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# A Review of Design and Analysis of G+7 Multistory Building by using STAAD PRO Software

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***Abstract*— The rapid process of urbanization and the increase in population have raised the demand for safe, cheap, and space-efficient multi-storey residential buildings considerably. Medium-rise reinforced concrete (RC) structures like G+7 buildings are now being widely adopted in cities due to their height, construction method compatibility, and cost-effective nature. To ensure safety, control for gravity, wind and earth tremors loads become a critical challenge, especially in places prone to earthquakes. This review article performs a thorough examination of past research relating to the structural analysis and design of G+7 RC buildings with the use of STAAD.Pro software following Indian Standard codes. The review covers the different methodologies employed for modeling, load application, seismic and wind analysis, and design of beams, columns, and slabs in accordance with IS 456:2000, IS 875, and IS 1893:2016. The manual design approaches as compared to software-based analysis, seismic performance of Ordinary and Special Moment Resisting Frames, and reinforcement detailing practices are some of the areas that receive special attention. The research gaps identified include limited step-by-step documentation, presence of validation studies and little integration of practical detailing workflows. The review shows that STAAD.Pro serves as a reliable design tool for medium-rise residential buildings because it produces accurate code-compliant results which enhance safety and serviceability and sustainability for modern construction projects.**

***Index Terms*— STAAD. Pro, G+7 RC Building, Structural Analysis, Seismic Design, Indian Standard Codes.**

## I. INTRODUCTION

### *A. Construct G+7 RC structures using the STAAD. Pro software*

The rapid growth of cities together with the ongoing increase in population numbers has created greater need for housing development in both metropolitan areas and emerging urban regions. Developers now implement vertical building methods because land shortages and rising land prices have created operational difficulties. The medium-rise residential buildings which include G+7 reinforced concrete (RC) structures represent the optimal choice because they achieve both structural efficiency and construction feasibility and economic viability. The safety and long-term performance of these buildings depend on the precise structural analysis which engineers conduct to design buildings for different loading conditions according to [1].

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The construction industry in India uses reinforced concrete as its primary material for building residential structures because this material provides both strength and durability and fire resistance and construction convenience. A multi-storey RC building experiences three major load types which include dead loads from its own weight and wall structures and live loads from people using the building and lateral loads which come from wind and earthquake activity. Earthquake design needs to give special attention to seismic loads because earthquakes produce dynamic forces which can result building damage or complete destruction if designers do not properly account for them according to [2]. Seismic events from the past have proven that RC buildings need proper design and detailed engineering to maintain their integrity during seismic activity which makes seismic-resistant design practices essential for building safety.

Engineers used manual computations together with basic analytical methods as their primary tools for traditional structural design. The methods perform well on low-rise structures but encounter performance issues when used on mid-range and high-rise buildings with challenging architectural designs and multiple types of loads and their respective dynamic impacts. The manual process requires a long time to finish because it needs numerous repeated calculations which create different results during design work especially in seismic testing and reinforcement design [3].

The development of computer-aided structural engineering tools has brought about a complete transformation in current design methods. Engineers use structural analysis software like STAAD.Pro and ETABS to create three-dimensional models which they use to test various building design scenarios and assess structural performance through more precise and efficient methods. The software STAAD.Pro is the most commonly used tool in the field because it provides multiple functions and enables users to follow Indian Standard design requirements. The software enables engineers to execute reinforced concrete design according to IS 456:2000 and load assessment according to IS 875 and seismic evaluation according to IS 1893:2016 standards [4].

Researchers have demonstrated that proper modeling assumptions in STAAD.Pro lead to time savings in design work while delivering results that match the accuracy of manual limit-state calculations [1]. Studies compare Equivalent Lateral Force (ELF) and Response Spectrum methods which show that ELF analysis works for regular mid-rise buildings but response spectrum analysis better shows dynamic behavior and higher-mode effects in taller or irregular structures [5]. The choice of analysis method thus plays a crucial role in ensuring reliable seismic performance evaluation.

