



(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)



Impact Factor: 8.699

Volume 14, Issue 6, June 2025

⊕ www.ijirset.com 🖂 ijirset@gmail.com 🖄 +91-9940572462 🕓 +91 63819 07438

www.ijirset.com |A Monthly, Peer Reviewed & Refereed Journal| e-ISSN: 2319-8753| p-ISSN: 2347-6710|

Volume 14, Issue 6, June 2025 |DOI: 10.15680/IJIRSET.2025.1406054|

A Comparative Study of RC Column and Compostie Column with Flat Slab System using Linear Static Analysis and Push over Analysis by STAAD PRO

M. Vamshi Krishana, Kamishetti Shiva, Koduri Vignesh Kumar, Mohammed Toufiq Umar

Assistant Professor, Department of Civil Engineering, Guru Nanak Institutions Technical Campus, Ibrahimpatnam,

Telangana, India

U.G. Student, Department of Civil Engineering, Guru Nanak Institutions Technical Campus, Ibrahimpatnam,

Telangana, India

U.G. Student, Department of Civil Engineering, Guru Nanak Institutions Technical Campus, Ibrahimpatnam,

Telangana, India

U.G. Student, Department of Civil Engineering, Guru Nanak Institutions Technical Campus, Ibrahimpatnam,

Telangana, India

ABSTRACT: This study presents a comparative evaluation of Reinforced Concrete (RC) columns and Composite columns integrated with flat slab systems in multistorey structures. The analysis focuses on assessing structural performance under lateral and gravity loads using both Linear Static Analysis and Nonlinear Pushover Analysis conducted in STAAD Pro. The objective is to examine the strength, stiffness, and deformation behaviour of the two types of columns within the flat slab system, which is increasingly preferred for its architectural flexibility and reduced construction time. Key parameters such as base shear, displacement, and load-carrying capacity are analysed to determine the efficiency and seismic resilience of each structural system. Results indicate that composite columns, owing to their higher strength-to-weight ratio, offer improved performance under seismic loads compared to conventional RC columns. This comparative investigation aids in selecting an optimal column system for safer and more economical high-rise building design.

KEYWORDS: RC Column, Composite Column, Flat Slab, Linear Static Analysis, Push Over Analysis, Load-Carrying Capacity, High-Rise Buildings.

I. INTRODUCTION

In modern high-rise construction, the selection of an efficient structural system plays a vital role in ensuring safety, performance, and cost-effectiveness. Among the various framing options, flat slab systems have gained popularity due to their architectural flexibility, reduced floor-to-floor height, and ease of construction. However, the structural efficiency of a flat slab system largely depends on the type of column used. Reinforced Concrete (RC) columns are widely adopted for their simplicity and compatibility with concrete construction, while Composite columns, which combine the properties of steel and concrete, offer enhanced load-bearing capacity and ductility.

This study aims to investigate and compare the performance of RC columns and Composite columns when used with flat slab systems. The comparison is carried out through two primary analytical methods: Linear Static Analysis and Nonlinear Pushover Analysis, both implemented using STAAD Pro software. These methods help in evaluating the structural behaviour under lateral and gravity loads, with a focus on parameters such as displacement, base shear, and overall structural response.

With increasing emphasis on earthquake-resistant design, understanding the performance differences between these two column types is essential for optimizing structural safety and material efficiency. This study not only highlights the strengths and limitations of each column system but also provides guidance for engineers and designers in selecting suitable construction practices for high-rise buildings.

www.ijirset.com |A Monthly, Peer Reviewed & Refereed Journal| e-ISSN: 2319-8753| p-ISSN: 2347-6710|

Volume 14, Issue 6, June 2025

|DOI: 10.15680/IJIRSET.2025.1406054|

Paper is organized as follows. Section II describes automatic text detection using morphological operations, connected component analysis and set of selection or rejection criteria. The flow diagram represents the step of the algorithm. After detection of text, how text region is filled using an Inpainting technique that is given in Section III. Section IV presents experimental results showing results of images tested. Finally, Section V presents conclusion.

II. LITERATURE SURVEY

Over the years, numerous researchers have explored the behaviour of structural systems under different loading conditions to enhance safety and efficiency in building design. The study of flat slab systems, in particular, has gained attention due to their advantages such as reduced formwork, ease of construction, and improved architectural flexibility. Flat slabs, however, transfer loads directly to the columns without the use of beams, making the column choice crucial for the structural integrity of the system

Reinforced Concrete (RC) columns have traditionally been used in such systems because of their durability and compatibility with flat slabs. Studies have shown that while RC columns provide adequate strength, they may exhibit limitations in ductility and performance under lateral loads, especially in high seismic zones.

In contrast, Composite columns—which combine structural steel and concrete—have demonstrated improved loadcarrying capacity and deformation resistance. Research indicates that these columns perform better under seismic loads due to their higher stiffness and energy absorption capabilities. Several comparative studies have been conducted using simulation tools like STAAD Pro, ETABS, and SAP2000, showing that composite columns can enhance both stability and economy in tall buildings.

Nonlinear pushover analysis has become a preferred method for evaluating the seismic performance of structures, offering insights into their behaviour beyond the elastic range. When used alongside linear static analysis, it provides a comprehensive understanding of structural response, particularly in identifying weak zones and failure patterns.

