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COMPARATIVE ANALYSIS OF SEISMIC AND WIND LOADS OF RESIDENTAL BUILDING WITH MATERIAL VARIATION

Mohannad Abdo[a,*], Prof. D. Annapurna[b]

a University college of engineering, Osmania university, Hyderabad, Telangana, India

[b]University college of engineering, Osmania university,Hyderabad,Telangana,India

ABSTRACT:

In general, design of high structures requires horizontal loads such as wind and seismic loads in addition to dead and live loads. Consideration of horizontal loads divided to design of loads which will cause long term effects on structures like wind forces that can cause torsion and creep. This effects can be noticed on structural elements like columns, slabs, beams of high and non-symmetrical buildings causing cracks, creep, and shear failure. Careful design is needed in case of seismic and wind loads due to their sudden and fast effects on structures showing within seconds.The overall goal is to design structures to have more resistance to seismic and wind loads. Studying and analyzing seismic and wind effects on structures show variation with respect to a height, materials and seismic zones.

However, in this research the behavior of different materials under simulation of same values of wind and seismic loads is analyzed and studied by considering the equal dimensions of RCC, STEEL, and COMPOSITE buildings. The study also considered using basic system of construction for each type of material which are column, beams, and shear walls. The current research focus on the impact of seismic and wind loads on reinforced concrete RCC, steel, and composite structures. Furthermore, the effect of building height varies from the outcomes of this research, which includes a comprehensive G+15, G+25, and G+35 height fluctuations. As a result, after analyzing and modeling the residential building with different materials and variation of height, Wind forces as a lateral effect for Displacement, Drift, Shear Forces, Overturning Moment, and Story Stiffness is stronger than Seismic load on tall buildings. The effect of both Wind and Seismic loads is increasing highly and severely with increase in the height of building. Comparison of RCC,STEEL& COMPOSITE buildings with the different parameters shows that the Composite buildings is the best option for most of the tall building considerations to resist Seismic and Wind loads.

Keywords: lateral loads Tall Buildings,various height and materials,Response Spectrum Method,Displacement. Storydrift. Shear Forces, Overturning Moment, Story Stiffness

1.Introduction

The study goal in this research is to create structures that are more resistant to earthquakes and wind. The behavior of different materials under simulation of the same values of wind and seismic loads is analyzed and studied with consideration of the equal dimensions. In this research, the type of behavior of different materials of the same values of wind and seismic loads is gathered and analyzed with consideration of the equal dimensions o In addition to the structure's materials such as concrete, steel or composite concrete and steel, were existed to design buildings, however, in this research the behavior of different materials under simulation of the same values of wind and seismic loads is analyzed and studied The study also considered the use of a basic construction approach for each type of material.

Under the modification in height of the designed buildings, the study demonstrates different values of Displacements, Drifts, Shear Forces, and Overturning Moment, Story stiffness between RCC, STEEL, and COMPOSITE.

When comparing the differences of various heights of one structure using Indian standard Code IS, however, consideration of type of materials should be taken when comparing heights of structure, followed by the effect of lateral loads, and at last, any surprises which may be realized while making these comparisons.

The answers to these questions can aid in determining which aspects require more research work and which do not.

The objective of this review is to provide some background information on how to use various materials in construction and, in particular, how to deal for changes in building height. When comparing RCC, STEEL, and Composite, there are several interacting aspects to consider. Simple comparisons of inter-story drift limitations and strength needs in different decades, for example, can result in inaccurate predictions unless other values are taken into account.

1.1 Defining structure analyzing and designing:

In the pre-study will be G+15, G+25, and G+35 floors of residential Building with material variation such as RCC, STEEL, and COMPOSITE are chosen. Analysis is done by Response Spectrum method by using IS Code 1893 2016.

1.2 Seismic and Wind Design for RCC building;

Many assumptions must be addressed when building RCC structures for seismic and wind resistance. Earthquakes create impulsive ground motions that are complicated and irregular in nature. Earthquakes are unlikely to happen at the same time as wind.

