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COMPARISION BETWEEN RCC AND COMPOSITE STRUCTURE OF (G+3) INDUSTRAIL BUILDING

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Abstract *— Use of composite material is of particular interest, due to its significant potential in improving the overall performance through rather modest changes in manufacturing and constructional technologies. Steel concrete composite construction means the concrete slab is connected to the steel beam with the help of shear connectors so that they act as a single unit. Steel-concrete composite construction system is an efficient, economical and innovative method for seismic resistance of multi storied buildings. Equivalent static method of seismic analysis used in the analysis of geometric models. The maximum shear force and maximum bending moment are less in composite beam as compared to RCC beam. The node displacement is on higher side in composite structure as compared to RCC structure. The weight of composite structure is also less compared to RCC structure. Comparison of parameters like time period, displacement, base shear and load carrying capacity is done with steel and R.C.C structures. The results are compared and it is found that composite structure are more good in several aspect and also composite structures are the best solution for high rise structure as compared to RCC structure.*

Keywords- *Composite column, Composite beam, RCC deck slab, Shear connectors, ETABS software.*

I. INTRODUCTION

Steel-concrete composite systems have become quite popular in recent times because of their advantages against conventional construction. Composite construction combines the better properties of the both i.e. concrete in compression and steel in tension, they have almost the same thermal expansion and results in speedy construction. The use of Steel in construction industry is very low in India compared to many developing countries. Experiences of other countries indicate that this is not due to the lack of economy of Steel as a construction material.

There is a great potential for increasing the volume of Steel in construction, especially the current development needs in India. Engineers are familiar with the problems involved in constructing either steel or concrete building, as each of these materials has its own peculiarity. Steel structural members are generally fabricated as component consisting of thin plate elements, so they are prone to local and lateral buckling. Therefore, a system comprising steel-concrete- structure was developed to take benefit of both the material. For building systems, steel-concrete composite structures are known as the most economical solution to the diverse engineering design requirements of stiffness and strength. The strength and behavior of composite slabs are governed by the shear interaction between the concrete and the steel deck. By the composite action between the two, one can utilize their respective advantages to the fullest extent. Structurally robust and aesthetically pleasing buildings are being constructed now-a-days by composite steel concrete construction meeting the specific requirements of large span, building height, soil condition, time, flexibility and economy. The main benefits from the use of composite steel concrete construction are in terms of construction time and cost. The use of rolled steel section and prefabricated component makes the composite construction fast track construction compared to the cast in situ concrete.

Composite structure for the design of a building, the choice was normally between a concrete structure and a masonry structure. But the failure of many multistoried and low-rise R.C.C. and masonry buildings due to earthquake has 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. In India, many consulting engineers are reluctant to accept the use of composite steel-concrete structure because of its unfamiliarity and complexity in its analysis and design. But literature says that if properly configured, then composite steel-concrete system can provide extremely economical structural systems with high durability, rapid erection and superior seismic performance characteristics. Steel and concrete although very different in nature, these two materials complement one another. A composite member is formed when a steel component, such as an I beam, is attached to a concrete component, such as a floor slab or bridge deck. In such a composite T-beam the comparatively high strength of the concrete in compression complements the high strength of the steel in tension. The fact that each material is used to the fullest advantage makes composite Steel-Concrete construction very efficient and economical. However, the real attraction of such construction is based on having an efficient

connection of the Steel to the Concrete, and this connection that allows a transfer of forces and gives composite members their unique behavior.

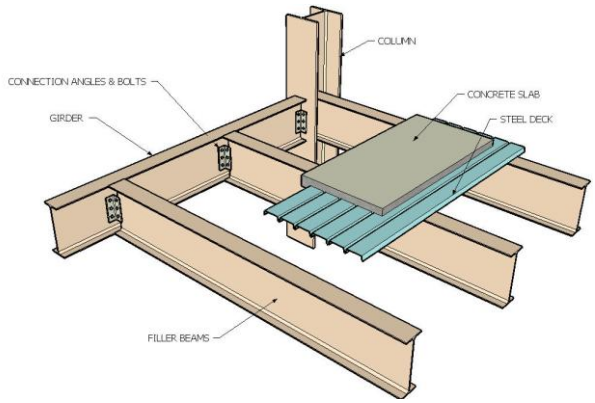

Fig. 1 Compsite slab

Fig. 2Install shear connector

Fig. 3 Shear connector

Fig. 4 Installation of concrete

Shear connectors are steel elements such as studs, bars, spiral or another similar devices welded to the top flange of the steel section and intended to transmit the horizontal shear between the steel section and the cast in-situ concrete and also to prevent vertical separation at the interface.
A steel-concrete composite 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