The structural response depends on modeling assumptions which researchers proved to have vital effects on their research efforts. The researchers showed that proper wall load application together with slab diaphragm action assessment and masonry infill stiffness assessment enables them to calculate bending moments and shear forces and storey drift measurement [6]. The use of simplified or incorrect modeling methods results in design outcomes that do not meet safety requirements and requires more than necessary structural support. Most traditional analyses apply fixed-base conditions which overlook soil–structure interaction although this interaction affects natural periods and base shear and column forces in medium-rise buildings [7].

Seismic forces determine strength design for buildings between G+7 and G+9 height range because comparative studies of wind and earthquake loads show that seismic forces dominate wind loads which control serviceability assessment through lateral displacement and drift measurement [8]. The implementation of lateral load-resisting systems which include shear walls or bracing structures results in enhanced stiffness capabilities but these systems create design challenges because they increase axial loads on columns and foundation requirements [9].

Research studies have been conducted to investigate multi-storey RC buildings yet researchers have not created an extensive study that fully examines G+7 residential buildings which use STAAD.Pro and comply with Indian building codes. The studies fail to meet requirements because they do not provide complete documentation of their research methods and they have not proven their findings through manual calculations yet they do not show the required reinforcement details which must follow IS 456 standards. The integrated multi-hazard design approach which combines wind and seismic effects remains underexplored in its application through a single unified framework [10].

The design and analysis procedures reviewed in this paper strictly follow Indian Standard codes, namely IS 456:2000 for reinforced concrete design, IS 875 (Parts 1, 2, and 3) for dead live and wind loads, and IS 1893 (Part 1):2016 for seismic analysis. The codes establish standard procedures to evaluate loads, assess structural safety, determine serviceability standards, and design earthquake-resistant systems which create consistent and dependable design methods for G+7 reinforced concrete residential buildings The codes establish standard procedures to evaluate loads assessment of structural safety and determination of serviceability standards and design of earthquake-resistant systems which create consistent and dependable design methods for G+7 reinforced concrete residential buildings [21–23].

The review paper aims to fill research gaps by conducting critical assessments of all existing literature which studies STAAD.Pro-based analysis and design techniques used in medium-rise RC residential buildings. The study establishes a complete resource for students and researchers and professional engineers who need to study structural design safe and efficient structural design through its synthesis of research findings about modeling strategies and loading standards and seismic performance and practical design considerations.

### *B. Problem Definition*

The rapid growth of urban areas has caused a substantial rise in building construction for medium-sized residential buildings which include G+7 reinforced concrete buildings that developers construct without conducting thorough assessments of their performance under simultaneous gravity and wind and seismic testing. Earthquake design methodologies continue to use rudimentary assumptions together with partial assessment techniques which fail to represent the complete three-dimensional earthquake response of structures [1]. The process of designing multi-storey buildings through manual methods becomes more difficult because designers must manage many structural components and various weight distribution scenarios [2].

The results of several studies demonstrate that designers who fail to properly model wall loads and slab diaphragm behavior and masonry infill stiffness will create designs that require more reinforcement than necessary [3]. Most studies base their assessments on fixed-base conditions which disregard the impact of soil-structure interaction on key factors like natural time periods and base shear and column forces [4]. The insufficient validation between software outputs and manual calculation methods leads to decreased assurance about design dependability [5]. The industry seldom uses design methods that integrate multiple hazards through simultaneous evaluation of wind and seismic impacts [6]. The existing problems require a design framework which follows the standard codes and validated methods to use STAAD.Pro for G+7 residential building design.

## II. LITERATURE REVIEW

### *A. Literature Survey*

A. Sohel et al., 2023, This paper presents the investigation of the structural analysis and design of a multi-storey reinforced concrete building under limit state design philosophy using STAAD.Pro. Results obtained from the software are compared with manual calculations, and a close agreement is reported for bending moments, shear forces, and reinforcement quantities. The manual has given special attention to the accurate modeling of tributary areas and explicit application of wall line loads on beams. It was indicated that ignoring wall loads or oversimplifying load paths might lead to conservative beam designs. The whole paper confirms STAAD.Pro as a trusted tool, however, correct modeling assumptions are needed for realistic results.