The following expression is used to calculate the horizontal seismic coefficient Ah for a structure:

Ah=Z*I*Sa/ (2*R*g) IS.1893.1.2002 clause 6.4.1

The overall design seismic force received at each floor level will be transferred to individual lateral load resisting elements. Along each design will require, the total model lateral force or design seismic base shear (VB) shall be computed by:

VB= Ah*W IS.1893.1.2002 clause 7.5.3

The empirical expression can be used to estimate the approximate fundamental natural period of vibration (T,), in seconds, of a moment-resisting frame building without brick infill panels:

Ta=0.075*h^0.75 for RCC IS.1893.1.2002 clause 7.6.1

The Vertical Distribution of Base Shear to Different Floor Levels and the design base shear (V) estimated in 7.5.3 shall be spread along the building's height as follows:

$$Q_i = V_B \frac{W_i h_i^2}{\sum_{j=1}^{n} W_j h_j^2}$$

IS.1893.1.2002 clause 7.7.1

Modal combination is Complete quadratic combination (CQC) approach is used to combine peak response values (for example, member forces, displacements, store forces, store shears, and base reactions).

$$\lambda = \sqrt{\sum_{i=1}^{r} \sum_{j=1}^{r} \lambda_i \rho_{ij} \lambda_j}$$

IS.1893.1.2002 clause 7.8.4.4

The building with a regular or irregular plan configuration as a system of messes lumped at the floor levels, each mass having one degree of freedom, lateral displacement in the direction of interest. In this scenario, the following equations must be used to compute the various numbers.

The modal mass (Mk) is used to represent as:

$$M_k = \frac{\left[\sum_{i=1}^{n} W_i \phi_{ik}\right]^2}{g \sum_{i=1}^{n} W_i (\phi_{ik})^2}$$

IS.1893.1.2002 clause 7.8.4.5.a

Modal Participation Factors (Pk) is represented as:

$$P_k = \frac{\sum_{i=1}^{n} W_i \phi_{ik}}{\sum_{i=1}^{n} W_i (\phi_{ik})^2}$$

IS.1893.1.2002 clause 7.8.4.5.bDesign Lateral Forces (Qik) is

$$Q_{ik} = A_k \phi_{ik} P_k W_i$$

as follow:

I.1893.1.2002 clause 7.8.4.5.c

Story Shear forces is represented as:

$$V_{ik} = \sum_{j=i+1}^{n} Q_{ik}$$

IS.1893.1.2002 clause 7.8.4.5.d

The wind speeds recorded at any location are quite changeable, and there are effects of gusts that can persist for a few seconds in addition to steady wind at any moment. These gusts raise air pressure, but their impact on building stability may be minor; generally, gusts affect only a portion of the structure, and the higher local pressures may be more than offset by a brief drop in pressure elsewhere. To achieve design wind velocity at any height (Vz) for the specified construction, the fundamental wind speed (Vb) at any site must be changed to reflect the following effects:

Vz =Vb* K1*K2*K3 IS.875.3.1987 clause 5.3

1.3 Seismic and Wind Design for STEEL building;

Steel frames must be constructed and detailed in such a way that they have the strength, stability, and ductility to shown earthquakes in all IS 1893 (Part 1) zones without failing. Frames that are part of a gravity load resisting system but are not made to resist lateral seismic loads do not need to meet the standards of this section if they can accept the consequent deformation.

Notional horizontal forces should be given to a frame subjected to gravity loads in order to determine the frame's sway stability. These virtual horizontal forces should be taken at each level as 0.5 percent of factored dead load plus vertical imposed loads applied at that level to account for practical limitations. In the analysis, the notional load should not be combined with other lateral loads like as wind and seismic loads.

The effects of design activities on a structure and its members and connections shall be determined by structural analysis with the assumptions in order to comply with the requirements of the defined limit states of stability, strength, and serviceability.

- Elastic Analysis is when the Individual members are considered to stay elastic under the action of the calculated design loads for all limit states in elastic analysis.The influence of hunching or any variation in the cross section along a member's axis must be examined and, if substantial, taken into consideration when determining the stiffness of the member.

