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Comparative Analysis of Composite Structure by STADD Pro Software

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Abstract: ***In comparison to many other emerging nations, India uses a fairly little amount of steel in the construction industry. Other nations' experiences suggest that this isn't because steel isn't economically viable as a building material. Maximum Axial Forces On Column Base Of The Structure Column RCC Structure (kN),steel Structure (kN) ,Difference in Foundation Size and Reinforcement Requirements Property RCC Structure, Steel Structure Size:- are found by staad pro software. .With the existing development requirements in India, there is a tremendous opportunity for raising the volume of steel in teaching. A significant loss for the nation results from not utilising steel where it is cost-effective as an alternative construction material. Also, it is clear that modern composite sections made of steel and concrete are a time, money, and cost-effective alternative for important civil structures like bridges and tall skyscrapers.***

Keywords: **G+4, Composite Structure, Zone-IV, Cost Effective, Storey Drift, Base Shear.**

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I. INTRODUCTION

A composite member is a rolled or built-up structural steel shape that is filled with concrete, encased in reinforced concrete, or physically linked to a slab of reinforced concrete. The use of composite members during construction ensures that the axial compression and/or bending resistance of the concrete and structural steel shapes. When a concrete component, such as a floor slab or a bridge, is linked to a steel component, such as an I-section beam, it creates a composite member that allows forces and moments to be transferred between them. It is important to note that both materials are used as efficiently as feasible in this instance, resulting in a construction that is advantageously both efficient and affordable. Thermal expansion (coefficient of thermal expansion) is comparable for steel and concrete. As a result, there are no obvious thermal strains caused by the segment that is experiencing temperature change. The total shear force at the interface between a concrete slab and steel beam is approximately eight times the total load carried by the beam. Therefore, mechanical shear connectors are required at the steel-concrete interface. These connectors are designed to (a) transmit longitudinal shear along the interface and, (b) prevent separation of steel beam and concrete slab at the interface. THUS, mechanical shear connectors are provided to transmit the horizontal shear between the steel beam and the concrete slab, ignoring the effect of any bond between the two. It also resistsuplift force acting at the steel interface. Commonly used types of shear connectors as per IS: 11384 –1985: Code of practice for composite construction in structural steel and concrete.

II. LITERATURE REVIEW

Lallotra and Singha(2017) The purpose of this work is to conduct a thorough examination of the key characteristics of three commonly used structural analysis and design software applications, STAAD Pro, SAP-2000, and ETABS. Each software package has unique characteristics, options for analysis, options for the design and output, limits, and benefits. The user must take full advantage of all a software program's positive features, but the programme shouldn't be used outside of its intended scope to prevent a catastrophic failure. The key aspects of all of these software applications are therefore covered in this essay, with a focus on their usefulness and potential drawbacks. This will provide a designer the confidence to select the necessary software in accordance with a structure's specifications.

Limbare and Dode (2018) The phrase "composite materials" refers to an usable substance that is created by macroscopically combining two or more easily identifiable components. The provisions of IS: 1893 part1)-2002 are taken into consideration for earthquake loading in the current work while comparing RCC structures with steel concrete composite solutions for G+20 storey buildings located in earthquake zone II. STAAD-PRO software is utilised for the design and analysis of the construction. Comparing the data, it was discovered that composite structures were more cost-effective.

Sarath et al. (2020) This study's main goal is to design a building's relaxing around a single column. The development of construction technologies and high-rise commercial structures is influenced by the population's rapid growth and the limited availability of land. The structure is essential in enhancing a variety of activities. People move quickly from one place to another in

today's world, mostly for financial gain.Our buildings are supported by a single column for aesthetic reasons, and the response of the single column and floor to linear and dynamic loading is studied for deflection, bending moment, and shear force. Structural planning and design is an art and science that focuses on creating structures with economy, elegance, and durability. The entire process of structural planning and designing requires not only creative creativity and intellectual thinking, but also solid structural engineering knowledge in addition to practical knowledge of elements like applicable design codes supported by real-world examples. Standards are meant to ensure and improve safety while carefully balancing economy and safety.

Javaid and Verma (2021) The purpose of this study is to evaluate the efficiency of viscous dampers (VDs) and buckling restrained braces (BRBs) in reducing seismic energy and enhancing seismic performance of irregular composite buildings during earthquake events. Using ETABS software and the response spectrum method as per IS 1893:2016 for seismic zone V, the seismic response of steel-concrete composite moment resisting frames of 15 stories with concrete filled steel tubes (CFST) as columns and composite beams was assessed with and without seismic protection devices. The constructions had both conventional and atypical layouts. C- and L-shaped buildings are among the irregularly shaped buildings in the plan. All of the structures have BRB and VD installations in two arrangements: corner bays and centre bays throughout the height. The outcomes demonstrated the superior energy dissipation capabilities of BRBs and VDs. Contributions from VDs were 5%–8% higher than those from BRBs, making them more effective. For typical buildings, the most effective placement of VDs was in the centre bays, which reduced the time period by 60%, the maximum story displacement by 57%, the base shear by 37%, and the maximum interstory drift ratio by 70%. Viscous dampers are a great option for midrise composite buildings because corner bay placement of VDs was most effective for C and L-shaped buildings, which reduced time-period by 55%–60%, maximum story displacement by 63%–65%, base shear by 30% and 13%, and maximum interstory drift ratio by 78%–80%, respectively.