II. LITERATURE REVIEW

1. **D. R. PANCHAL AND P. M. MARATHE." COMPARATIVE STUDY OF R.C.C, STEEL AND COMPOSITE (G+30STOREY) BUILDING."International Journal of Civil And Structural Engineering .Volume 6, No 1, 2015.**

   Steel-concrete composite systems for buildings are formed by connecting the steel beam to the concrete slab or profiled deck slab with the help of mechanical shear connectors so that they act as a single unit. In the present work, steelconcrete composite, steel and R.C.C. options are considered for comparative study of G+30 storey commercial building which is situated in earthquake zone IV. Equivalent Static Method of Analysis is used.

   Modeling with ETABS

   3-D model is being prepared for the frame static analysis of the building in ETABS.

   The basic parameters considered for the design

   Slab depth : 125 mm thick

Live load in office area : 4 kN/sq m

Live load in passage area : 4 kN/sq m

Live load in urinals : 2 kN/sq m

Floor finish load : 1.5 kN/ sq m

Wall thickness : 150 mm thick wall

Stair case loading : 4 kN/sq m

Lift shaft : 300 mm thick shear wall

Earthquake parameters considered

Zone : IV

Soil type : Hard soil

Importance factor : 1

Time period : Program Calculated

Seismic zone factor : 0.24 for zone IV

Earthquake load in X and Z direction.

Rigid frame diaphragm

Codes used for analysis

R.C.C. design: IS 456: 2000 [5]

Steel design: IS 800: 1984 [8]

Composite design: AISC LRFD 99 [9]

Table 1: Column axial force

	RCC	STEEL	COMPOSITE
Ground to 10th floor	22051.9	11668.3 47%(Reduction)	17365.00 21.5%(Reduction)
10th floor to 20th floor	14061	7665.2 45.4% (Reduction)	17360.00 26% (Reduction)
20th floor to 30th floor	6977.70	3850.7 44.8 %(Reduction)	5625.00 20% (Reduction)

Table 2: Column bending moment in X direction

	RCC	STEEL	COMPOSITE
Ground to 10th floor	1023.9	731.40 25.8%(Reduction)	710.80 30.5%(Reduction)
10th floor to 20th floor	886.2	473.10	710.80

		46.6% (Reduction)	20% (Reduction)
20th floor to 30th floor	545.3	368.90 32.3 %(Reduction)	901.60 65% (Reduction)

Table 3: Column bending moment in Y direction

	RCC	STEEL	COMPOSITE
Ground to 10th floor	1126.6	1304.6 15.8%(Reduction)	409.4 63%(Reduction)
10th floor to 20th floor	1121.5	608.6 45.7% (Reduction)	409.4 63% (Reduction)
20th floor to 30th floor	913.9	525.2 42.5 %(Reduction)	477.6 48% (Reduction)

Table 4: Shear force of main beam

	RCC	STEEL	COMPOSITE
Ground to 10th floor	390.35	1169.86 200%(Reduction)	554.96 42%(Reduction)
10th floor to 20th floor	332.7	557.63 67% (Reduction)	631.19 89% (Reduction)
20th floor to 30th floor	233.86	534.73 128 %(Reduction)	634.88 171% (Reduction)

Table 1: Bending moment in main beam

	RCC	STEEL	COMPOSITE
Ground to 10th floor	904.3	1839.8 161%(Reduction)	1322 87%(Reduction)
10th floor to 20th floor	585.3	2127.1 263% (Reduction)	1217 108% (Reduction)
20th floor to 30th floor	474.5	2119 346 %(Reduction)	1227.2 118% (Reduction)

Table 5: Quantity

	Conc. in cubic meter	Reinforcement In tonne	Structural steel In tonne
RCC	10174	1600	-----
Steel	3200	200	3600
Composite	3600	250	3000

2. **SHASHIKALA. KOPPAD, DR. S.V.ITTI "COMPARATIVE STUDY OF RCC AND COMPOSITE MULTISTOREYED BUILDINGS" International Journal of Engineering and Innovative Technology Vol. 3, Issue 5, November 2013**

Steel concrete composite construction means the concrete slab is connected to the steel beam with the help of shear connectors so that they act as a single unit. In the present work steel concrete composite with RCC options are considered for comparative study of B+G+15 storey of residential building which is situated in earthquake zone 3 and for earthquake loading, the provisions of IS:1893(Part1)-2002 is considered. For modeling of composite and RCC structures, STAAD-proV8i software is used. The results of this work shows that, the cost of composite beam is less by 27% as compared to RCC beam. The maximum shear force and maximum bending moment are less in composite beam as compared to RCC beam. The node displacement is on higher side in composite structure as compared to RCC structure. The weight of composite structure is also less compared to RCC structure. Composite structures are the best solution for high rise structure as compared to RCC structure.