- Plastic analysis is unless enough ductility of the structure and plastic rotation capacity of its members and connections are established under the design loading conditions by other ways of evaluation, all of the following conditions must be met when a plastic technique of analysis is used.

- Dynamic analysis in accordance with IS 1893 (Part 1). IS.800.2007 clause 4.1.d

The response reduction factors listed in Table 23 can be combined with the IS 1893 provision for determining design earthquake forces.

The story drift limitations must be in accordance with IS 1893. IS 1893 further requires that members not designed to resist seismic lateral load will be deformation safe (Part 1).

Ordinary moment frames (OMF) should be verified to sustain inelastic deformation corresponding to a joint rotation of 0.02 radians with no loss of strength or stiffness below the entire yield value (MP). Ordinary moment frames that meet the requirements of this section are judged to satisfy the inelastic deformation requirement.

The individual thickness of the column webs and doubler plates, as follow:

$T \geq (dp + bp)/90$ IS.800.2007 clause 12.11.2.4

The empirical expression can be used to estimate the approximate fundamental natural period of vibration (T), in seconds, of a moment-resisting frame building without brick infill panels:

Ta=0.085*h^0.75 for STEEL IS.1893.1.2002 clause 7.6.1

1.4 Seismic and Wind Design for composite building

The compression strength of concrete is complemented by the tension strength of steel, resulting in an efficient section. Concrete and steel are used in a well-organized manner by the notion of this composite part. Steel concrete composite columns are compression members formed of both steel and concrete parts. Composite columns are divided into two categories, shown in Figure 1.

1. A concrete piece having a steel component inserted in it
2. A concrete-filled hollow steel section.

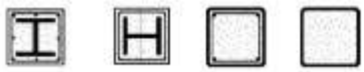


Figure 1 Composite columns

1.4.1 Structural Steel

All structural steels used shall, before fabrication conform to IS: 1977-1975, IS: 2062-

1992, and IS: 8500-1977 as appropriate. Some of the structural steel grade commonly used in construction are as per IS: 961-1975 and IS: 1977-1975.

1.4.2 Structural Concrete

The typical cube strengths (fck), fcu of concrete are measured at 28 days and are used to specify its strength. The properties of various concrete grades, as well as their EC4 values are considered according to IS: 456-2000

IS: 11384-1985 Code for composite construction has prescribed $\mu m = 1.15$ for structural Steel.

There is currently no Indian Standard code that covers the Seismic and wind analysis of Composite buildings. The proposed design method in this research is based on AISC 360-16, which incorporates the recent composite building. The design method used in ETABS 2018 is mixed with both IS 875-2015 and AISC 360-16 for proposed composite structure.

2 PROJECT DETAILS

The scope of study consists of one residential building; dimensions are 35 m x 20 m, 35 m height and building consists of G+15, 25, or 35 floors

2.1 **Project Brief**

Type of building: Residential Building

•Plinth area: 35 x 20 m

•Number of Story's: G+ 15, 25, 35 Floors

•Floor height: 3.5m

•Dead load: Self Weight

•SDL loads: 2 KN/m2

•Live load: 2 kN/m2

•Wall weight on beams = 2.87*1*0.2*3.5= 2 Kn/m2

•Slab depth: 150 mm

•Unit weight of masonry: 20 kn/m3

•Unit weight of R.C.C: 25 kn/m3

•Unit weight of steel: 79 kn/m3

•Grade of concrete: M30, M40, and M50 for R.C.C, Steel and Composite model

•Grade of steel: HYSD bars for reinforcement Fe 415

•Fe 250 for Steel and Composite model

2.2 RCC Cross Sectional Details of Tall Building:

The cross sectional details of beams and columns of RCC buildings considered in the design are prescribed in Table 1.

Table 1 cross sectional elements of RCC building

Cross Section Elements Dimensions RCC			
Type of element	Names	Definition	Dimension mm
Beams	B1	Height x Width	250 x 200
	B2	Height x Width	350 x 250
	B3	Height x Width	450 x 300
columns	C1	Width x Width	750 x 600
	C2	Width x Width	600 x 750
	C3	Width x Width	350 x 250
	C4	Width x Width	250 x 350

2.3 Steel Cross Sectional Details of Tall Building

A Special Plate Shear Wall (SPSW) is a structural system in which the vertical elements of some SLRS are steel frames which are often restrained by thin steel plate walls. Inelastic deformation of the structure is driven by the development of diagonal tension-field action in the web of the steel plate.

