"Comparative study and Environmental Effect of various parameters on RCC, and LWSS for G+3, G+6, and G+9"

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Abstract

In this paper we discuss the comparative study between RCC structures and Light weight steel structures. What are the environmental effects on the steel and precautions done for that also discuss in this paper. What type of connections and material used for the construction of light weight steel structures? A heavy reinforced concrete column, seen before and after the concrete has been cast in place around its rebar cage Reinforced concrete (RC) (also called reinforced cement concrete or RCC) is a composite material in which concrete's relatively low tensile strength and ductility are counteracted by the inclusion of reinforcement having higher tensile strength or ductility. The reinforcement is usually, though not necessarily, steel reinforcing bars (rebar) and is usually embedded passively in the concrete before the concrete sets. Reinforcing schemes are generally designed to resist tensile stresses in particular regions of the concrete that might cause unacceptable cracking and/or structural failure. Steel frame is a building technique with a "skeleton frame" of vertical steel columns and horizontal I-beams, constructed in a rectangular grid to support the floors, roof and walls of a building which are all attached to the frame. The development of this technique made the construction of the skyscraper possible. For the maintenance of reinforced concrete structures and buildings, it requires periodic inspection. In that case there is very little awareness in civil engineers and other discipline. As a result, many of the times due importance is not given to the repair and maintenance of the building. But now a day it has become necessary to give more attention towards the repair and maintenance of old and damaged building structure. Hence, in depth requirement has been generated for structural repair, restoration and strengthening of RCC structures. New and innovative techniques have been developed in the repairs of concrete structures. Light weight steel structures construction speed is more than the RCC structures. Time is main factor in this two structures and also strength. Light weight steel structures are super-quick to build at site, as a lot of work can be prefabbed at the factory. They are flexible, which makes them very good at resisting dynamic (changing) forces such as wind or earthquake forces. A wide range of ready-made structural sections are available, such as I, C, and angle sections .They can be made to take any kind of shape, and clad with any type of material .A wide range of joining methods is available, such as bolting, welding, and riveting. Thus ,Purpose of this project is which structures is more economical and construction speed and strength also matter. Also environmental effects on the steel and new technique of precautions for this. In this projects we conclude that It is conclude that steel structure is more resist as compared to the normal concrete structure . A building constructed using steel has less dead load on it, even the bending moment and shear forces acting are less as determined in this work .Speed of construction is another important advantage of steel structure. Since Standard sections of steel are available which can be prefabricated in the workshop, they may be kept ready by the time the site is ready and the structure erected as soon as the site is ready. Hence there is lot of saving in construction time.

Keywords: Steel, RCC, Inclusions, Defects, Slab Caster, Plant Measurement, Review, Detection Method.

I. INTRODUCTION

A. Background

A variety of modernized construction material options have recently become available due to ongoing research and support in innovative technologies. An ideal and modern construction material will aim to maintain structural strength while reducing its impact on the environment. In addition, modern construction materials must be able to adapt to various weather and site conditions . A French gardener by name Joseph Monier first invented the reinforced concrete in the year 1849. Reinforced concrete is one of the most widely used modern building materials. Steel reinforced concrete is a specific type that has had strong steel rebar or fibers added to it while wet, creating a very strong type of concrete that is able to withstand almost anything when it has dried. Because the result of using steel reinforced are so good for the strength of the building, most modern building today use steel reinforced concrete in the construction process. By adding thin steel bars to concrete can increase the strength of the concrete, making it better to use in variety of application. The first used of steel structure in construction of countries can be traced back to the end of 18th century in British , steel structure are widely used in high-rise, residential high-rise steel structures are very common in the developed countries. 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. Exploring Steel as an alternative construction material and not using it where it is economical is a heavy loss for the country. In this work comparing RCC and steel structure by using Staad-pro models

