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A review on Single Bay Structure with Composite Beam and RCC Columns

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Abstract: Structural engineering Software SAP 2000 developed by CSi used for modeling and analysis of structure is done. Advanced structural analysis and design software "SAP 2000" is used for analysis of frame. A three dimensional modeling and analysis of the structure are carried out with the help of SAP 2000 software. In India, Indian standard criteria for earthquake resistant design of structures IS 1893 (PART-1): 2002 is the main code that provides outline for calculating seismic design force. Wind forces are calculated using code IS-875 (PART-3). The analysis and design of composite beams are in progress.

Keywords: Single Bay Structure, Composite section, steel girder, seismic load, SAP 2000, Fe-250.

Introduction

Multistory building has always reminded a challenge in design for society. As the availability of land is becoming difficult modern societies are moving detached houses to high rise buildings.

Wind load and earthquake load starts dominating resulting into increase in size of columns and beams for high rise buildings. The composite sections using Steel encased with Concrete are economic, cost and time effective solution in major civil structures such as bridges and high rise buildings.

There is a great potential for increasing the volume of Steel in construction, especially the current development needs in India exploring Steel as an alternative construction material and not using it where it is economical is a heavy loss for the country. Also, it is evident that now-a-days, the composite sections using Steel encased with Concrete are economic, cost and time effective solution in major civil structures such as bridges and high rise buildings.

In the past, for the design of a building, the choice was normally between a concrete structure and a masonry structure. But the failure of many multi-storied and low-rise R.C.C. and masonry buildings due to earthquake have forced the structural engineers to look for the alternative method of construction. Use of composite or hybrid material is of particular interest, due to its significant potential in improving the overall performance through rather modest changes in manufacturing and constructional technologies.

Elements of Composite Structure

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extremely economical structural systems with high durability, rapid erection and superior seismic performance characteristics. Formally the multi-story buildings in India were constructed with RCC framed structure or Steel framed structure, but recently the trend of going towards composite structure has started and growing. In composite construction the two different materials are tied together by the use of shear studs at their interface having lesser depth which saves the material cost considerably. There is no induction of different thermal stresses in the section under variation of temperature

Shear Connectors: Shear connections are essential for steel concrete construction as they integrate the compression capacity of supported concrete slab with supporting steel beams to improve the load carrying capacity as well as overall rigidity.

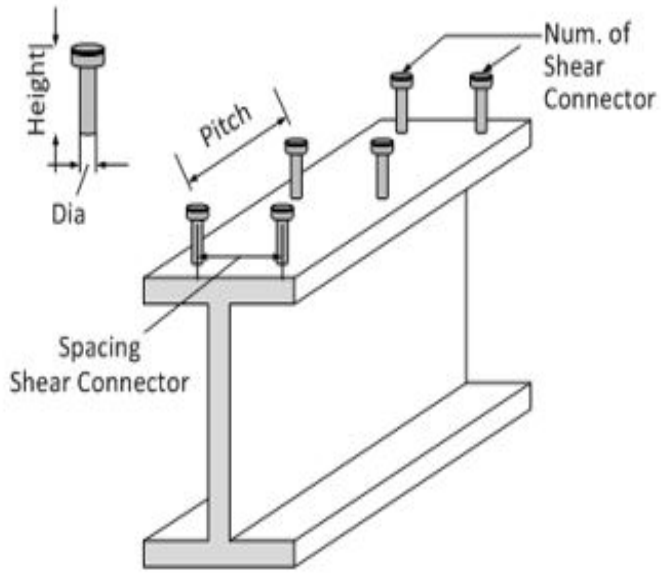

Fig. 1: Shear Connectors

Composite Slab: The loads are applied in such a way that the load combination is most unfavorable. Load factors of 1.5 for both dead load and imposed load are employed in design calculations.

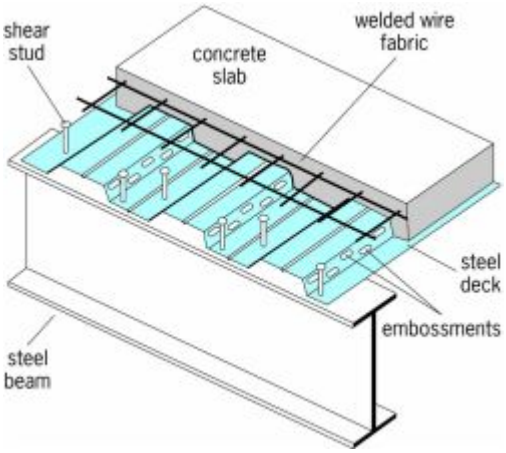

Fig. 2: Composite Structure Cross-Sectional View

Composite Beam: A steel concrete composite beam consists of a steel beam, over which a reinforced concrete slab is cast with shear connectors. The composite action reduces the beam depth.

