COMPARISION OF RCC & COMPOSITE TALL STRUCTURE ON THE EFFECT OF LATERAL FORCES

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Abstract - *Current work has been completed to analyze the structural analysis of tall structures using composite profiles mixed with RCC beams and panels. In this study, a model of a 10 storey ground floor truss structure subjected to Zone V nonlinear dynamic loads is used according to IS 1893-2016 from the ETABS software package. Two similar models were constructed with different column types, RCC and CFST columns, and similar loading conditions were applied. These two models were decomposed and the results obtained were analyzed from a structural design point of view based on the following parameters.*

***Key Words*: Non linear, structure, lateral forces, composite, columns, displacement, optimization.**

1. INTRODUCTION

Although India is a developing country, steel consumption in the Indian construction sector is much lower than other developed countries in the world. Due to huge population growth, concentration of development in peri-urban areas and limited land area, urban population density is increasing day by day. Increased population density has increased the demand for skyscrapers. In high-rise buildings, the vertical gravity of columns dominates the design of the building structure, as loads accumulate on all floors.

Earthquakes are devastating events and, unlike other disasters such as floods, people are able to evacuate to safer locations along these lines, resulting in enormous loss of life and property. increase. Subsequent planning of structures for these seismic loads is the most important possible option. Each incident provided important data for improving planning and development exercises in this manner to protect the structure's occupants. This section includes code-based methodologies for seismic surveys, structural instruction concepts, and current survey objectives.

Most structural seismic surveys are based on lateral forces assumed to correspond to true stacking. The fundamental shear, which is the total uniform force on the structure, is registered based on the mass of the structure and the critical time of vibration, taking into account the mode shapes. Base shear is used along the height of the structure, as is lateral force, as indicated in the code conditions. This system is typically conventional for low to medium height structures with common configurations..

Composite Structures

Composite columns are the compression element which constitutes of concrete encased steel section or concrete filled steel tubes. Concrete steel composite columns are the combination of concrete and steel hence uses both the materials for their advantages. Concrete steel composite columns based on the material inside and outside may be classified in following categories:–

- **Concrete-filled tubes: Concrete-**filled hollow rectangular or round steel tubes are called concrete-filled composite columns.
- **Fully Encased Composite Column:** A section of rebar covered with a plain/reinforced concrete jacket is called a fully encased concrete composite column.
- **Partially Encased Composite Column:** Partially Encased Reinforced Concrete Section, i. H. Those with two or more sides (but not all sides) are called partially coated concrete composite columns**.**

2. LITREATURE REVIEW

Murtuza S. Aainawala (June 2016) Through the ETABS-2015 programming, he evaluates and reflects historical seismic performance of G+15 consisting of RCC and composite structures. Both steel-solid composite structures with concrete-filled steel pipes and RCC structures had delicate floors near the ground. , a strategy with equal static and reactive regions is used. Floor lift, displacement, self-weight, torsion and shear drive are considered as parameters. at which point the analyzed composite structure shows a more favorable design than the RCC.

Shakhet. al, (2013): They studied a comparison of the structural behavior of his R.C.C. Composite structure of skyscrapers. To do this, a model of his G+15 projectile in seismic zone IV was created using structural analysis and design software (STADD PRO). A wind load with a velocity of 39 m/s was applied.

Desire. Al, (2013): This work seeks to study the seismic performance of composite soft slug columns. Four different models were prepared and their performance was investigated using Stad Pro software. In the -1 model, the floor height of the building was kept constant, but in the -2 model, only the columns on the first floor were replaced with composite columns. In model 3 the first floor and first floor columns were replaced with composite columns, and in model 4 the height of the first floor was changed to 4 m.

Soni et al. Al. (2010): Floors and his five floors, 3D frames during seismic force analysis using Stad Pro software. His three different frame types are considered: RCC frame with RCC plate, second steel frame with steel plate and third steel beam with RCC column and plate. The bearing reaction forces, bearing moments and nodal displacements of RCC and steel were compared for moderate soils in Seismic Zone - III.

Bayerette. al. (2010): The object of consideration is composite structures. For this reason, several research posts have been structured and established. Segments require a lot of trial and error to create new gadget parts with different construction materials. The research site was planned with the advanced graphics program CAx Siemens NX 7.