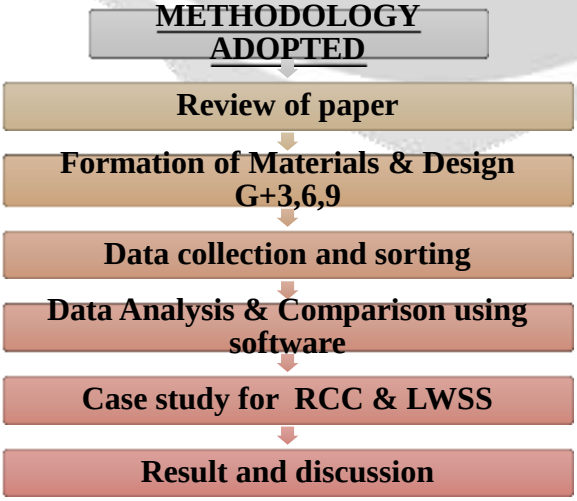
B. OBJECTIVES

- Comparative study between R.C.C. &light weight steel structure using ETab.
- The composite sections using Steel encased with Concrete are economic, cost and time effective solution in major civil structures high rise buildings.
- Comparative analysis of forces and loads on R.C.C and light weight steel structure.

II. REVIEW OF LITERATURE

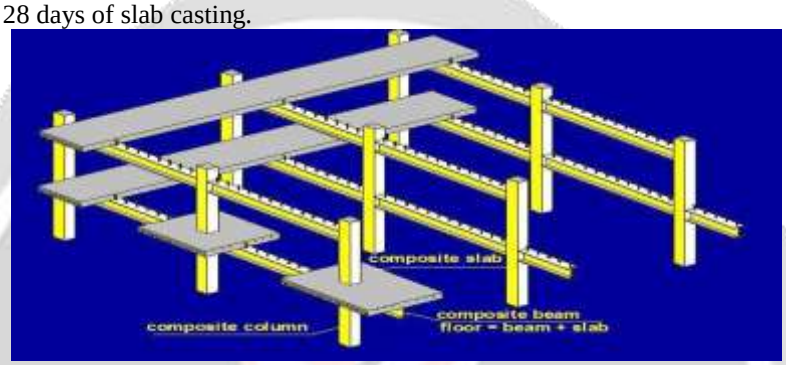
Reinforced concrete and steel are the materials that are mostly used in the framing system for most of the building. Steel members have the advantages of high tensile strength and ductility, while concrete members have the advantages of high compressive strength and stiffness. Composite members combine steel and concrete, resulting in a member that has the beneficial qualities of both materials. The present study is based on structural behavior of Composite, RCC and Steel structure when subjected to earthquake. In the present work RCC, steel and composite materials are considered for comparative study of G+5 story commercial building which is situated in earthquake zone III, The provisions of IS:1893 (Part 1) is considered. A three dimensional modeling and analysis of the structure are carried out with the help of E-tabs 2013 software. Equivalent static analysis and Response spectrum analysis are carried out on all three structures. The results are compared in terms of base shear, Lateral force distribution, maximum displacement, Time period and frequency, and found that composite structure gives better performance compare to RCC and steel.

III. METHODOLOGY



Construction methodology of steel framed Composite floor building:

This is the one of the methods of implementing composite elements in construction called as hybrid construction. Foundation of this building is normal box footings and RCC pedestals to hold steel columns. Anchor bolts of length 1200 mm is provided to hold huge steel columns in a position with special arrangement. Erection of column and beams of this building can be done in four stages. As shown in Figure 2, first lift includes the ground, first and second floor column and beams erection only. While second lift is in progress that time ground, first and second slab construction activities are in a progress. Likewise whole structure can be erected for all four lifts. Time scheduling gives clear idea about such simultaneous activities. After completion of column & beams erection for first lift, at one time construction of composite floor is progresses for three floors. On third floor deck sheet placing, on second floor shear stud welding and on first floor reinforcement lying is in progress. This type of system allows many work faces open together and huge amount of time saving can be achieved. Figure 6 shows the section of composite floor slab with all details. For pre-stressing of steel main beams, six cables on each side of the beam (includes six tendons in each cable) and for secondary beams, two cables on each side of the beam are placed with the help of fixtures. The construction activity of post-tensioning of composite steel beam is divided into three stages. In first stage, after 14 days of slab casting, the post-tensioning is with only 50% load. In second stage, after 21 days of slab casting, the post-tensioning is with 25% load. In third stage, after 28 days of slab casting, the post-tensioning is with 25% load. The full post-tensioning is done after 28 days of slab casting.