SPSW are very ductile and may give an attractive design solution for buildings if the location of structural walls around elevator, stairwell, and utility chase service cores may provide acceptable earthquake protection. Shear walls, like braced frames; exert significant overturning forces on foundations. Furthermore, the massive field welding that this method requires result in rather high construction costs. Special Wall Shear Plate thickness is considered as 50 mm. The cross sectional details of beams and columns of steel building are given in Table 2.

Table 2 cross sectional elements of steel building

Cross Section Elements Dimensions Steel								
Type of element	Names	Definition	Dimension mm					
			Total Depth	Top flange width	Top flange thickness	web thickness	Bottom flange Width	Bottom flange thickness
Beams	ISLB75	I Section	75	50	5	3.7	50	5
	ISLB100	I Section	100	50	6.4	4	50	6.4
	ISLB125	I Section	125	75	6.5	4.4	75	6.5
	ISLB150	I Section	150	80	6.8	4.8	80	6.8
	ISLB175	I Section	175	90	6.9	6.1	90	6.9
	ISLB200	I Section	200	100	7.3	5.4	100	7.3
	ISLB225	I Section	225	100	8.6	5.8	100	8.6
columns	Column 30	I Section	600	250	30	30	250	30
	Column 40	I Section	600	250	40	40	250	40
	Column50	I Section	500	250	50	50	250	50
	Column edited 50	I Section + 2 x channels	500	250	50	50	250	50
			250	25	25		150	25

2.4 Composite Cross Sectional Details of Tall Building

The cross sectional details of beams and columns of composite building are specified in Table 3.

Table 3 cross sectional elements of composite building

Cross Section Elements Dimensions Composite								
Type of element	Names	Definition	Dimension mm					
			Total Depth	Top flange width	Top flange thickness	web thickness	Bottom flange Width	Bottom Flange thickness
Beams	ISLB75	I Section	75	50	5	3.7	50	5
	ISLB100	I Section	100	50	6.4	4	50	6.4
	ISLB125	I Section	125	75	6.5	4.4	75	6.5
	ISLB150	I Section	150	80	6.8	4.8	80	6.8
	ISLB175	I Section	175	90	6.9	6.1	90	6.9
	ISLB200	I Section	200	100	7.3	5.4	100	7.3
	ISLB225	I Section	225	100	8.6	5.8	100	8.6
columns			Depth	Width	Flange thickness	web thickness	Material	Fill Material
	C1	Box	300	300	20	20	Steel 345	M30
	C2	Box	450	450	25	25		
	C3	Box	600	600	30	30		

Plan view and ETABS models of RCC, Steel and Composite buildings are given in Figure 2,3.

3.1 Define Earthquake Load Cases:

Definition Menu > Define > Static Load cases is where earthquake load scenarios are defined. EQX stands for earthquake load in the X direction, whereas EQY refers for earthquake load as in Y direction. For seismic analyses, three main factors are crucial and must be considered.

Define direction of the force: X / Y with no eccentricity

Define time period: 2.407 for R.C.C. model, 2.728 for Steel and Composite model

Seismic zone, Z: 0.24 for ZONE IV, 0.16 for ZONE III

Soil type: Hard soil

Importance factor, I: 1

Response reduction factor, R: 5 for R.C.C model

: 3 for Steel model

4 for Composite model

For R.C.C. Frame: without infill wall

T = Time period**IS 1893(Part 1): 2002, 7.6.2**

(Time of oscillation)

T = 0.075 * h^0.75

Where, h = Height of building in meter

h1= G+15= 3.5+15*3.5= 56 m

h2= G+25= 3.5+3.5+25 = 91 m

h3= G+35= 3.5+3.5*35= 126 m

T1 = 0.075 * h1^0.75 = 1.53

T2 = 0.075 * h2^0.75 =2.21

T3 = 0.075 * h3^0.75 =2.82

For Steel and Composite Frame:

T = 0.085 * h^0.75

Where, h = Height of building in meter

T1 = 0.085*56^0.75= 1.74

T2 = 0.085*91^0.75= 2.5

T3 = 0.085*126^0.75= 3.2

3.2 Define Wind Load Cases: (Equivalent Static Method):

Static load applications with Exposure and Pressure Coefficients, Wind Exposure Parameters, Exposure Height, and Wind Coefficients, Wind Speed, Terrain Category, Structure Class, and Risk Coefficient Factor are used to define lateral loads.