3. METHEDOLOGY

Structural analysis and design software extended three dimensional analysis of building systems (ETABS) is used to carry out the analysis of frame with RCC structure and structure with composite columns. The flow diagram of modeling and analysis of building structure frame on etabs will be as below -

1. Select a plan of commercial/ residential high rise building.
2. Select column positions on the plan.
3. Plan beam layout for each floor for setting up grid lines.
4. To start modeling on etabs select base units and design standards.
5. Setup grid lines for the modeling and define storey levels.
6. Define section properties including material.
7. Draw structural objects like column, beam, slab & openings.
8. Assign properties to drawn structural objects.
9. Define load patterns, assign load and define load combinations.
10. Check Model, Run analysis, Design and Generate Report.

MODELLING & ANALYSIS

To carry out the analytical work building structure having five grids in X direction at 7.0 mt. equal distance and five grids in Y direction at 7.0 mt. equal distance are considered as shown in figure below-

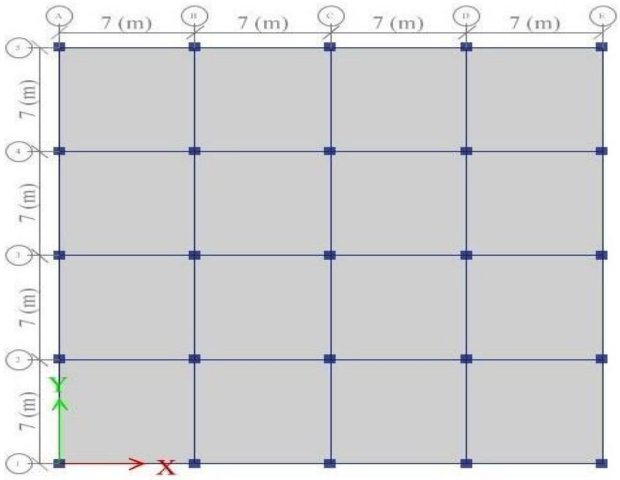

Fig-1: Grid Lines of the Building Structure

To create a model of three dimensional building structures in ETABS Software following assumptions are considered-

Table -1: Data for Modeling of Building Frame Structure

1	Number of Stories	G +10+mumty
2	Height of stilt floor	3.2 mt.
3	Height of upper stories	3.2 mt.
4	Depth of foundation	-2.0 mt
5.	Grade of concrete for RCC Beam & Slab	M-25
6	Grade of concrete for Columns	M-25
7	Steel used for longitudinal reinforcement	HYSD 500
8	Steel used for lateral reinforcement	HYSD 415
9	Steel Sections	Fe 345
10	Masonry	Infill brick
11	Seismic Zone	Zone - V

Table -2: Section properties

Conventional Reinforced Concrete Frame		
1	Column	650mm x 650mm
2	Beam	300 mm x 400 mm
3	Slab	150 mm thick
4	Masonry	130 mm thick
Composite Column with RCC Slab & Beam		
1	CFST Composite Column	450 mm x 450mm
2	Beam	300 mm x 400 mm
3	Slab	150 mm thick

Table -3: Load Details

1	Dead Load	Self weight of structure
2	Live Load	Occupancy load on floors.
3	Super Dead Load	Floor Finish & Ceiling plaster
4	EQ +X	Seismic load in X direction
5	EQ +Y	Seismic load in Y direction

Table -4: Load Combinations

1	Combination -1	1.5 (DL+LL)
2	Combination -2	1.2(DL+LL+ EQ+X)
3	Combination -3	1.2(DL+LL- EQ+X)
4	Combination -4	1.2(DL+LL+ EQ+Y)
5	Combination -5	1.2(DL+LL- EQ+Y)
6	Combination -6	1.5 (DL+ EQ+X)
7	Combination -7	1.5 (DL- EQ+X)
8	Combination -8	1.5 (DL+ EQ+Y)
9	Combination -9	1.5 (DL-EQ+Y)
10	Combination -10	0.9 (DL+ EQ+X)
11	Combination -11	0.9 (DL- EQ+X)
12	Combination -12	0.9 (DL+ EQ+Y)
13	Combination -13	0.9 (DL-EQ+Y)