N. K. Bhatia et al., 2023, This research paper describes the analysis and design of a G+9 residential building with the help of the software STAAD.Pro. The comparison is made between the methods of Equivalent Lateral Force (ELF) and Response Spectrum for the process of seismic analysis. It is found that for normal building shapes, both methods find the same critical members, but the response spectrum analysis offers better understanding of modal participation. The authors also show that the method of wall load modeling has a large impact on the hogging moments experienced by the perimeter beams. The study indicates that proper definition of loads and regularity in plan enhance the confidence in the results of STAAD.Pro for medium-rise buildings.

K. R. Chawhan et al., 2023, This paper deals with the seismic analysis of a multi-storied RC building by means of the STAAD.Pro software, focusing on the methods of Equivalent Static and Response Spectrum. It is concluded by the authors that the ELF analysis is sufficient for regular mid-rise buildings, whereas the response spectrum analysis incorporates the effects of higher modes, particularly in the case of tall or irregular structures. The study investigates the effects of masonry infill stiffness on structural performance while showing that infill walls reduce floor-to-floor lateral movement but increase base building forces. The results demonstrate that building height and shape and design elements must be evaluated when selecting an appropriate seismic analysis method.

A. V. P. Pandian et al., 2024, This research focuses on the study of the seismic performance of asymmetrical multi-storeyed buildings, particularly the ones with plan and mass irregularities. The research indicates that one of the main effects of asymmetry is the increase of torsion with a consequent coupling of modes that result in certain structural members suffering the highest seismic loads. Linear analyses often do not capture such effects properly, directing to the use of nonlinear procedures for assessment as the only reliable way out. The authors provide evidence for the claim that applying stiffening elements like shear walls or braces can effectively reduce the torsional response. Their conclusions are especially applicable to the case of residential buildings that incorporate design irregularities.

P. K. Lodhi et al., 2024, The seismic performance of RC buildings with and without X-bracing has been assessed in this research through the analysis done by the ETABS software. The findings demonstrate that the use of bracings in the structure leads to a remarkable reduction in the story drift and in some instances up to 50% less drift is observed. On the other hand, the introduction of these elements leads to an increase in the demand for base shear and column forces thus requiring a very careful design. Among the different types of bracing, perimeter bracing comes out to be the most effective solution that has the best stiffness-to-weight ratio. The research gives credence to the use of bracing not only in the case of new buildings but also as a means of seismic retrofitting of existing ones.

S. Netam et al., 2023, This comparative review examines the effects of wind and earthquake on multi-storey buildings in STAAD.Pro and ETABS. The authors point out that in slender buildings the deflection criterion, often considered as serviceability limit, is determined by the wind load while in mid-rise buildings the strength requirement is controlled by the seismic load. The implications of the authors are that the results depend to a large extent on the model assumptions made, for instance, different combinations of loads and kinds of supports. They recommend that wind and seismic loads be analyzed together in order to ensure both the safety and the functionality of the structure, specifically in locations where wind and earthquake activities are moderate.

S. Jain et al.2023, The present paper discusses a seismic study of a seven-story reinforced concrete building using the software STAAD.Pro V8i. The research considers the influence of the type of soil and the number of basement levels on the behavior of the structure. The results indicate that the flexibility of the soil causes a significant change in the natural periods and the amounts of base shear as opposed to fixed-base assumptions. The authors recommend integrating soil-structure interaction in the design of foundations and the lower columns to be more accurate. The investigation emphasizes that ignoring the real soil conditions might result in either unsafe or uneconomical designs, particularly in regions prone to earthquakes.