Composite Structures

Steel structures Vs Concrete structures:

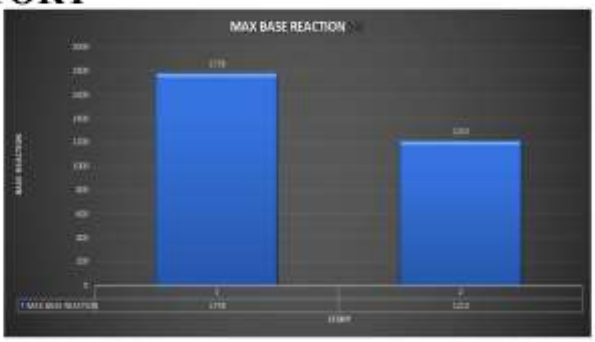
Point of difference	Concrete structure	Steel structure
Durability	The concrete structure are more durable	The durability of steel structure is adversely affected by weather condition and rusting.
Earthquake resistance	The concrete structure are brittle so they are less earthquake resistance.	Steel Structure can withstand earthquake more effectively than concrete structure.
Load carrying capacity	In the comparison to the steel the load carrying capacity of the concrete is low.	The load carrying capacity of steel structure is good.
Scrap value	The scrap value of concrete is nil.	The scrap value of steel is good.
Self-weight	The self-weight of concrete is more.	The steel is 60% lighter than the concrete.
Foundation	The foundation for the concrete structure should be strong because of the larger weight of concrete.	The steel structure can be made without foundation.
Construction time	The concrete structure generally needed 28 days before they are ready to use.	The steel structure are fast in their erection and can be used soon after their erection.
Labor	It requires less skilled labor.	It requires more skilled labor.
Cost	The cost of construction is less.	The cost of construction is more.
Joining	The joints such as construction joint, expansion joint, contraction joint, etc are needed in concrete structure.	The steel component are joined by using rivets, welding, nuts & bolts, etc. in steel structure.

IV. EXPERIMENTAL PROGRAMS

		2334	2072										
	G+6	RCC	Steel	RCC	Steel	RCC	Steel	RCC	Steel	RCC	Steel	RCC	Steel
	Story	Shear X	Shear X	Shear Y	Shear Y	Drift X (mm)	Drift X (mm)	Drift Y (mm)	Drift Y (mm)	EQX	EQX	EQY	EQY
	Story 1	176.705	72.2944	119.0446	49.7213	1.565	4.343	2.917	7.505	0.000522	0.001448	0.000973	0.002502
	Story 2	174.6506	71.4951	117.6605	49.1716	2.551	6.338	3.64	8.957	0.000851	0.002113	0.001214	0.002986
	Story 3	166.4331	68.298	112.1245	46.9727	2.629	6.324	3.534	8.648	0.000877	0.002108	0.001178	0.002883
	Story 4	147.9437	61.1043	99.6684	42.0252	2.402	5.735	3.175	7.783	0.000801	0.001912	0.001059	0.002594
	Story 5	115.0737	48.3157	77.5241	33.2297	1.933	4.604	2.508	6.201	0.000645	0.001535	0.000836	0.002067
	Story 6	63.7144	28.3334	42.9238	19.4866	1.271	2.926	1.489	3.747	0.000424	0.000975	0.000497	0.001249
		1778	1213										
	G+3	RCC	Steel	RCC	Steel	RCC	Steel	RCC	Steel	RCC	Steel	RCC	Steel
	Story	Shear X	Shear X	Shear Y	Shear Y	Drift X (mm)	Drift X (mm)	Drift Y (mm)	Drift Y (mm)	EQX	EQX	EQY	EQY
	Story 1	154.51	50.55	154.51	50.55	1.435	0.43	3.6	0.305	0.000479	0.000143	0.00012	0.000102
	Story 2	142.68	46.68	142.68	46.68	2.01	0.571	4.096	0.4	0.00067	0.000172	0.001366	0.000133
	Story 3	95.35	31.31	95.35	31.31	1.441	0.361	2.741	0.266	0.000481	0.00012	0.000914	0.00009
		3370	3155										
	G+6	RCC	Steel	RCC	Steel	RCC	Steel	RCC	Steel	RCC	Steel	RCC	Steel
	Story	Shear X	Shear X	Shear Y	Shear Y	Drift X (mm)	Drift X (mm)	Drift Y (mm)	Drift Y (mm)	EQX	EQX	EQY	EQY
	Story 1	207.8326	69.4564	139.947	44.7642	1.357	2.168	2.829	5.486	0.000453	0.000723	0.000943	0.001829
	Story 2	207.0742	69.2153	139.4364	44.6088	2.277	5.022	3.513	8.806	0.000759	0.001075	0.001171	0.002936
	Story 3	204.0408	68.2512	137.3938	43.9874	2.487	6.679	3.559	9.4	0.000829	0.002227	0.001187	0.003134
	Story 4	197.2155	66.0886	132.7979	42.5937	2.525	7.564	3.51	10.259	0.000842	0.002522	0.00117	0.00342
	Story 5	185.0817	62.2532	124.6274	40.1218	2.465	7.908	3.358	10.778	0.000822	0.002637	0.001119	0.003593
	Story 6	166.1226	56.2634	111.861	36.2614	2.309	7.487	3.081	11.779	0.00077	0.002496	0.001029	0.003927
	Story 7	138.8215	47.4554	93.4774	30.5847	2.045	6.85	2.654	11.312	0.000682	0.002284	0.000885	0.003771
	Story 8	101.6617	35.2634	68.4554	22.7271	1.669	6.538	2.056	9.731	0.00056	0.00218	0.000685	0.003244
	Story 9	53.1264	19.2996	35.7734	12.4385	1.219	6.17	1.285	7.567	0.000406	0.002057	0.000429	0.002522