Model Prepared in ETABS of RCC Building Structure

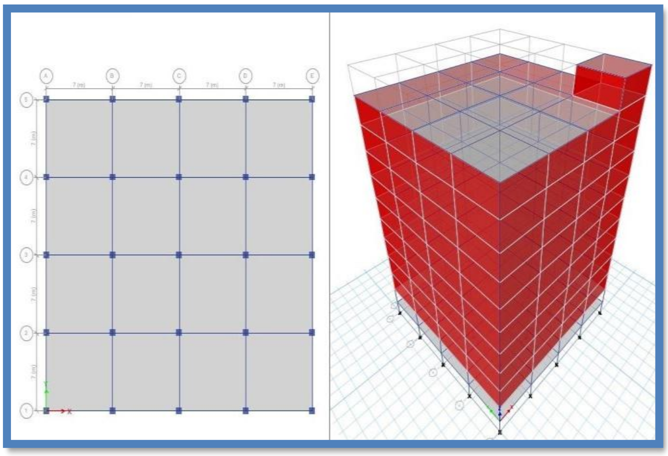

Fig -1: RCC Structure

3D View - Displacement Due to Dead Load (RCC)

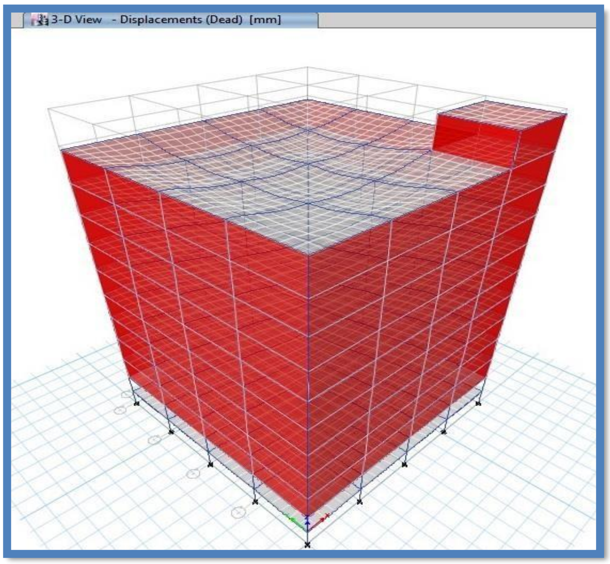

Fig -1: Composite Structure

3D View - Displacement Due to EQ+X Seismic Load

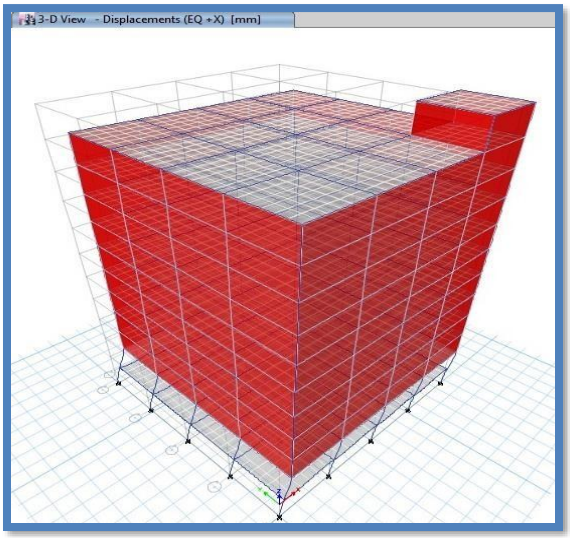

Fig -1: Displacement Due to EQ+X Seismic Load (RCC)