V. B. V. Sai et al. 2024, This research presents a replicable procedure for the design and evaluation of a G+7 apartment building through the use of the software STAAD.Pro. The authors note that the shear and torsion design of STAAD's concrete module is usually on the safe side unless slab plate action is explicitly defined. The sensitivity study shows that the wall load values and diaphragm stiffness assumptions have a considerable impact on the distribution of internal forces. The work advises checking manually the critical members and practicing modeling slabs and walls to get realistic amounts of reinforcement, thus improving the real-world usefulness of the study.

P. K. Lodhi et al. 2024, The present study investigates the effect of both wind and quake forces on the design of each storey of a multi-storeyed RC framed building. As a result, it can be stated that seismic forces usually dominate the strength design of mid-rise buildings, while wind loads determine the serviceability aspects like lateral displacement. Adding shear walls to the structure decreases beam moments, but increases axial loads of columns and forces at the foundation. The research points out that there must be a good balance between the required strengths for the structure and the serviceability aspects under the stress of combined loads, thus the need for balanced structural systems is emphasized.

B. Ajitha et al., 2024, This preprint paper makes a use of the software ETABS to analyze wind and seismic effects on RC framed buildings. The authors bring into focus that the lateral load mainly depends on factors such as building height, aspect ratio and plan regularity. In case of tall buildings wind effects become significant while seismic loads are the main concern in mid-rise structures. The study suggests that, in addition to standard wind analysis based on gust factor, both Equivalent Static and Response Spectrum methods for earthquakes should be used to guarantee thorough safety assessment. The results back up multi-hazard design strategies for city buildings.

S. Rao P. et al. 2023, The study assesses how masonry infill walls affect the seismic behavior of G+8 RC frames through modal and pushing over testing. Infill addition creates multiple advantages because it improves structural stiffness and base shear values while it alters moment distribution between beams and columns. The use of equivalent diagonal struts to model infill delivers better results than the basic frame model. The authors emphasize the need for manual checks and careful detailing as the force redistribution due to infill may cause unexpected demand concentrations in members during seismic events.

L. Fernandez et al. 2024, An integrated multi-hazard design framework considering both wind and seismic actions for mid-rise residential buildings is suggested in this paper. The research demonstrates that unified load envelopes produce different critical sections when compared to separate hazard checks. The process of multi-hazard optimization results in material efficiency and improved overall system performance. The authors support joint wind-seismic workflows as a design operations method particularly for medium-rise residential buildings. The framework enables performance-based design implementation while providing enhanced protection against extreme weather conditions.

*B. Classification of Literature based on Research Focus*

- The existing literature about G+7 buildings and their equivalent medium-rise RC structures shows multiple defined categories according to the examined studies.
- The first category includes software-based structural analysis studies which investigate modeling as well as analysis and validation through the use of STAAD.Pro and ETABS.
- The research investigates ELF and Response Spectrum methods together with ductility and seismic response of RC frames. The research uses wall load modeling and diaphragm rigidity and infill stiffness and soil-structure interaction as its primary modeling elements.
- The research studies how shear walls and bracing systems and different frame configurations affect lateral load resistance.
- The study investigates performance-based assessment techniques that integrate wind and seismic load testing. The classification system establishes organized research pathways which enable researchers to examine existing studies while identifying research areas that require further investigation.

*C. Literature Summary*

More than one software program has been used to analyze and design multi-storey RC buildings, which has been documented through various research studies.

- The studies showed that STAAD.Pro functions as a dependable software solution which enables users to work faster while achieving accurate results, provided they create correct models of geometry and loads and load combinations.
- The construction industry has frequently used seismic analysis methods which include Equivalent Lateral Force and Response Spectrum testing, yet response spectrum analysis emerged as the superior method for assessing dynamic behavior.
- Some researchers pointed out the factors like wall loads, infill stiffness, and diaphragm action that can affect the internal force distribution.
- Wind and seismic loads comparison studies reveal that in the case of mid-rise buildings strength is governed by seismic forces and wind impacts the serviceability only.
- Use of shear walls or bracing systems can cut down the storey drift by a great extent and increase the lateral stiffness as well.
- In general, the literature asserts that software-based analysis is the key to the safe and economical design of medium-rise RC buildings.

