Analysis of A High Rise Building Frame Considering Wind Pressure Considering Steel RCC Composite Structure Using ETABS

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Abstract- *Tall structures and innovative architectural designing are now a days on trend. every one want beautifull design with safety parameters in a high rise building. For creating such beautiful structures architects and structural engineers always keep safety and structural stability first to avoid any hazadious situation or collapse of structure. Thus in this study we are presenting a technique of structure where we can consider both safety as well as innovative design.*

As we all known that composite structures are now a days In trend to enhance structural strength and stability therefore in this present work we are considering a symmetrical building frame of G+10 and assigning lateral load i.e. wind load for a selected region of wind speed 39 m/s. I this study we are considering two cases RCC building and Composite structure and comparing both in terms of forces, displacement, moment and cost effectiveness using analysis tool ETABS.

In this study it is concluded that composite structure is relatively more stable and economical than RCC structure as it resist 30% more forces and displacement.

Keywords- lateral laod, structure, wind pressure, composite, moments, displacement, optimization.

I. INTRODUCTION

The intensity of population thickness brought about the developing interest for elevated structures. In tall structure because of the collection of a heap, all things considered, vertical gravity heap of segments rules the plan of structure. The composite structure is being utilized as a choice to steel structures because of its advantages over RCC structure and high expense of the steel structure.

As a rule, most of the common structures are planned with the presumption that every single connected burden is static. The impact of the dynamic burden isn't being considered because the structure is once in a while exposed to dynamic burdens, more its thought in the examination makes the arrangement progressively muddled and tedious. This part of ignoring dynamic powers may once in a while become the reason for the fiasco. Especially if there should arise an occurrence of seismic tremor.

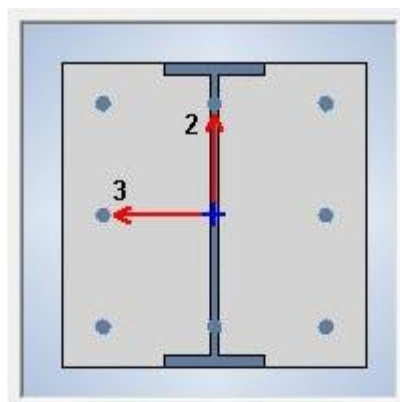

Fig 1: Composite section

Wind impacts on structures can be delegated Static and Dynamic. Static breeze impact fundamentally causes flexible bowing and bending of structure. What's more, for a tall, long-range and thin structures, a dynamic examination of the structure is fundamental. Wind blasts cause fluctuating powers on the structure which initiates huge unique movements, including motions.

Avoiding wind effect includes fortifying zones where things could fall to pieces. The dividers, rooftop and establishment must be solid, and the connections between them must be solid and secure. For a home to oppose tropical storm and feeble tornadic winds, it must have a constant burden way from the rooftop to the establishment - associations that tie every single auxiliary part together and can oppose kinds of wind stacks that could push and draw on the house in a tempest.

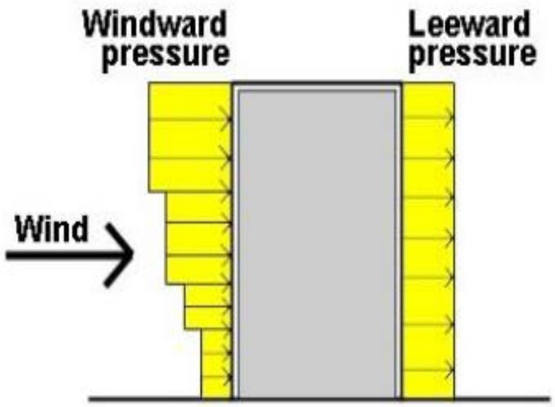

Fig 2: Wind pressure

II. LITERATURE REVIEW

Radomiret. al. (2016)[Design and analysis of steel-concrete composite structure]here the author exhibited the present cutting edge identified with plan and examination, in light of cited references, in steel-solid composite structures. The attention was on steel pillar solid section and their associations and the impacts of their cooperation. The solid piece could be executed as to give in situ or a role as precast, fortified and additionally prestressed. Different segments (pillars, pieces and sections) of a structure and their properties were considered. The investigation of time-subordinate disfigurements (creep and shrinkage of cement) and stress unwinding of prestressing steel was remarked. The issues managing the planning of structures and scaffolds were even secured.