3D View- Displacement Due to EQ+Y Seismic Load

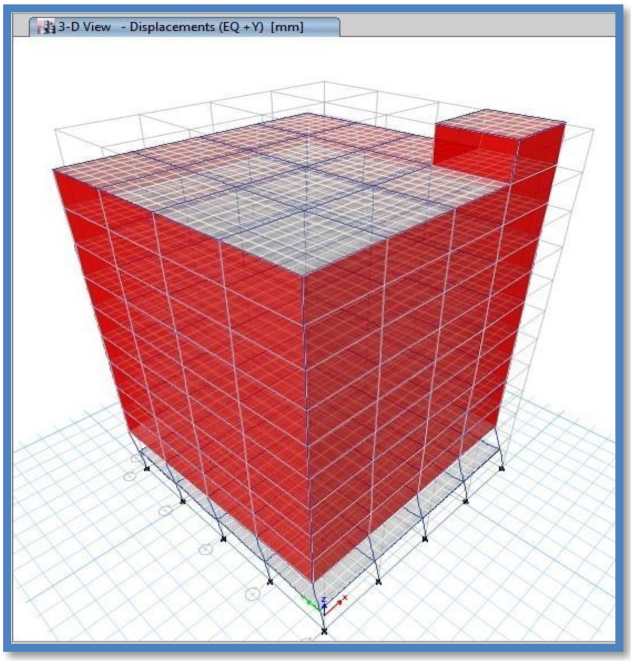

Fig -1: Displacement Due to EQ+Y Seismic Load (RCC)

2. HEADING 2

Cement behavior is surprisingly unpredictable and many subtleties are not understood. Interestingly, constructive buildings require basic but solid material laws. Further development relying on trial testing has been shown to be moderate. Advanced numerical techniques provide amazing additional tools. Composite properties and processes can be decomposed using a restricted component strategy. To take advantage of these possible outcomes, it is important to intentionally create a composite structure that looks like real cement. In the past, when designing structures, decisions were generally made between solid structures and craftsman structures. In any case, the disappointment of numerous high- and low-rise RCCs. In addition, seismic masonry structures have forced structural designers to seek selective techniques for development. The use of composite or hybrid materials is very attractive due to the huge potential to improve overall execution through rather modest assembly changes and engineering innovations. In India, many consulting architects Due to the novelty and complexity in research and design, we are reluctant to allow the use of bonded steel bulk construction. However, this paper shows that the solid steel framework properly placed and assembled at this time is an incredibly conservative structure with the qualities of high strength, rapid construction and better seismic performance Interconnection planning for high-rise structures is rapidly improving in the region and should be kept in mind. This is relatively new in India and the equivalent structure codes have not been updated. Officially, multi-layered structures in India were developed with R.C.C. Circled Structure or Steel Confined Structure, but more recently patterns towards composite structures have begun and developed. In the development of composite materials, two dissimilar materials can be integrated by using shallow depth headed studs at the interface, resulting in significant material cost savings. The heat build-up (coefficient of thermal expansion) of both cement and steel are nearly identical. Thus, different warm concerns in different temperature regions are not accepted.

1) Composite Beam Definition A solid steel composite beam consists of a steel beam strung with solid plates reinforced with chemical anchors. Combined activity reduces the depth of the jet. The movable steel segments themselves are sometimes found to be sufficient for construction, and the designed stanchions are usually pointless. Composite beams can also be constructed using profiled sheets with solid facings or cast or prefabricated reinforced solid plates.

2) Definition of Composite Column A steel-mass composite segment is expected to be a compression section where the steel composition is in the structural steel region. There are three types of composite segments used: concrete-enclosed sections, concrete-filled sections, and impacted sections. Legacy code implicitly makes method attempts to satisfy all three goals. A. Negligible damage due to tremors of a one-off earthquake with a recurrence period of about 50 years. This can be achieved by providing elastic structural response and limiting tier displacement to minimize damage to nonstructural components such as cladding and interior walls. B. Prevention of collapse in the largest required earthquake that may occur at the site. Such earthquakes occur with a recurrence period of about 2500 years. The requirement for inelastic deformation is less than the deformability, roughly accounting for the loss of stiffness and

strength due to gravitational loading, secondary effects, and cyclic loading. Additionally, the bullet deformation is small enough to prevent catastrophic damage to nonstructural members. Deformation is a key parameter in performance-based seismic design, not force or magnitude. variants he can be divided into three categories. a. total construction movement. Drifting and other internal deformations of the BC story. c. Inelastic deformation of parts and elements. These motions are caused by rigid body displacements and shear deformations.