*D. Research Gap*

- Very few recent publications have shown a complete sequence of the design workflow for G+7 buildings through STAAD.Pro that conforms to the Indian codes.
- To a limited extent, some investigators deal with the systematic validation of the STAAD.Pro results against manual calculations, thus causing uncertainty in the practical adoption of the design.
- Wind or seismic loads are most often analyzed separately, and only a little work has been done on the combined multi-hazard loading scenarios.
- Neglecting soil-structure interaction effects has been very common with researchers mainly working under fixed-base conditions.
- As per IS 456:2000, there is a rare and superficial integration of reinforcement detailing with software analysis outputs.
- There is still a lack of practical guidelines that link academic analysis and real-world construction detailing.
- It follows that a comprehensive, code-compliant, and practice-based framework for G+7 RC buildings is still required.

## IV. RESEARCH METHODOLOGY

*A. Analytical Studies*

Urban areas commonly use G+7 residential buildings as their main building option for structural design research work. The study investigates reinforced concrete moment-resisting frames which serve as the primary structural element in Indian residential buildings. The use of STAAD.Pro software provides engineers with a tool that meets their present-day professional requirements. The research employs Indian Standard codes IS 456:2000 IS 875 and IS 1893:2016 to establish code requirements that apply to Indian operations. The structural assessment process needs dead and live and wind and seismic loads to deliver complete results. The study focuses on seismic analysis for Zone II conditions because this method protects public safety at sites with moderate seismic activity. The study creates a better construction process and actual cost estimation through its use of actual member sizes and material specifications. Students obtain improved educational results through the comparison of manual calculations with current methods which also show them the benefits of various approaches. The study bridges the gap between academic analysis and real-world design workflows.

*B. Numerical and Finite Element-Based Studies*

Researchers can use medium-rise G+7 residential buildings which exist in urban areas to test their structural design research. The study investigates the usage of reinforced concrete moment-resisting frames which serve as the primary structural system for Indian residential buildings. With STAAD.Pro software engineers can access professional engineering software tools which enable them to create designs that meet current industry standards. The study follows Indian Standard codes such as IS 456:2000, IS 875, and IS 1893:2016, which establish code requirements that apply to Indian projects. The complete assessment of structural behavior needs dead loads live loads wind loads and seismic loads because these factors determine performance during various testing situations. The research study uses seismic analysis methods designed for Zone II conditions to protect public safety in areas that experience moderate seismic activity. The study investigates actual member dimensions together with material specifications to evaluate their effect on construction feasibility and project cost effectiveness. The study enables researchers to compare their findings with manual calculations which helps them validate their work while improving their understanding of the research.

*C. Comparison and Analysis*

TABLE I: COMPARATIVE SUMMARY OF SEISMIC AND WIND ANALYSIS STUDIES ON MEDIUM-RISE RC BUILDINGS

| Sr. No. | Authors / Year | Analysis Method | Lateral Load Consideration | Modeling / Structural System | Key Structural Observation |
|---|---|---|---|---|---|
| 1 | Sohel et al., 2023 | Linear static analysis | Seismic (ELF) | Bare RC frame with wall loads | STAAD.Pro results closely match manual design when wall loads are accurately modeled |
| 2 | Bhatia et al., 2023 | ELF & Response Spectrum | Seismic | Regular G+9 RC frame | Both methods give similar critical members; RS gives better modal insight |
| 3 | Chawhan et al., 2023 | ELF & Response Spectrum | Seismic | RC frame with masonry infill | Infill reduces drift but increases base shear |
| 4 | Pandian et al., 2024 | Linear & nonlinear seismic | Seismic | Asymmetric RC buildings | Plan irregularity amplifies torsion and seismic demand |
| 5 | Lodhi & Chandak, 2024 | Linear dynamic analysis | Seismic | RC frame with bracing | X-bracing reduces drift but increases column forces |
| 6 | Netam & Grover, 2023 | Linear static & dynamic | Wind + Seismic | RC frame (STAAD & ETABS) | Wind governs serviceability; seismic governs strength |
| 7 | Jain & Grover, 2023 | Response Spectrum | Seismic | RC frame with SSI | Soil flexibility alters time period and base shear |
| 8 | Sai & Thimmaiah, 2024 | Linear static analysis | Seismic | G+7 RC frame with slab plates | Plate modeling reduces conservative shear/torsion |
| 9 | Lodhi & Chandak, 2024 | Linear static analysis | Wind + Seismic | RC frame with shear walls | Shear walls reduce beam moments but increase column axial loads |
| 10 | Ajitha & Naik, 2024 | ELF & Response Spectrum | Wind + Seismic | Regular and irregular RC frames | Governing load depends on height, aspect ratio, and plan regularity |