3. **SATTAINATHAN.A, NAGARAJAN.N "COMPARITIVE STUDY ON THE BEHAVIOR OF R.C.C, STEEL & COMPOSITE STRUCTURES (B+G+20 STOREYS)", International Journal on Applications in Civil and Enviornmental Engineering. Vol. 3, Issue 3, March 2015**

Use of composite material is of particular interest, due to its significant potential in improving the overall performance through rather modest changes in manufacturing and constructional technologies. Steel concrete composite construction means the concrete slab is connected to the steel beam with the help of shear connectors so that they act as a single unit. In the present work, steel concrete composite with RCC options are considered for comparative study of B+G+20 storey of commercial building which is situated in earthquake zone 4 and for earthquake loading, the provisions of IS:1893(Part1)-2002 is considered. For modeling of composite, Steel and RCC structures, E-TABS analysis software is used. Steel-concrete composite construction system is an efficient, economical and innovative method for seismic resistance of multi storied buildings. Equivalent static method of seismic analysis used in the analysis of geometric models. In this study, the seismic design and performance of composite steel-concrete frames are discussed in particular. Comparison of parameters like time period, displacement, base shear and load carrying capacity is done with steel and R.C.C structures. The results are compared and it is found that composite structure are more good in several aspect

4. **UMESH P. PATIL1, SURYANARAYANA M2 ," ANALYSIS OF G+15 RCC AND COMPOSITE STRUCTURE HAVING A SOFT STOREY AT GROUND LEVEL BY RESPONSE SPECTRUM AND EQUIVALENT STATIC METHODS USING ETABS 2013." International Research Journal of Engineering and Technology. Vol. 3, Issue 3, June 2015.**

Comparing to RCC structures, steel concrete composite system are being more popular due to the various advantages they offer. Both speed and economy can be achieved in case of composite systems. An attempt was made in this work to evaluate and compare the seismic performance of G+ 15 storey's made of RCC and composite structures ETABS 2013 software was used for the purpose. Both steel and concrete composite structures and RCC structures were having soft storey at ground level, structures were located in the region of earthquake zone III on a medium soil. Equivalent static and response spectrum method is used for analysis. Storey drift, self weight, bending moment and shear force, are considered as parameters. When compared composite structures shows better performance than RCC.

5. **NITIN M. WARADE1, P. J. SALUNKE2. "COMPARATIVE STUDY ON ANALYSIS AND DESIGN OF COMPOSITE STRUCTURE." International Journal Of Advance Research In Science And Engineering. Vol. 3, Issue 12, December 2013.**

This paper deals with the study of composite structure as compare with the concrete and steel structure. The composite structure is far more advantageous over steel and concrete structure regarding Strength, Costs, and Time Period requirements. There is no need for formwork because the steel beam is able to sustain the self weight of steel and concrete, by itself or with the assistance of a few temporary props. Also this paper deals with the design of composite building with fixed base. In this paper seismic analysis of a multi level car park is made using different construction material, like Concrete, Structural steel and Composite of Structural Steel and Concrete. Effect of each building is studied with respect to time period, base shear, total dead load and most important cost of different schemes.

III. CONCLUSION

From the above literature we conclude that:

1. The axial forces in RCC structure is on higher side of composite structure
2. Composite structures are more economical than that of RCC structure.
3. Weight of composite structure is quite low as compared to RCC structure which helps in reducing the foundation cost.
4. Composite structures are the best solution for high rise structure as compared to RCC structure.
5. Speedy construction facilitates quicker return on the invested capital and benefits in terms of rent.
6. The node displacement and deflection in composite structure is more compared to RCC structure but the Deflection is within permissible limit.
7. The maximum bending moment in composite beam is less compared to RCC beam.
8. The maximum bending moment in composite beam is less compared to RCC beam.
9. The maximum shear force in composite beam is less Compared to RCC beam.
10. The cost of composite beam and column is reduces by compared to RCC beam and RCC column.
11. Steel and composite structure gives more ductility to the structure as compared to the R.C.C. which is best suited under the effect of lateral forces.

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