Critical Issues:

- High foundation overturning moment and foundation design.
- High requirements for foundation shear capacity.
- High gravitational stress reduces usable floor space and increases component cross-sectional area.
- Ductility development of basic elements under high compressive stress.
- Lateral acceleration and story drift controls.
- Damage control that allows repairs.
- Ensuring ductile energy dissipation mechanism and avoiding brittle fracture

1 RESULT AND DISCUSSION

The maximum storey displacements

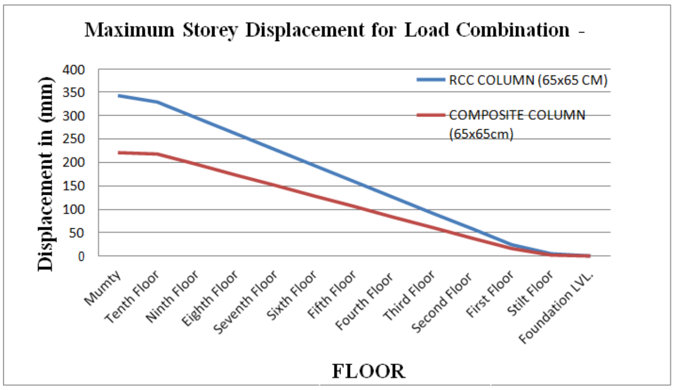

Chart -1: Maximum Storey Displacement for Load Combination -1

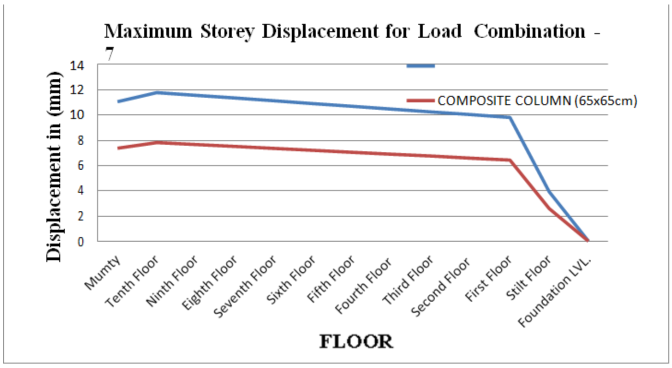

Chart -2: Maximum Storey Displacement for Load Combination -7

DISCUSSION: The maximum floor displacement of the frame withRCC columns is 49% to 55% higher than with composite columns.However, if the cross-sectional size of the composite column is reduced to the minimum required size, i.e. 450 x 450mm for H. current model, the maximum floor displacement of the RCC frame will be reduced by 6% to 12%.

The Storey shear

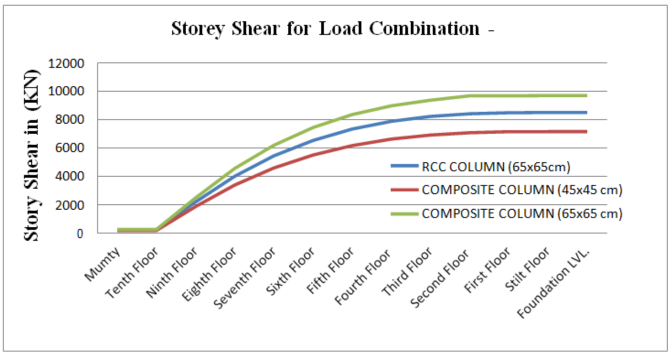

Chart -3: Storey Shear for Load Combination -2

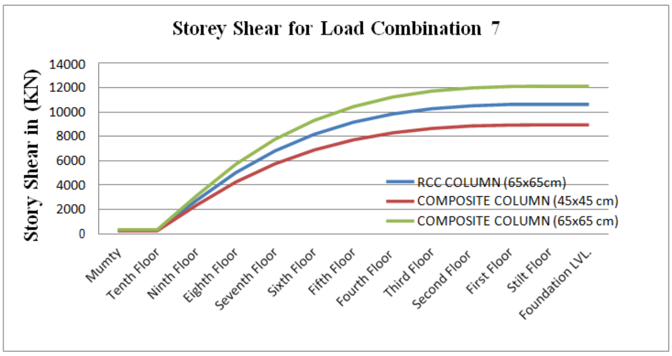

Chart -4: Storey Shear for Load Combination -7

DISCUSSION: Maximum Storey shear for frame with RCC columns (65x65 CM) is 17% to 19% higher than the frame with composite columns (45x45cm). Storey shear in composite columns are less due to reduced weight of structure with composite columns.