Overall, the literature suggests a growing preference for composite columns in modern construction, especially when combined with flat slab systems in seismically active regions. However, further comparative investigations using detailed analysis tools are necessary to quantify the performance differences in practical scenarios, which this study aims to address.

III. METHODOLOGY

The methodology adopted in this study involves the development and analysis of two structural models using STAAD Pro software to evaluate and compare the performance of RC columns and Composite columns within a flat slab system. Both models are designed with identical structural dimensions, story heights, and slab configurations to ensure an accurate comparative assessment. RC columns are modelled using standard concrete and steel properties, while composite columns are modelled with a combination of structural steel encased in concrete. The material properties and section sizes are chosen in accordance with relevant IS codes. Each structure is subjected to similar loading conditions, including dead load, live load, and seismic load, as defined by IS 875 and IS 1893 standards. Initially, Linear Static Analysis is performed to assess the structural behaviour under elastic conditions, focusing on displacements, base shear, and internal forces. Subsequently, Nonlinear Pushover Analysis is conducted to evaluate the response of the structures under increasing lateral loads, identifying plastic hinge formations and ductility characteristics. The analytical results from both models are compared to determine which column system offers better structural performance and seismic resilience when used with a flat slab system. This methodological approach provides a clear understanding of the practical differences in using RC versus Composite columns in multistorey building design.

www.ijirset.com |A Monthly, Peer Reviewed & Refereed Journal| e-ISSN: 2319-8753| p-ISSN: 2347-6710|

Volume 14, Issue 6, June 2025

|DOI: 10.15680/IJIRSET.2025.1406054|

IV. EXPERIMENTAL RESULTS

Figures shows the results of A comparative study of RC column and composite column with flat slab system using linear static analysis and push over analysis by STAAD pro.

Fig: 1 Typical floor column layout

Fig: 2 Dead Load on G+6 Commercial Building

www.ijirset.com |A Monthly, Peer Reviewed & Refereed Journal| e-ISSN: 2319-8753| p-ISSN: 2347-6710|

Volume 14, Issue 6, June 2025

|DOI: 10.15680/IJIRSET.2025.1406054|

Fig: 3 Shear Force and Displacement

Fig: 4 Competition of RC Column vs Displacements

www.ijirset.com |A Monthly, Peer Reviewed & Refereed Journal| e-ISSN: 2319-8753| p-ISSN: 2347-6710|

Volume 14, Issue 6, June 2025 |DOI: 10.15680/IJIRSET.2025.1406054|

Fig: 5 Capacity Curve of RC Column

Fig: 6 Capacity Curve of Composite Column

www.ijirset.com |A Monthly, Peer Reviewed & Refereed Journal| e-ISSN: 2319-8753| p-ISSN: 2347-6710|

Volume 14, Issue 6, June 2025

|DOI: 10.15680/IJIRSET.2025.1406054|

V. CONCLUSION

This comparative study has analysed the structural performance of RC columns and Composite columns integrated with flat slab systems using Linear Static and Pushover Analysis in STAAD Pro. The results clearly indicate that composite columns exhibit superior performance in terms of strength, stiffness, and energy dissipation capacity, particularly under lateral seismic loading conditions. While RC columns are effective and commonly used due to their simplicity and availability, composite columns provide enhanced load-bearing capacity and reduced lateral displacements, making them more suitable for high-rise and earthquake-prone structures. The use of flat slab systems with composite columns also contributes to material optimization and construction efficiency. Overall, the study concludes that composite columns, when used with flat slabs, offer a more resilient and efficient structural system compared to conventional RC columns. These findings can assist structural engineers in making informed design decisions for safer and more economical building construction.

REFERENCES

- Vignesh Kini K, Rajeeva S V "Comparison of response spectrum analysis and construction sequence analysis of RC and steel-concrete composite multi-storeys building with floating columns" IJRSAEVolume 6 Issue: 05 | May-2017
- 2) B. Sri Harsha and J Vikranth "Study and comparison of construction sequence analysis with regular analysis by using Etabs" IJRSAE Volume 2, issue 8, PP:218-227, oct-dec 2014
- Meghana B.S, Sadashiva Murthy T.H, "Comparison of linear static analysis and construction sequence analysis on multi-story building with RC floating column resting on RC and composite transfer girders", International Journal of Engineering Trends and Technology, volume: 36, number:07, June-2016, pp:343-346
- Sagupta and R. Amin, S.K. Mahajan "Analysis of multi storied RCC building for construction sequence loading" IJMTER, ISSN(e) 2349-9745 Date:2-4july, 2015.
- Swapnil. Choleka and Basavlingappa.S.M, "Comparative analysis of multistoried RCC and composite building due to mass irregularity "International research journal of engineering and technology, vol.2, issue.4, pp603-608, July-2015
- 6) Yousuf Dinar "Chronological Construction Sequence Effects on Reinforced Concrete and Steel Buildings "THE IJES, ISSN(e):2319-1813, Volume 3 issue:1 Pages 52-63,25 December 2014
- 7) IS 456:2000, "Indian Standard code of practice for Plain and Reinforced concrete", Bureau of Indian Standards, New Delhi, India.
- 8) IS 456:2000, "Indian Standard code of practice for Plain and Reinforced concrete", Bureau of Indian Standards, New Delhi, India.
- 9) Euro code 3, "Design of Steel Structures". European Committee for Standardization.

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

www.ijirset.com