Composite Column: Column is conventionally a compression member in which the steel element is a structural steel section. There are three types of composite columns used in practice, which are Concrete Encased, Concrete filled, Battered Section.

Advantages of Steel Concrete Composite Structure

- Most effective utilization of materials means concrete for compressive stress and steel for tensile stress.
- Steel is highly ductile in nature hence better seismic resistance of the composite section.
- Steel component has the ability to absorb the energy released due to earthquake forces.
- Ability to cover large column free area.
- Faster construction by utilizing rolled and/or prefabricated components.
- Keeping span and loading unaltered, smaller sections are required compared to non-composite construction. Minimum disturbance to traffic in bridge construction.

Types of Composite beams

The basic types of composite beams are mostly used in buildings.

1. Channel Section
2. Ordinary Section
3. Angle Section
4. T Section
5. I Section

All sections are of steel Fe-250 section encased in concrete and those with the steel section filled with concrete.

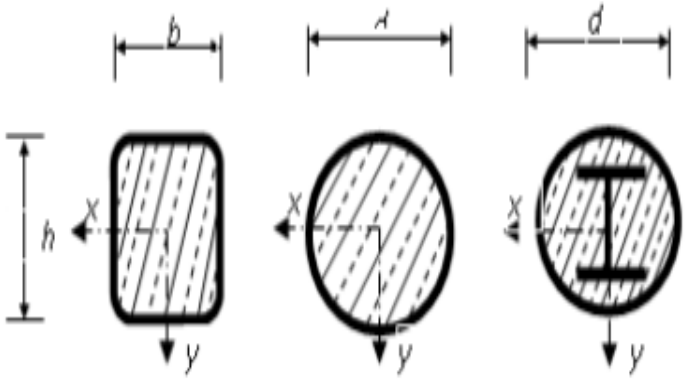

Fig 3: Typical Cross Sections of Concrete Filled Tubular Sections

Conclusion

In composite structure due to high ductile nature of steel it leads to increased seismic resistance of the composite section. Steel component can be deformed in a ductile manner without premature failure and can withstand numerous loading cycles before fracture. As we are using steel member for beams, the concrete is reduced in beam sections. Due to reduction in concrete and reinforcing steel in composite structure, it is cost effective than RCC structure.

6. References

1. Panchal D. R., Marathe P. M. (2011), “Comparative Study of R.C.C, Steel and Composite (G+30 Storey) Building”, International Conference 4 on Current Trends In Technology, pp 01-06.
2. Tedia Anamika, Dr. Maru Savita (2014), “Cost, Analysis and Design of Steel-Concrete Composite structure RCC Structure”, IOSR Journal of Mechanical and Civil Engineering, vol. 11, issue 1, pp 54-59.
3. Koppad Shashikala, Dr. Itti S.V. (2013), “Comparative Study of RCC and Composite Multistoried Buildings”, International Journal of Engineering and Innovative Technology (IJEIT), vol. 3, issue 5, pp 341-345.
4. Wagh Shweta A., Dr. Waghe U. P. (2014), “Comparative Study of R.C.C and Steel Concrete Composite Structures”, International Journal of Engineering Research and Applications, Vol.4, Issue 4, pp 369-376.
5. LIU Jingbo, LIU Yangbing (2008), “Seismic behavior analysis of steel-concrete composite frame structure systems”, The 14th World Conference on Earthquake Engineering.
6. AISC 360-05, Specification of Structural Steel Building, An American National standard, American Institute of Steel Construction, Inc., 2005.
7. Calado L, Simoes da Silva L and Simoes R (2000), “Cyclic Behavior of Steel and Composite Beam-To-Column Joints”, Department Of Civil Engineering, Instituto Superior, Tecnico, Lisbon, Portugal And Universidade de Coimbra, Coimbra, Portugal, pp. 159-169.
8. Christopher J. Earls (2000), “Geometric factors influencing structural ductility in compact I shaped beams”, Journal of Structural Engineering, Vol 126, No. 7, pp. 780-789.
9. Design Aids (for Reinforced Concrete) to IS 456 :1978 ,Special Publication SP : 16, Bureau of Indian Standards, New Delhi, 1980.
10. K.Mukeshkumar, H.SudarsanaRao. “Seismic Analysis of Composite Structures and its Comparison with RCC Structures.” International journal of engineering science and computing (IJESC) (2016).
11. Kumawat, Mahesh Suresh, and L. G. Kalurkar. "Analysis and design of multi-storey building using composite structure." International Journal of Structural and Civil Engineering Research (IJSCER) (2014).
12. Prof. Rajendra R. Bhoir, Prof. VinayKamble, Prof. DarshanaGhankute. “Analysis and Design of Composite Structure & Its Comparison with RCC Structure.” International Journal for Research in Applied Science & Engineering Technology (IJRASET) (2017)
13. D.R. Panchal, P.M. Marathe. “Comparative study of RCC and composite (G+30) story building”, Nirma University, Ahmedabad, India. (2011)