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Stability Analysis of High-Rise Buildings by Altering the Beam Members: A Review

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Abstract: ***For buildings larger than 15 to 20 floors, a system with a clean rigid frame is not adequate because it does not provide the required lateral rigidity and causes excessive deflection of the building. These requirements are met in two ways. By introducing the effective section such as beam, column etc in to the structure. This increases the stability and rigidity of the structure, and also limits the requirement for deformation. Now days the composite beam is also used for tall buildings. The Paper present the short summery report of use of various beam elements in building to get the effective out comes to sustained under the lateral forces response. The literature review focus on the impact on the building analysis by altering the Beam Members. Reinforced Concrete Beams, Steel Beams, and Composite Beams. The articles reviewed the concept on introducing the alternating beam in the structure are effective and achieve the higher resisting capacity against the lateral loads.***
Keywords: Reinforced Concrete Beams, composite beam, Steel Beams, tall buildings, deformation, stability

I. INTRODUCTION

A beam can be defined as a structural element that carries all vertical loads and resists bending. Different types of materials are used for beams, such as steel, wood, aluminium, etc. But the most common material is reinforced cement concrete (RCC).

Basic Fundamental Beams based on materials are as follows:

A. Reinforced Concrete Beams

Reinforced concrete beams are structural elements that are designed to withstand transverse external loads. Loads cause bending moment, shear forces and in some cases torsion along the entire length. Moreover, concrete is strong in pressure and very weak in tension. Beams can be individually reinforced or double reinforced

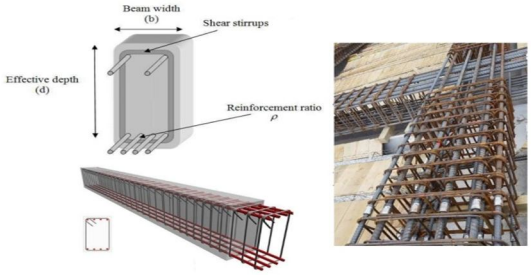

Fig. 1: Typical type of RCC Beam Section

B. Steel Beams

A steel beam is a structural steel product made to withstand high loads. Steel beams come in different sizes and types, and therefore their different applications in the construction of structures and buildings. Construction specifications determine the geometry, size and shape of the beam. These beams can be straight or curved.

Fig. 2: Typical type of Steel Beam Section

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C. Composite Beams

A structural member composed of two or more different materials joined together to act as a unit in which the resulting system is stronger than the sum of its parts. An example in civil construction is a steel-concrete composite beam in which a steel shape of a wide flange (I or V shape) is attached to a concrete floor slab.

Many other types of composite beams include steel-wood, wood-concrete and plastic-concrete or advanced composite materials-concrete. Composite beams as defined herein differ from beams made of fiber-reinforced polymeric materials.

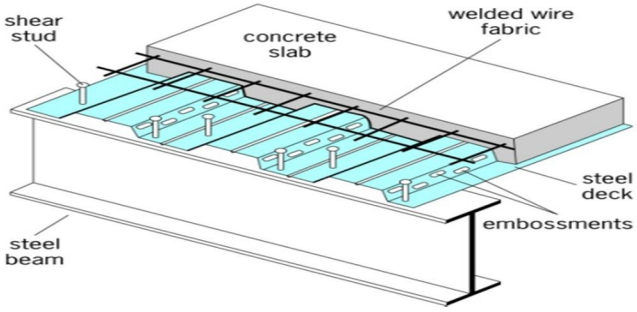

Fig. 3: Typical type of Composite Beam Section

II. LITERATURE REVIEW

The following literature review is taken for the analysis of various types of beam under building analysis.

A. Abbood I.S., Jasim M.A. & et. al. (2021)

This paper aims to give a brief overview of high-rise buildings related to key definitions, safety features, structural stability and design challenges. A brief description of the existing construction systems in the literature is given to explain the widespread technical problem of the adoption of an effective construction system to withstand winds and seismic events. Accordingly, a general overview covering the behavior of various structural systems at various levels in terms of height of tall buildings using numerous analyzes of nonlinear static procedures (pushing) and nonlinear analyzes of dynamic procedures is presented. Finally, a critical overview of the available simplified seismic energy base model and design is presented. This paper aims to assist in the development and implementation of building systems for tall buildings in the future.