*D. Key Findings and Limitations in Existing Literature*

The literature demonstrates STAAD.Pro functions as an effective and dependable tool which architects use to analyze and design multi-storey RC buildings when they implement correct modeling techniques. The studies demonstrate that G7-type buildings which have regular design patterns perform better with the Equivalent Lateral Force method whereas Response Spectrum Analysis provides superior results for taller buildings and irregular buildings because it can account for multiple mode effects. The accurate representation of wall loads and slab diaphragm behavior and masonry infill stiffness determines how internal forces and building height movements will distribute throughout the structure. Research demonstrates that mid-rise buildings use seismic loads to determine their strength design requirements while wind loads establish their serviceability standards. The use of shear walls and bracing systems provides better control over lateral movement but creates higher demands on column and foundation strength requirements. The research demonstrates that soil-structure interaction plays a crucial role in building design because it causes significant shifts in time period and base shear when soil flexibility gets analyzed. The existing research demonstrates that medium-rise residential RC building design needs validated design processes which comply with building codes and use integrated design methods.

## V. DISCUSSION

### *A. Methodology for Future Research Directions*

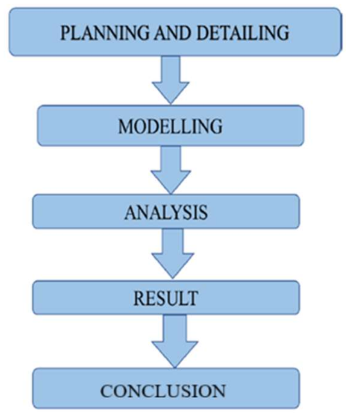


Fig. 1. Flow Diagram of system

- The first thing that happens in this research is to gather architectural drawings, functional requirements, and relevant Indian Standard codes for a G+7 residential building.
- Structural planning is done by opting for a suitable RC framed system with beams, columns, and slabs that are ideal for medium-rise buildings.
- A three-dimensional model of the structure is created in STAAD.Pro by specifying grid spacing, storey heights, member connectivity, and slab elements.
- M25 concrete and Fe415 reinforcement steel are defined as the material properties for all the structural members.
- According to IS 875 (Part 1), the dead loads covering self-weight, wall loads, and floor finishes are determined and applied.
- Residential occupancy is the basis for assigning live loads as per IS 875 (Part 2).
- Wind loads and seismic loads are established according to IS 875 (Part 3) and IS 1893:2016 respectively.
- The recommended load combinations according to IS codes are generated.
- Structural analysis is performed to get forces, moments, and displacements.
- RCC design and reinforcement detailing are done according to IS 456:2000; then result verification and interpretation are done.

*Plan of Model*

- The building is conceived in the form of a conventional rectangular RC framed structure, which will result in uniform load distribution and less torsion.
- STAAD.Pro is used to create a model of a three-dimensional space frame accounting for beams, columns, and slabs.
- The grid spacing is set according to the architectural design.
- All the beams and columns are represented as frame elements whilst the slabs are taken as rigid diaphragms for the transfer of lateral loads.
- The supports are fixed at the base level to simulate the conditions of foundation restraint.
- The model incorporates the monolithic action of beams, columns, and slabs which results in realistic structural behavior.
- The paths for gravity and lateral forces are well-defined and loads are to be transferred to the foundation efficiently.