The load conveying limit of composite scaffolds is a significant factor that influences the generally speaking and nonlinear extension conduct, which is researched by utilizing distinctive FEM models, for example, ADINE code, the ABAQUS programming, and by various models and utilizing various sorts of components. The nonlinear examination was displayed in the exploration paper.

D. Dattaet. al. (2016) [Steel-Concrete Composite Construction – New Trend in India]author expressed that Technological developments are required to make enthusiasm for the manufacturers to keep the land business aggressive. The utilization of Steel-Concrete Composite development systems will assist the engineers with making more benefit and the clients could likewise get more floor covering the region and strong structure at their moderate cost. The advantages of structuring Green Buildings had been seen for the most part as far as vitality sparing. The advantage of steel development contrasted with other structural materials is huge concerning such contemplations moreover. Americans Institute of Architects (AIA) in their Environmental Resources Guide prescribes that Steel is naturally less hurtful than numerous other focused alternatives. By and large, steel-concentrated development being completely recyclable gives improved ecological execution and such development offers a practical advancement to the general public with least utilization of vitality, minimization of waste and usage of inexhaustible assets and so forth. Consequently, in the coming decades, steel could be ideally used by the Engineers to make the development of Indian culture more easy to use coordinating with the National Housing and Habitat Policy and Housing needs of natives.

III. OBJECTIVES

The main objectives of this study are –

1. Comparison of structural performance of conventional structure with composite structure.
2. To determine the variation in forces, moment and displacement in both the cases considering wind pressure.
3. To determine the cost analysis of both the structure to find out the economic structure as per S.O.R.
4. To determine the formation of composite structure in analysis tool ETABS.
5. To justify the positive effect of using composite members to resist forces and displacement of a tall structure.

IV. METHODOLOGY

Step-1: Selection of geometry

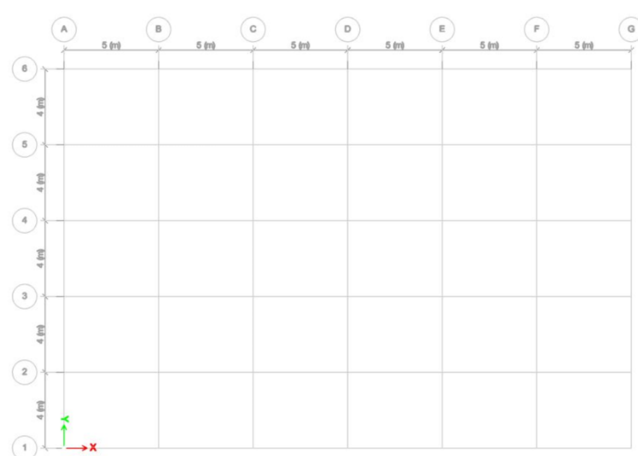

Fig 3: Selected geometry

Step-2: Assigning sectional properties and support conditions.

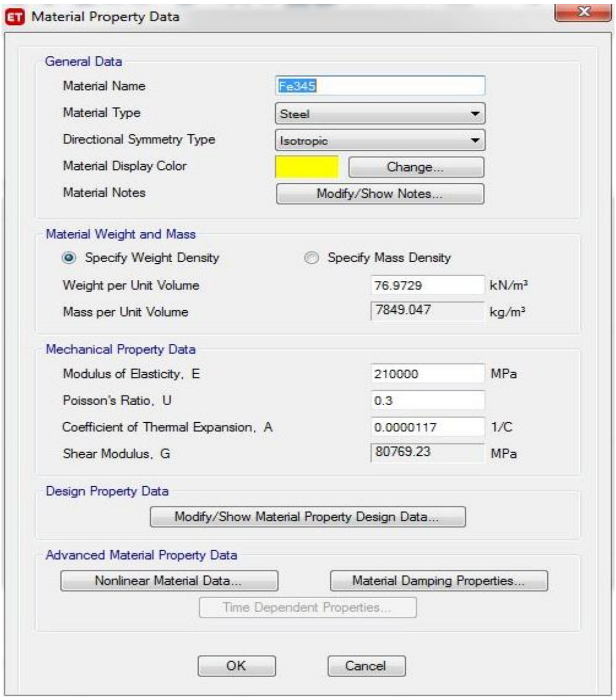

fig 4: creating material

Step-3: Loading conditions.