B. Lozano D., Martin A. & et. al. (2019)

The research consist the use of simple industrialized Components for the building customization. The concept use in the research is taken different orthogonal geometries to satisfy the basic flexibility of structure. Based on named as flexible structural system. The process of building a construction system is based on various combinations of so-called construction-producing pairs with two basic units (BIs) to obtain durable members. It is concluded in the paper that a flexible structural system enables the generation of a large number of orthogonal structures in a systematic way.

C. Chauham A. , Sharma S.(2019)

The current focus is on static beam analysis in terms of different load conditions. The beam to be analyzed has a generalized state of support, i.e. Simple support, cantilever and fixed support by the FEM. The analyzed beam has a cross section of "rectangular" shape. The maximum deviation for all the above beams was determined by the NKS Cad method and the FEM. This paper relates to the assessment of the maximum absorption of rays for different support conditions, i.e. stable support, cantilever rays, and simple rays for equal distribution under each load and point load. After analyzing the result that the determined beam is evenly distributed and shows the lowest deflation under similar load conditions for the point load condition, the cantilever beam shows the highest deflation.

D. Rajendra T. U. , Manohar. K (2019)

The research analysed a G+ 30 high rise structures which is considered for analysis. In this static, dynamic and wind analysis by ETABS software. And comparisons of results are made with help of the plotting graphs. By comparing the results, it really concludes that Steel Concrete Composite Structures are more recommendable than RCC structures. It shows that RCC structures have more bending moment and shear force compared to Composite structure.

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E. Savadi A.S., Hosur V. (2019)

The work consists of a concrete computer with an RCC, metal-shaped options are taken for comparison with the G + 2 floor of the industrial building located in the earthquake-3 area of IS 1893-2002 an earthquake. The same static analysis method is used to model multi-component, Steel and RCC components; STAAD-pro V8i Finite software is used. Combined structure The steel column is sealed with PCC and RCC steel girder is used. The dead load and the live load are considered IS-875 (part-1 & 2) and the air load is considered IS-875 (part-3). The results of this work showed that the price of the connector is lower than the RCC model as well as the metal structure. Significant bending time and Shear strength values are in many cases compared to the RCC structure and higher than steel structures due to the reduction in dead load. A multi-component structure is the best solution for a more flexible Composition compared to the RCC and Steel structure.

F. Wewin Inge W., Sofie Nugroho S. & et. al. (2018)

The purpose of this paper is to explain how to build a concrete building that people can use / learn as a better way to reduce potential costs and save time. The reinforcing method described in this paper is the wearing of metal, which explores this method of expanding a restaurant in Medan, Indonesia. In this study, the engineers found that the pressure of the RC column and the existing shade were not strong enough to accelerate the development of the applied building load. The iron coating method can therefore be used to improve the strength and sliding of the column and rod. The results of the case study prove that this is one of the best building extension techniques used in Indonesia. The problem of damage to the metal roofing system, as mentioned in this paper, has been solved by looking at the internal structure of the building, which is not directly exposed to the outside environment and climate.

G. Shetty R.A., Praveen R.K. (2018)

The literature implemented seism operations of a high -level building and assembling columns and structures with shear walls & assembling columns as well as seismic and assembling columns, constructing and assembling columns, brackets, shear walls exploring the main problem systems included. The present study deals with the instability behavior of most of the structural structures studied by the same analytical methods as by ETABS program. The analysis was performed on a stack of two types of standard resistant 3D model parts and highly composite columns. The study is available and means the results are comparable to the importance of seismic patterns such as Base shear, storey displaces and other forces on high -rise buildings.

H. Basa N., Ulicevic M. & et. al. (2018)

The observer deals with the experimental studies of seven fixed sequences, exceeding two intervals of 1850 mm in length, the cross section of which is 150 × 250 mm, which are regulated to the strengths specified in the middle of the vessels until the unsatisfactory position. Six beams were reinforced with different lengths of GFRP with the same strength to match the GFRP, and one iron -reinforced metal was used as reinforcement. + have different structural variables representing the type of GFRP reinforcement and the rate of reinforcement in the visual centre and in the support centre, fabric, redistribution time pattern. + e results of the study have shown that the redistribution time to continuous beams of GFRP-stimulated can be, without reducing the load-bearing capacity, compared to the analytical study. The test results have also been compared with the provisions of the following bylaws, and they have also shown that the American Concrete Institute (ACI) 440.1R-15 effectively predicted the removal of loads for continuous reinforcement and GFRP reinforcement. On the other hand, the current legislation on disruption continues and enforces the GFRP, especially for high burdens. Finally, a model classification for the determination of defects is proposed.