Coefficients between Exposure and Pressure: The object's exposure,

Wind Exposure Parameters:Use X&Y-Direction area forces

Wind Speed (Vb m/s): 44 m/s for Hyderabad City

Terrain Category: 2

Structure Class: C

Risk Coefficient Factor (K1): 1.07

Topography Factor (K2): 1 for slope < 3 degree

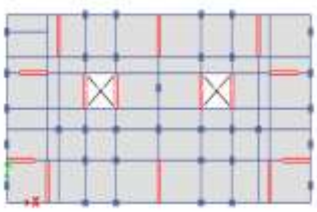
Where:

Vb =44 m/s, basic wind speed for Hyderabad city (as per IS 875-part-3, p-53, appendix A, fig-1 p-9).

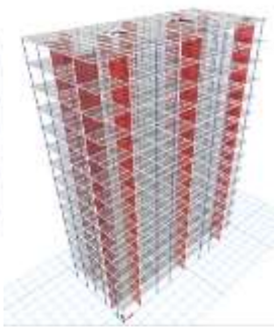
K1= 1.07, Probability factor (risk coefficient) (clause 5.3.1) (as per IS 875-part-3, p-11, table-1.

K2= 1.1, 1.16, 1.19 Terrain, Height and Structure size factor (as per IS 875-part-3, p-12, table-2) (Clause =5.3.2.2) (terrain category -2, class – c, height – 56, 91, 126 m).

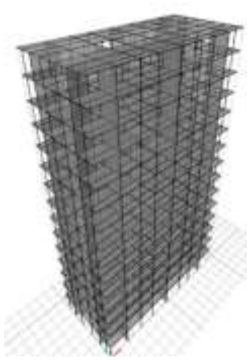
K3 = 1 Topography Factor for slope < 3 degree.



RCC Plan View



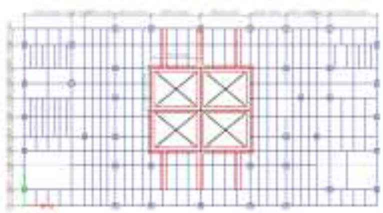
ETABS Model



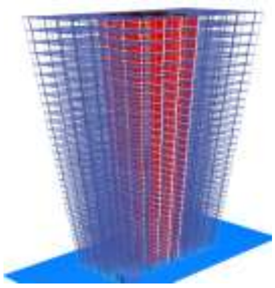
Steel Plan View

ETABS Model

Figure 2 plan view and model of buildings



Plan view of Composite building

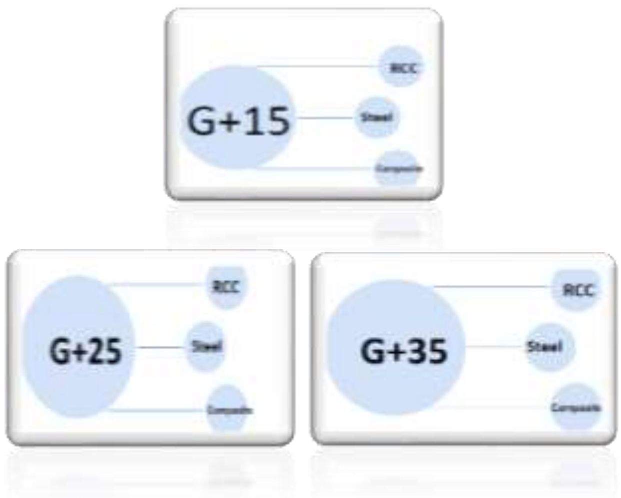


ETABS Model

Figure 3 Plan view and model of composite building

3.4 Levels of Analysis:

Levels of Analysis is divided into 9 models of Designing for one Residential Building which has same Dimensions at the base, the differences will be with the heights and materials as follows:



3.5 Analyzing Process through ETABS:

After making checking for the module for any overlaps or any Errors might be happen during the design phase, we run the analyzing to get the results of the structure.

