column removal, these studies contribute significantly to our knowledge of structural behavior under extreme conditions.

One common theme across these studies is the critical role of infill walls in enhancing a structure's resistance to progressive collapse. Infill walls act as compression struts, improving the overall system's behavior and reducing deformation during extreme events.

Additionally, these studies underscore the importance of adhering to guidelines and standards, such as those provided by the General Services Administration (GSA) and local building codes, to ensure that structures can withstand progressive collapse scenarios. The research findings suggest that careful consideration of factors like column removal, load redistribution, and dynamic response is essential for designing and retrofitting structures to resist progressive collapse effectively.

Overall, this literature review highlights the ongoing efforts to develop safer building designs and retrofitting techniques, with a focus on preventing progressive collapse. It provides a foundation for further research and the development of guidelines and standards to enhance the resilience of structures against various hazards, including seismic events and blasts.

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