I. Zeeshan M., Sadiq M. & et. al. (2018)

This paper summarizes the concept of stability for high-level mega structures affected by seismic and wind movements that occur at low or higher levels. Because, high -rise buildings must be constructed in such a way that they can withstand wind loads and seismic forces. The building and the discontinuity in the rigidity and in large part were affected by the consolidation of forces and changes during the discontinuity which may have led to the failure of the members in the encounter with the skin of the house. The method used for stabilizing the records of columns, wall panels, mounting and connecting components, bases, single storey and multi -storey structures is studied. Buildings and structures are designed to be stable and supportive by the use of body shielding or shear system or both such as walls to ensure the stability of the building. Too many cases have failed structures due to uncertainty that require the study of the P-Delta. One of the problems is related to wind pressure.

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Designed methods to assist the computer in how to use the program, ETAB/SAP2000. Comparisons of results are made between different methods, programs and different models with different limitations. The P-Delta Test is a built-in wall-to-wall test made using the software.

J. Prasad A., Preetha V. (2016)

The G + 9 multi-storey building, Seismic Zone 3 and Seismic Zone 4 are modelled and analyzed using ETABS-2016. Three different models were performed in this study, one for RCC and the other two. For two different columns, such as steel concrete composite structure and column columns and concrete filled pipes. Comparisons of models such as Linkage, Sequence and Shear Stories are carried out and the results are compared. Steel Concrete Composite structure is best suited for high-rise building due to its decreased self weight of the structure. Steel Concrete Composite structures have higher ductile in nature and hence more suited during Earthquake consideration.

K. Aniket V R., Yogesh S. (2015)

The project involves the study of a residential building with steel-concrete assemblies and R.C.C. construction The planned structure of four large-storied buildings is G + 9, 12, 15, 18. The side plan width of the building is 15m x 9m. The analysis and includes the planned load, analyzed in 2D models using the STAAD-Pro 2007 software. Studies have been completed for various combinations of loads in accordance with the Indian Standard Code of Practice. The project also includes analyzing the similarity of the R.C.C. structure in order to make a price comparison between the iron-concrete composite and a similar R.C.C. structure The combination of components is more economical than the R.C.C. structure Composite structure is the best solution for higher elevations when compared to the R.C.C. structure The speed of construction makes it easy to quickly return on investment and benefits in terms of wages.

L. David Leaf D., Laman J.A. (2013)

This paper presents laboratory research tests and analyzes the flexural strength of beam samples using these available methods and compares the observed behaviours. In addition, simple simplification of the basic elements of the beam assembly was developed and the results were also compared with the data obtained from the tests. Based on the results of these analyzes, recommendations for submission are made to allow accurate verification of the combination of combined belt forces.

M. Matsumoto M. S., Morita M. K.(2012)

This paper reported the structural design of an ultra-high-strength housing using high-strength CFT columns that combine high-strength 780N /mm2 and ultra-high-strength concrete Fc150N / mm2. In integrated and responsive regulatory systems, these agents have the necessary mechanical properties for high -level design satisfaction. In addition these members are able to achieve built -in frames and builders with a high DOF as a result of their large load capacity, so in the future their applications are considered in the ultra high rise. buildings will be expanded

N. Abbood I.S., Jasim M.A. & et. al. (2021)

This paper aims to provide a brief overview of tall buildings in terms of basic definition, appearance safety, building stability and design challenges. The brief demonstrates that these principles are available to describe a well-reported, well-marked, well-known phenomenon as a good basis for resisting wind loads and wind turbines. Therefore, a general visual overview is shown to cover the behavior of many different structures for different high-rise buildings by performing a number of linear analysis (pushover) and nonlinear great process detail. As a result, an important analysis of the simplified space and seismic energy-based design is also presented. This paper is intended to help develop and implement the construction methods of tall buildings in the future.

O. Lozano D., Martin A. & et. al. (2019)

The study covers the use of simple industrial components for building construction. Applying the concepts in the study to different orthogonal geometries satisfies the flexibility of the structures. Based on the naming of a system -based adaptation. The formation of the baseline functions is based on different combinations by labeling the pair rescue unit and the two main units (BUi) to produce the resistors (RMn). in an categorical system.