Singh and Singh (2022) The desire for tall structures with good aesthetic appeal and distinctive designs to set them apart from other structures that result in irregularity in construction grows as a result of the modern, innovative world. It is well known that an irregular structure is more prone to damage than a regular one, and that irregularity leads to structural instability. There are modern methods to keep buildings stable and safe, such as shear walls, belt walls, dual systems, etc., because modern issues demand modern answers. This study uses ETABS, outriggers, and belt truss to analyse various G+9 composite frame structure shapes. Dynamic and static analyses both take seismic load into account (Response Spectrum method).they also considered the parameters like Story drift, Story displacement, base shear of the different structures.

III.DATA FOR DESIGN AND ANALYSIS OF FRAMED STRUCTURE

S. NO	PARTICULARS	DIMENSION/SIZE/VALUE
1.	Model	G+4
2.	Seismic Zone Factor	0.24 (Zone IV)
3.	Floor Height	3.2m
4.	Depth Of Foundation	1.5m
5.	Building Height	16m
6.	Plan Size	12mx12m
7.	Total Area	144 m^2
8.	Earthquake Load	As per IS-1893-2002(2016)
9.	Type Of Soil	Type -II, Medium soil as per IS-1893(2016)
10.	E_c	$5000\sqrt{fck}$ N/ mm^2(E_c is short term static modulus of elasticity in N/ mm^2)
11.	F_{ck}	$0.7\sqrt{fc}$ k N/ mm^2(F_{ck} is characteristic cube strength of concrete in N/ mm^2
12.	Live Load	2 kN/ m^2 as per IS : 875 (Part II)-1987
13.	Floor Finish	1.00kN/ m^2
14.	Specific Weight Of RCC	25.00 kN/ m^2
15.	Specific Weight Of Infill	20.00 kN/ m^2

16.	Material Used	Concrete M-30and Reinforcement Fe-415(HYSD Confirming to IS-1786)
17.	Reinforcement Used	High strength deformed steel Confirming to IS-786. It is having modulus of Elasticity as 200 kN/ mm^2
18.	Static Analysis	Equivalent static lateral force method
19.	Software Used	STAAD-Pro for static analysis, MS Excel For Excel Sheets
20.	Specified Characteristics	Compressive strength of 150mm cube at 28 days for M-30grade concrete-30N/ mm^2
21.	Importance Factor	1
22.	Fundamental Naural Time Period Of Building	Ta = 0.075 h0.75 for moment resisting RC frame building without infill's Ta = 0 .09 h/√d for all other building i/c moment resisting RC frame building with brick infill walls Where h = height of building d = base dimension of building at plinth level in m along the considered direction of lateral forces.