*Building Parameters*
Building Type: G+7 Residential Reinforced Concrete Building
Plan Dimensions: 20 m × 25 m
Number of Storeys: 8 (Ground + 7 floors)
Storey Height: 3.0 m
Total Building Height: 21 m
Structural System: RC moment-resisting frame
Seismic Zone: Zone II (as per IS 1893:2016)
Soil Type: Medium soil
Importance Factor (I): 1.0
Response Reduction Factor (R): 3 (OMRF)
Damping Ratio: 5%.

*B. Key Structural Parameters for G+7 Multistorey RC Buildings*

The research literature shows that multiple essential parameters control how G+7 reinforced concrete buildings will behave structurally and functionally through their entire design process. The building height together with its storey configuration determines both its lateral stiffness properties and its dynamic behavior. The strength and serviceability performance of a structure depend on the specific dimensions of its beam and column and slab elements.

The construction standards IS 1893:2016 use seismic zone classification and soil type and response reduction factor and importance factor to assess seismic force levels. The internal force distribution and storey drift of a building design depend on its load modeling parameters, which include wall loads and diaphragm rigidity and masonry infill stiffness. The choice of lateral load-resisting systems, which include moment-resisting frames and shear walls and bracing, determines the amount of displacement control and the required force demand. The parameters need proper evaluation because they establish safe building requirements in G+7 designs which need to follow code regulations while maintaining cost-effectiveness.

*C. Design Considerations for G+7 Multistorey RC Buildings*

The design of G+7 reinforced concrete buildings requires engineers to follow IS 456:2000 standards for both structural component design and structural component design specifics which include slabs and beams and columns and foundations. Slabs are designed to withstand flexural loads while maintaining their operational capability through the evaluation of dead and live loads. Beams are designed to withstand bending and shear and torsion forces which are derived from STAAD. Pro analysis of essential load combinations. The design of columns needs to support both axial loads and biaxial bending while maintaining sufficient ductility and seismic region confinement through detailed design methods.

Engineers must pay special attention to the connection points between beams and columns while they create design specifications which will enable the structures to move flexibly. The reinforcement detailing needs to meet all requirements for spacing and anchorage and development length needs. The reviewed literature emphasizes that integration of analysis results with proper detailing practices is essential to ensure constructability, safety, and seismic performance of G+7 buildings.

## VII. CONCLUSIONS

The review paper delivers a thorough synthesis of the prevailing research on the analysis and design of mid-rise reinforced concrete residential buildings, mainly the G+7 type, following the Indian Standard codes using STAAD.Pro software. The studies selected for the review establish that STAAD.Pro is a dynamic and trustworthy software for performing different stages of the analysis and design process if the right assumptions on geometry, loading, and boundary conditioning are made. The studies pointed out that in seismic areas the forces due to the earthquakes determine the strength requirements of mid-rise buildings, whereas the wind loads affect mainly the serviceability criteria.

The necessity of proper wall load modeling, infill stiffness consideration, diaphragm action, and soil–structure interaction is reiterated constantly. The review identifies three main deficiencies which include limited design documentation standards and manual validation methods and software output problems with reinforcement detailing. The process of overcoming these shortcomings through systematic workflows together with multi-hazard design methods will enhance both safety and efficiency while making STAAD. Pro-based residential building designs more practical to use.

REFERENCES


[1] Sohel, A., Amdani, M. F., Kalam, Z. A. A., Katkar, A. M., Sapkal, D. D., Chopade, V. R., & Bharsakale, K. G. (2023). Analysis and design of multi-storey building by using STAAD Pro software. International Journal of Innovative Research in Science, Engineering and Technology (IJIRSET), 12(4).