G+3 RCC and Steel Frame Structure

STORY MAX. BASE REACTION G+3 STORY



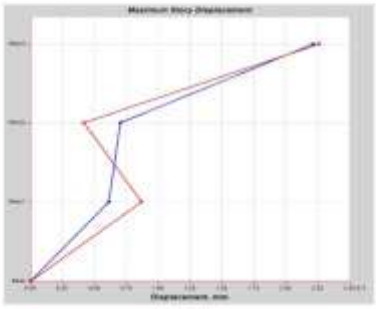
STORY SHEAR G+6 STORY

STORY DRIFT DUE TO SHEAR G+3 STORY

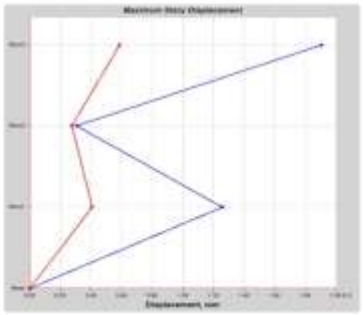
STORY DRIFT G+3 STORY

STORY DISPLACEMENT

G+3 RCC Frame Structure

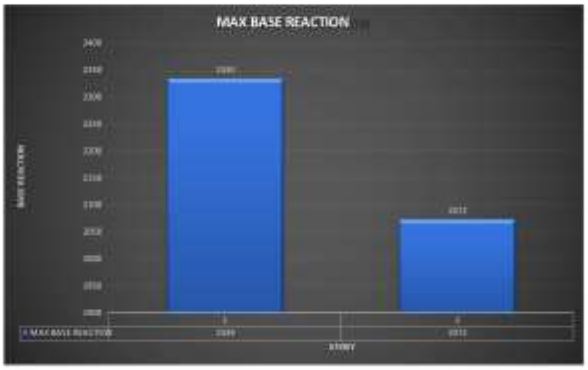


G+3 Steel Frame Structure



G+6 RCC and Steel Frame Structure

STORY MAX. BASE REACTION G+6 STORY



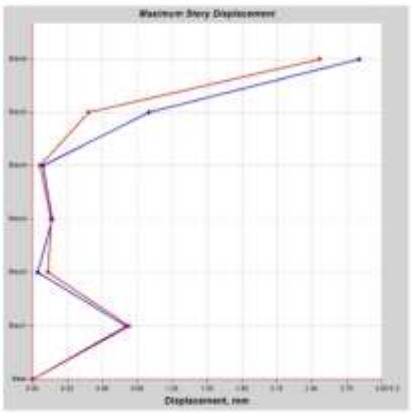
STORY DRIFT G+6 STORY

STORY SHEAR G+6 STORY

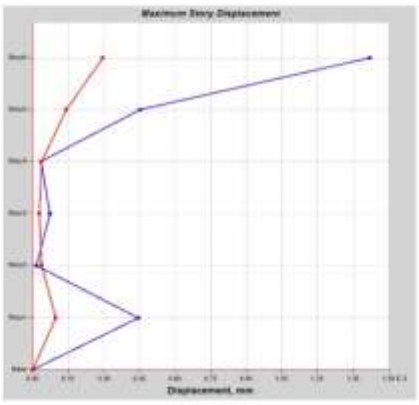
STORY DRIFT DUE TO SHEAR G+6 STORY

STORY DISPLACEMENT

RCC Frame Structure

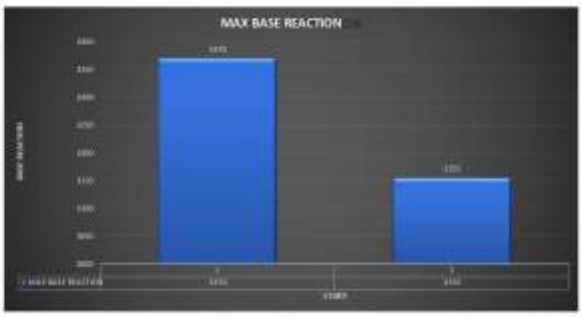


Steel Frame Structure

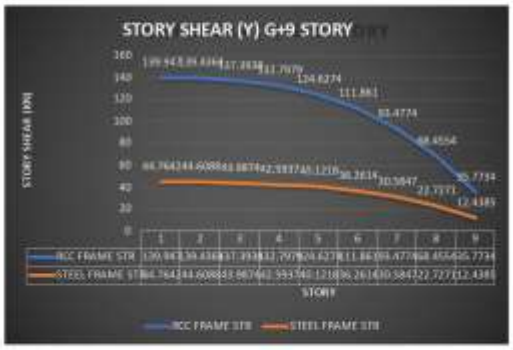


G+9 RCC and Steel Frame Structure

STORY MAX. BASE REACTION G+9 STORY

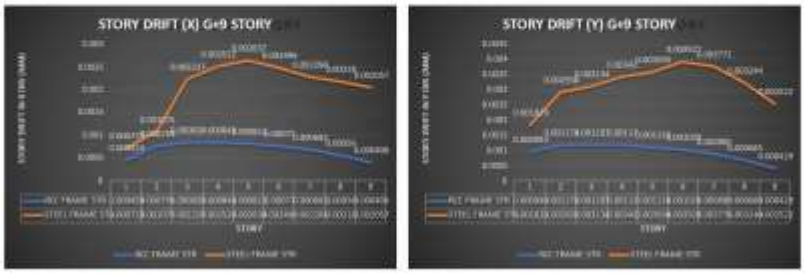


STORY SHEAR G+9 STORY



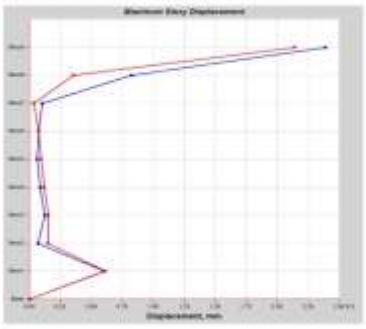
STORY DRIFT DUE TO SHEAR G+9 STORY

STORY DRIFT G+6 STORY

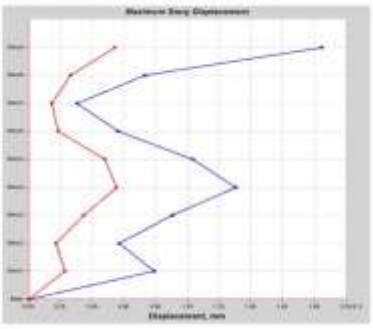


STORY DISPLACEMENT

G+9 RCC Frame Structure



G+9 Steel Frame Structure



V. CONCLUSION

It is conclude that steel structure is more resist as compared to the normal concrete structure. A building constructed using steel has less dead load on it, even the bending moment and shear forces acting are less as determined in this work . It has high strength per unit mass. Hence even for large structures, the size of steel structures elements is small, saving space in construction and improving aesthetic view. Speed of construction is another important advantage of steel structure. Since Standard sections of steel are available which can be prefabricated in the workshop, they may be kept ready by the time the site is ready and the structure erected as soon as the site is ready. Hence there is lot of saving in construction time**.** From this project, we conclude that for small structures like G+1 structure, R.C.C. structure resulting slightly more Shear, bending, & Deflection as compare to Steel Structure But for economical purpose R.C.C. structure is much more economical than Steel structure

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