The Overturning Moment

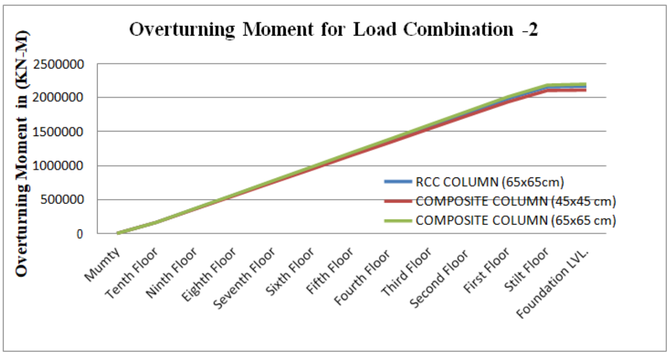

Chart -5: Overturning Moment for Load Combination -2

DISCUSSION: Overturning Moment in Frame with composite columns of size 45x45 cm is marginally lower than RCC columns of size 65x65 cm due to reduced weight.

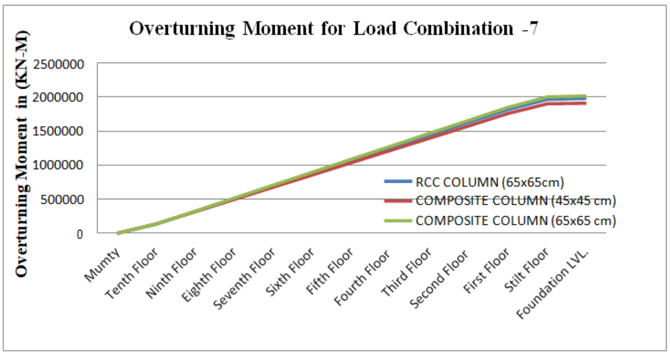

Chart -6: Overturning Moment for Load Combination -7

The Storey stiffness

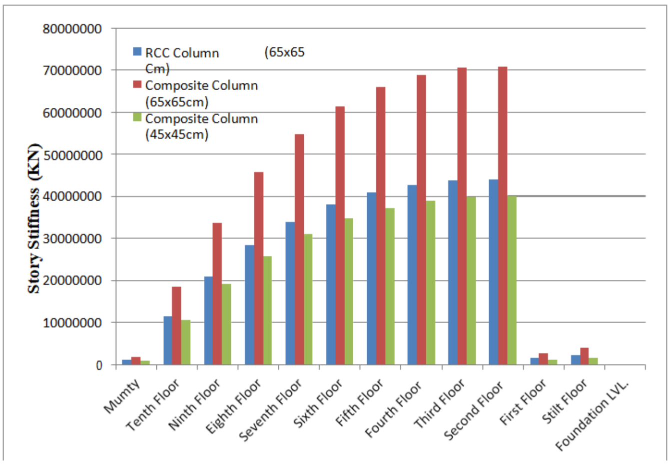

Chart -5: The Storey stiffness for models

DISCUSSION: Storey Stiffness in RCC columns of Size 65x65 CM is 8% to 26% higher than the composite columns of size 45x45 CM.

3. CONCLUSIONS

After analyzing frames with RCC columns and frames with composites and examining the results obtained, the following conclusions can be drawn:

1. This model requires a segment area of 650 x 650 mm in RCC, but when planning the same model in composite segments, the segment size was reduced to 450 x 450 mm.

2. The maximum floor displacement of the RCC segment is 49% to 55% higher than that of the composite segment with the same area size. The space size required for a compound segment decreases as the segment size decreases. The most extreme bullet displacements of the composite segment are 6% to 12% higher than the RCC segment.

3. The edge maximum floor shear with RCC profiles (65 x 65 cm) is 17% to 19% higher than formwork with composite segments (45 x 45 cm). Composite bullet shear is lower because there is less stress on the structure of the composite.

4. The fall times of the 45x45 cm composite segment are hardly higher than the 65x65 cm RCC segment.

5. Bullet stiffness of 65 x 65 cm RCC segments is 8% to 26% higher than 45 x 45 cm composite sections

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