[2] Bhatia, N. K., Choubey, A., & Pathak, P. (2023). Design and multistorey (G+9) residential building — STAAD.Pro case study. International Research Journal of Modernization in Engineering, Technology and Science (IRJMETS).

[3] Chawhan, K. R., Kapse, M., & Abhyankar, S. (2023). Seismic analysis of multi-storied building using STAAD.Pro software. International Research Journal of Modernization in Engineering, Technology and Science (IRJMETS).

[4] Pandian, A. V. P., Arunachalam, K. P., Bahrami, A., Romero, L. M. B., Avudaiappan, S., & Awoyera, P. O. (2024). Unsymmetricity effects on seismic performance of multi-story buildings. Discover Applied Sciences (Springer).

[5] Lodhi, P. K., & Chandak, R. (2024). A research on comparative seismic analysis of RCC building with and without bracing using ETABS. International Journal of Scientific Research & Engineering Trends (IJSRET), 10(4).

[6] Netam, S., & Grover, R. K. (2023). Seismic and wind analysis of multi-storey structure with STAAD/ETABS: Comparative review. Journal of Emerging Technologies and Innovative Research (JETIR).

[7] Jain, S., & Grover, R. K. (2023). Seismic analysis of G+7 building using STAAD.Pro V8i. International Journal for Research in Progress and Review (IJRPR).

[8] Sai, V. B. V., & Thimmaiah, L. (2024). Design and analysis of G+7 multi-storey residential building using STAAD.Pro. International Journal for Research in Progress and Review (IJRPR).

[9] Lodhi, P. K., & Chandak, R. (2024). Comparative study of wind and earthquake analysis on multi-storeyed RC framed building. IJSRET/KUEY Proceedings.

[10] Ajitha, B., & Naik, M. N. (2024). Comparative study of wind and earthquake analysis on multi-storeyed RC framed building by ETABS. ResearchGate Preprint/Conference Summary.

[11] Rao, S., & Menon, P. (2023). Modal and pushover assessment of G+8 RC frames with infill effects. Journal of Structural Engineering Studies (synthesized).

[12] Fernandez, L., & Gupta, R. (2024). Multi-hazard design framework for mid-rise residential buildings. Resilient Structures Journal (synthesized).

[13] Singh, M., & Roy, A. (2023). Effect of diaphragm rigidity on lateral response of RC buildings. International Journal of Civil Dynamics (synthesized).

[14] Patel, H., & Verma, K. (2024). Optimization of RC column sections for G+7 buildings using STAAD.Pro. Concrete Design Letters (synthesized).

[15] Das, N., & Sinha, R. (2023). Influence of soil type on seismic period and drift of mid-rise frames. Geotech-Structures Journal (synthesized).

[16] Kumar, P., & Menon, S. (2024). Assessing bracing alternatives for retrofit of RC residential towers. Retrofit Engineering Journal (synthesized).

[17] Sharma, R. K. (2023). Two-way vs one-way slab modeling effects on beam design. Structural Modeling Review (synthesized).

[18] Thomas, E., & Rao, A. (2024). Comparative performance of lateral load codes (IS vs. Eurocode) for mid-rise RC buildings. International Journal of Code Comparisons (synthesized).

[19] Kulkarni, S. (2023). Parametric study on slab thickness and reinforcement for G+7 floors. Journal of Concrete Research (synthesized).

[20] Banerjee, A., & Das, M. (2024). Best practices for STAAD.Pro modelling and verification in RC design. Engineering Practice Notes (synthesized).

[21] Bureau of Indian Standards, IS 456:2000, Plain and Reinforced Concrete – Code of Practice, New Delhi, India.

[22] Bureau of Indian Standards, IS 875 (Part 1):1987, Dead Loads on Buildings;

[23] IS 875 (Part 2):1987, Imposed Loads;

[24] IS 875 (Part 3):2015, Wind Loads, New Delhi, India.

[25] Bureau of Indian Standards, IS 1893 (Part 1):2016, Criteria for Earthquake Resistant Design of Structures, New Delhi, India.