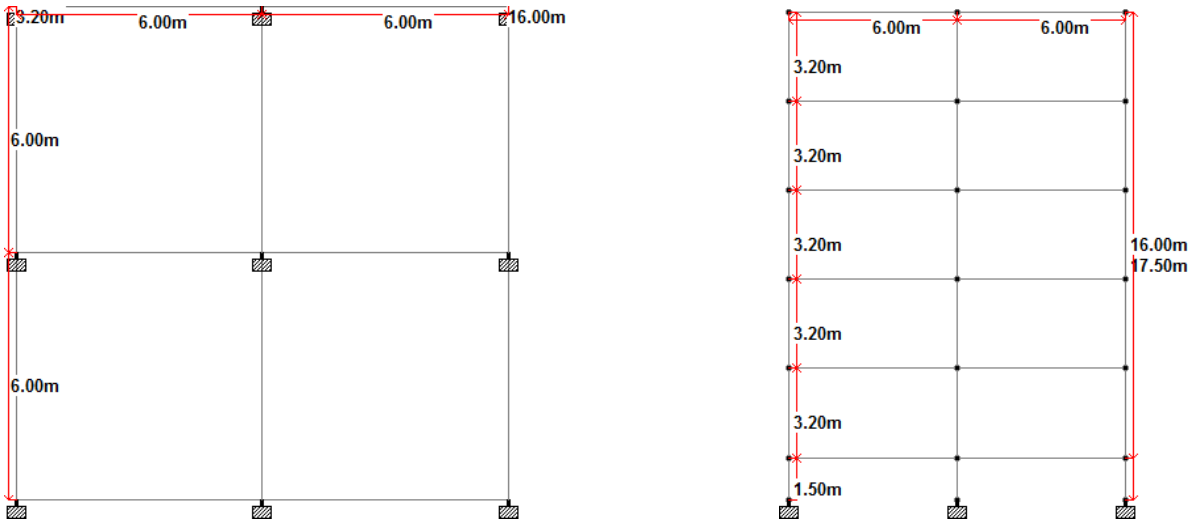

Figure 1 Plan and Elevation of the Structure

IV. CONCLUSION

Based on the above study following conclusions can be made

1) Sufficient To comprehend how the composite elements behave, researchers have studied the literature on composite structures.
2) Design loads and exposure conditions are applied in accordance with IS Codes.
3) An analysis, design, and calculation of cost per unit quantities have been completed for a G+4 RCC structure with plan dimensions of 12m x 12m.
4) Due to its inherent flexibility, steel structures perform better than traditional R.C.C. structures. An equivalent steel structure has also been studied and developed with earthquake considerations.

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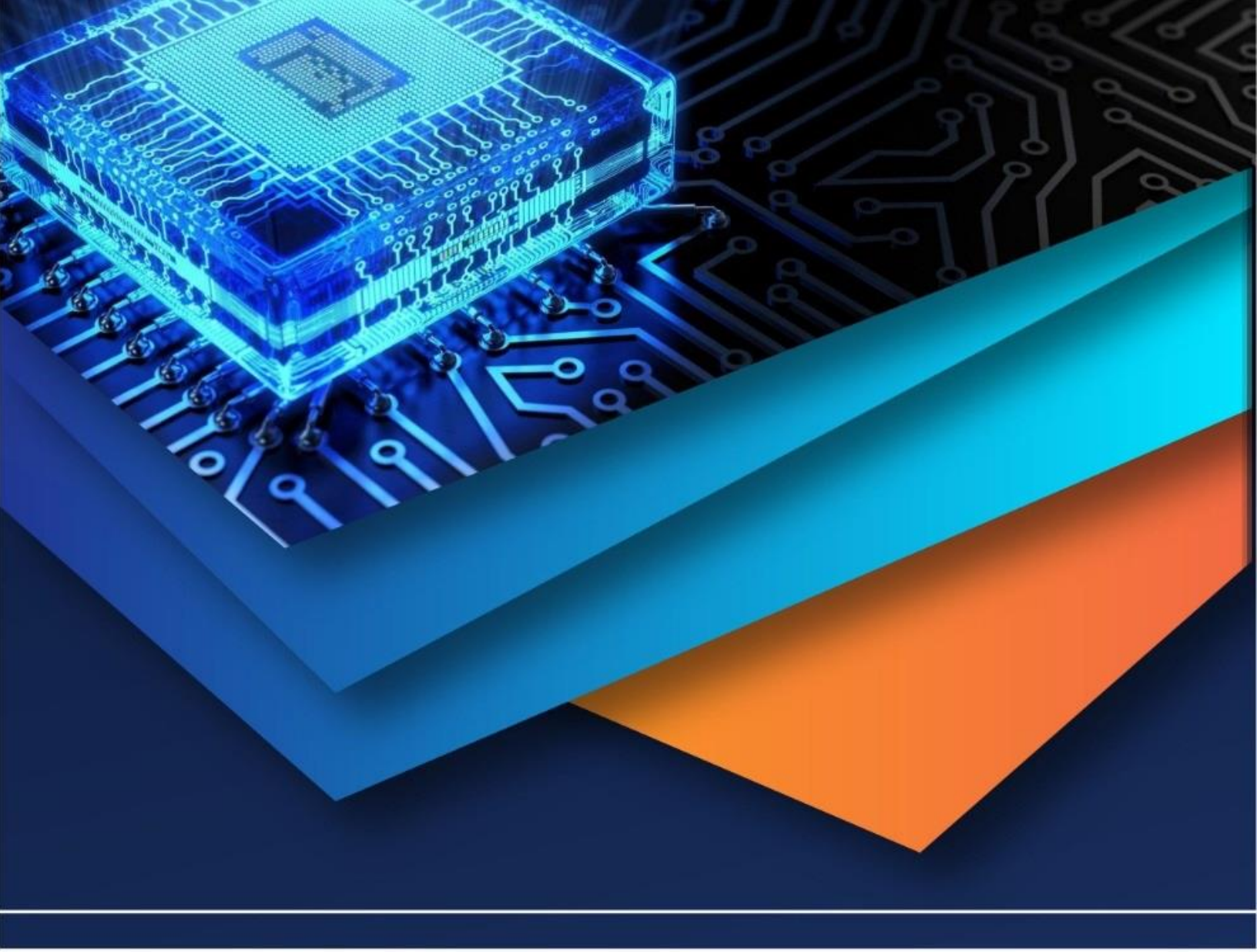

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