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P. Chauham A., Sharma S.(2019)

The beam under study had extensive support level such as support, cantilever and permanent support through the Finite Element Method. The beam studied has a "square" college -shaped section. The maximum beam height for all the above beams is designed using NX Cad and Finite Element Methods, This paper deals with the calculation of the beam heights for various support conditions such as support beam, cantilever beam and only support to posts for each issue under equal distribution. and load status. After evaluating all beam conditions, it is clear that the cantilever beams show the lowest deflection under the same standard conditions for all uniform distribution and load conditions while cantilever beams show the highest deflection.

Q. Tiwari Darshita, Patel Anoop (2012)

Concrete is one of the most inexpensive and most sought after materials used in large -scale enterprises around the world. A substituted component of the composite fine by other relevant materials such as sinter fly ash, crushed rock ash, powder coating, glass powder, recycled cement powder and others is being studied from the last twenty years, in the sense of preserving a balanced environment. In this regard, a strength and durability study was conducted using "Spent Fire Bricks" (SFB) (fabric bricks from bed and wall mounting; and chimney lighting used in many applications. business) and "Glass Powder" for altering the alloying quality in concrete. This document recommends that powdered glass and powdered bricks can be used as an alternative construction material that works well together with concrete. The results of this study indicate that brick powder or brick powder can be easily applied in foundation cement.

R. Viktor castlenrist, Stefan svensson(2016)

This paper summarizes methods based on well -defined simulations and more efficient structural elements, with a particular focus on important, common and high -speed building materials. In recent years it has been seen that in societies, there have been many changes such as economic, urban, and urban changes that have become more popular for the construction of high-rise buildings. So far, the construction of large buildings in Sweden has been limited. Challenges are faced during the design and construction of high -rise buildings.

S. Wensheng LU, Xilin LU(2000)

The papers about the tests are high-quality built-in large-scale models on vibration tables. In evaluating the effect of floor adjustments on a new detailed model is presented. The result of the test takes into account the increase in comparative behavior. The combination of floors between high -rise towers, and the rigidity of the foundations with strong behavioural structures are also described in this paper. Many definitions and guidelines have also been achieved.

T. Y. Zhou, T. Kijewski & et.al. (2003)

The researcher examine the action of the wind, high -rise buildings oscillate similarly during wind, crossing winds, and Torsional directions. Although wind loads were successfully treated using quasi-steady and strip theories in the event of a wind surge, large wind and Torsional loads could not be treated in this manner, since these loads cannot be connected in a direct way to changes in the flow path. Accordingly, most of the time these rules and standards provide little guidance for wind crossing and Torsional responses. To fill this gap, a first, linked aerodynamic load database is displayed, which can be accessed by any user with The database contains high -level balance -based measurements over a number of different high -rise model buildings. When combined with the prepared set model, the non-dimensional aerodynamic load can be used to classify the wind-provoked response of high-rise buildings. The impact of key constraints, such as side size, scale, and turbulence of sample groups, is also discussed. The database and process analysis of candidates may be included as a guideline design to the next generation of code and models

III. CONCLUSIONS

The following conclusions are the listed out from the above research papers which are as follows:

A. All the research includes the approach the flexible system in the structure for the development and application of construction systems for high-rise buildings in the future.

B. It is found that beam element is major elements in the structure for the action again flexure, shear, torsion etc common elemental use in high rise and multi-storey buildings.

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C. Use of beam types such simply supported, cantilever elements affect the geometry of the structure and based on them the stability is also enhanced.
D. The case study of various researchers such as Indonesia for the introduce the steel elements in the buildings to gets the exposure from the environmental condition.
E. To evaluated earthquake resisting building with shear wall approach the analysis of building or any structure using linear and non linear approach is compulsory.
F. Comparative study is carried out using multi story building with variation in major elements in terms of materials and other sectional properties
G. Comparative study is taken with shear wall and shear wall with opening.
H. The study is also based on use of different types of software used for analysis such STADD, ANYSIS, ETABS etc
I. Analysis of building for axial force should done on various soil condition.