Table 1: Load condition

1.	Dead Load	Self weight of structure
2.	Live Load	Occupancy load on floors.
3.	Super Dead Load	Floor Finish & Ceiling plaster
4.	W xdirection	wind load in X direction
5.	W zdirection	wind load in Y direction

Step-4: Analysis of building frame

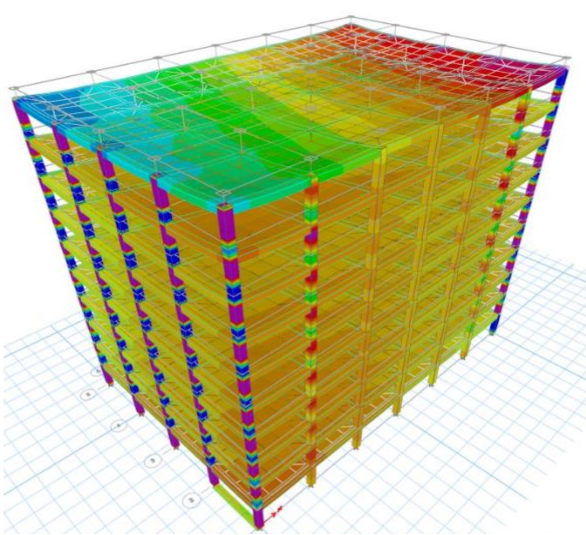

Fig 5: Analysis

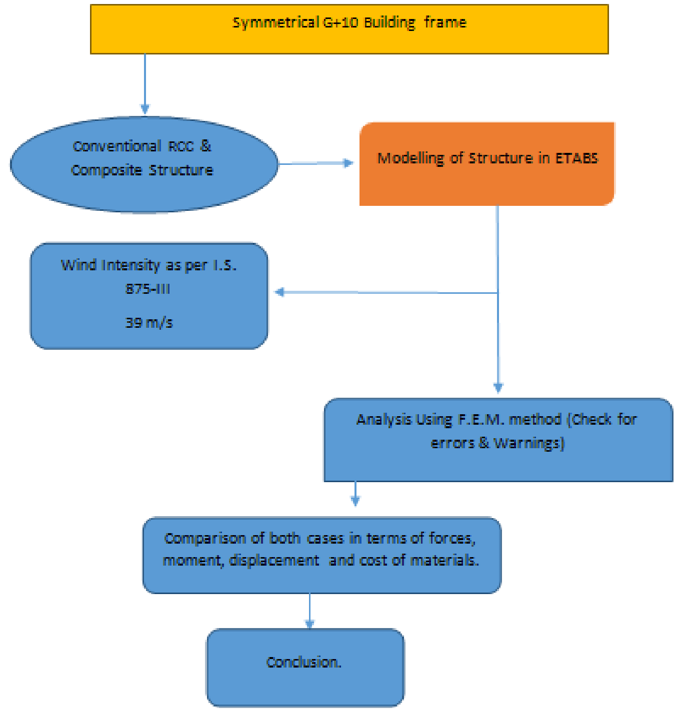

Fig 5: Flow Chart of the study

Analysis results:

Bending moment kN-m:

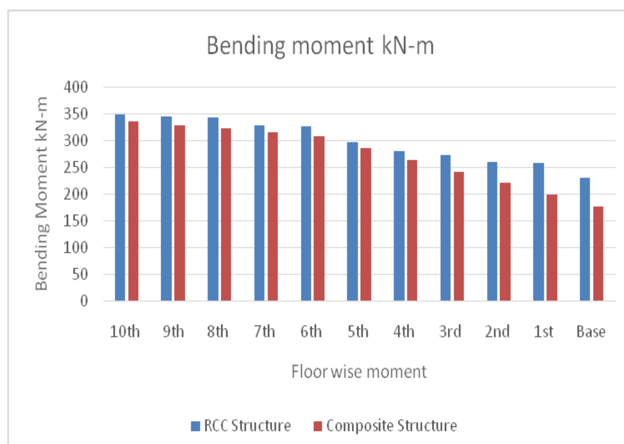

Fig 6: Bending moment

Shear Force KN

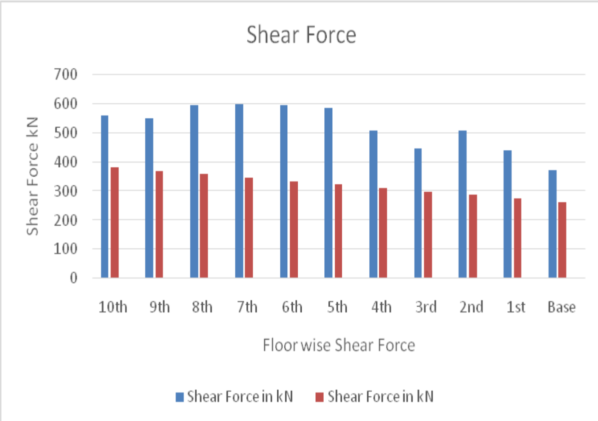

Fig 7: Shear force

Axial Force:

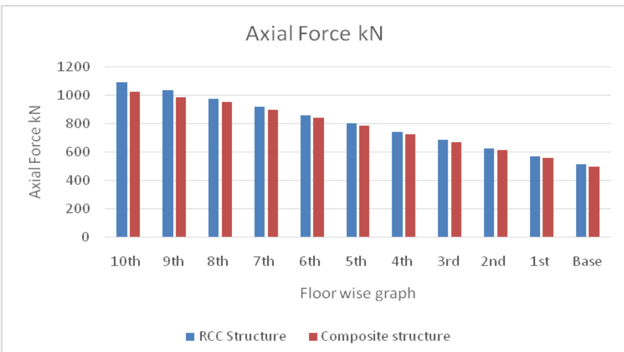

Fig 8: Axial force

Displacement:

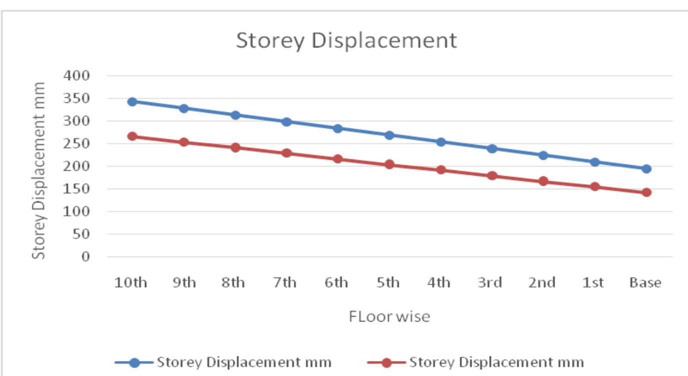

Fig 9: Displacement

Cost Analysis:

Table 2: Cost Analysis

S.N.	Description	Unit	Qty.	Rate	Amount
For RCC Structure					
1	Concrete M25	Cu m	475.06	4500	2137770
2	Shuttering	Sqm	6000	160	960000
3	Rebar	Kg.	129671.96	74	9595725.04
4	Mortar for plaster	Sqm	2906.15	80	232492
Total Cost of RCC Structure (Rs.)					**12925987.04**
For Composite Columns					
1	Concrete M25	Cu m	380.7	4500	1713150
2	Steel + Rebar	Kg.	148780.98	74	11009792.52
3	Mortar for plaster	Sqm	2180.87	80	174469.6
Total Cost of Composite Structure (Rs.)					**12897412.12**

V. CONCLUSION

During analysis of frame with RCC structure and frame with Composite structure following conclusions are drawn after studying the result obtained –

- Due to decreasing percentage of cement in composite sections, its quantity is limited. Which result in cost cutting of the structure.
- Maximum storey displacement comparison in above chapter shows that composite structures are comparatively more stable and lateral load resisting than RCC structure by 32%.
- Maximum bending moment in each floor is calculated in above chapter where we can conclude that moment in composite structures are less by 30% which can minimize the reinforcement requirement (Ast.) of the structure.
- It is clearly observed that unbalanced forces are less in composite structure in comparison to RCC structure due to proper distribution of forces in compression and tensile zone.
- Axial forces are the vertical forces distribution beam load from column to end condition. It is observed that composite structure is distributing it properly confining proper settlement of load to foundation level.

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