IV. FUTURE SCOPE

A. Assessment of tall building/Multistorey/medium high rise buildings with introducing the beam elements with variation in materials.
B. Flexible Structural System in India
C. Use of various types of RCC, Steel, Composite beam & column elements.
D. Earthquake effect under different Zone and different Country Codes.
E. FEM Analysis, Comparative software analysis
F. Case Study of pre exiting building and introduce equivalent to new.

V. ACKNOWLEDGMENT

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A. Abbreviations Used
1) RCC: Reinforced Cement Concrete
2) FEM: Finite element method
3) BI: Basic units
4) GFRP: Glass fiber reinforced polymer

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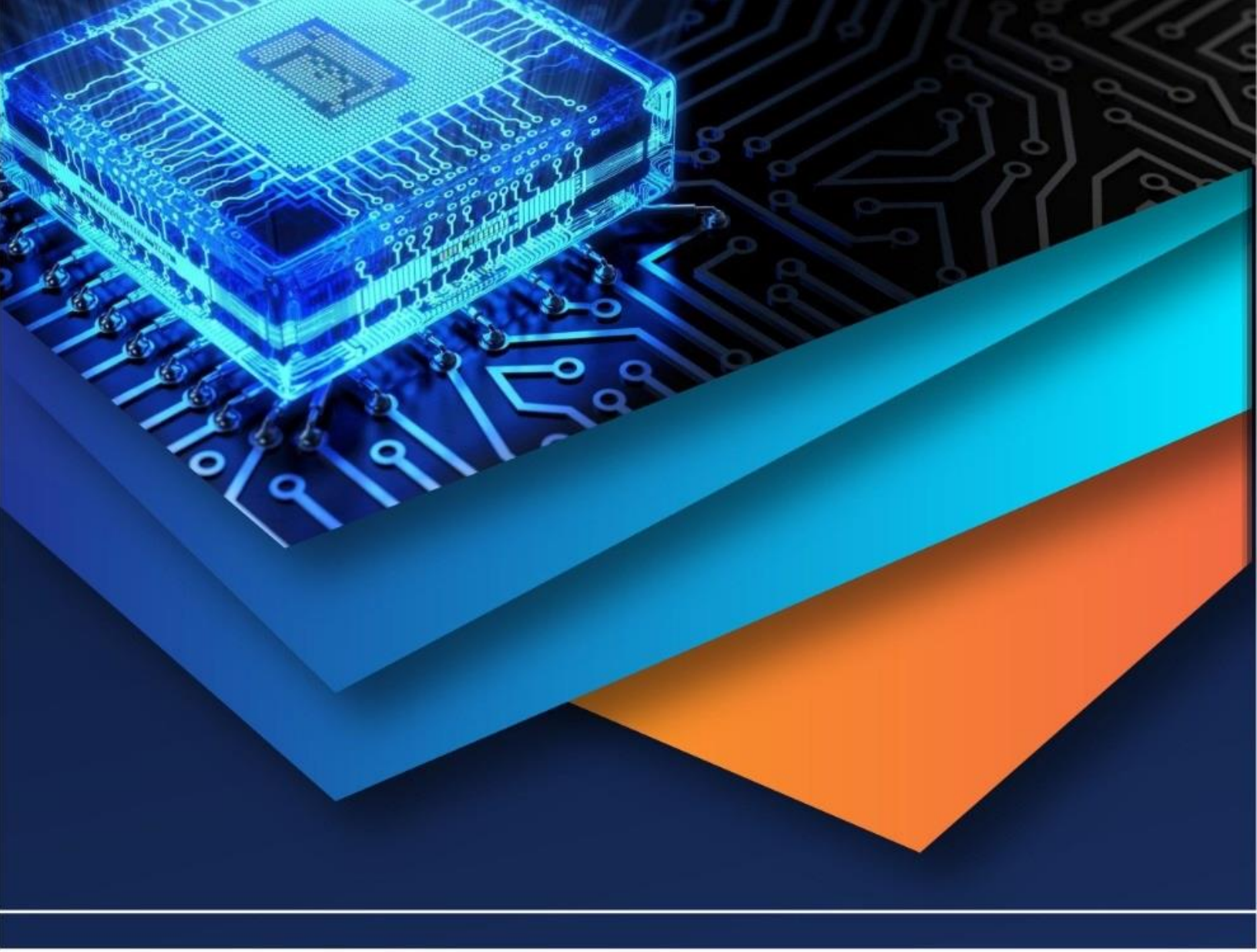

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