3.5.1 Drift and Displacements Analysis:

Displacements and Drift analysis is crucial for all types of structures. Displacements occurs under horizontal forces such as seismic and wind forces which may cause a strong effect to the structure, the effect of displacement may led to collapse of structure's elements if the displacement was not considered during the design step, the high value of Displacement can also destroy the structure when the structure suffers from high value of seismic and wind loads alternatively.

Allowed Drift or displacement values depends of the Response factor which is related to the type of structure like residential, commercial industrial buildings (Importance Factor clause 7.2.3). In addition to the height of structure itself.

- **Maximum Displacement Value for Concrete frame:**

The max value for the concrete building as IS 456-2000 Clause 20.5 P.33 is:

$\Delta wl \leq H/500$

H : the total hight of the building.

For G+15, H= 56m

56m/500= 112mm

For G+25, H= 91m

91m/500= 182mm

For G+35, H= 126m

126m/500= 252mm

- **Maximum Displacement Value for Steel& Composite frame:**

The max value for the concrete building as per IS.800.2007 clause 4.1.2 is:

$\Delta wl \leq H/2000$

H : the total hight of the building.

For G+15, H= 56m

56m/2000= 28mm

For G+25, H= 91m

91m/2000= 45.5mm

For G+35, H= 126m

126m/2000= 63mm

- **Maximum Drift value For Concrete Frame:**

According to IS 1893-2002, the storey drift in any storey generated by the minimum specified design lateral force, with a partial load factor of 1.0, shall not exceed 0.004 times the storey height, for the purposes of displacement requirements only.

- **Maximum Drift value For Steel and composite frame:**

IS.800.2007.12.6 Storey Drift: The storey drift restrictions must comply with IS 1893. IS 1893 further requires that members not designed to withstand seismic lateral load be deformation compatible (Part 1). For RCC, Steel, and Composite buildings, the maximum drift values are**:**

For G+15, G+25, G+35, H= 3.5m

0.004 * 3.5m= 14mm

4. RESULTS AND DISCUSSION

4.1 Results of G+15, G+25, G+35 Analysis:

For each variation of height and materials, ETABS model has been designed and analyzed for everyone. As a result, nine models are the total number for this research. The results which have been made, are collected and presented as tables, graphs, and charts.

4.2 Comparison Values of Analysis

Comparing ETABS design models after showing previously above will be by choosing the highest values between Seismic and Wind Forces for each variation of height G+15, G+25, and G+35. Every height has comparison simultaneously for RCC, STEEL, and COMPOSITE.

4.2.1 Comparison Displacement Values for RCC, STEEL, and Composite:

The maximum values of Displacements is selected through comparing values of Seismic and Wind forces for each type of materials. The result is shown by following Table 4:

Table 4 Comparison of displacement values

Comparison Displacement values					
Total Story No	15				
Type of Building	RCC	Steel	Composite	Max Value	The Maximum Value
Seismic X	13.77	12.06	3.7	13.77	93
Seismic Y	10.955	8.5	0.18	10.955	
Wind X	29.97	88	5.3	88	
Wind Y	40.55	93	8.5	93	
Type of Building with maximum value					Steel Wind Y

Comparison Displacement values					
Total Story No	25				
Type of Building	RCC	Steel	Composite	Max Value	The Maximum Value
Seismic X	40	43.6	14	43.6	454
Seismic Y	23.2	19.6	10.07	23.2	
Wind X	123	454	26. 6	454	
Wind Y	155	340	42	340	
Type of Building with maximum value					Steel Wind X

Comparison Displacement values					
Total Story No	35				
Type of Building	RCC	Steel	Composite	Max Value	The Maximum Value
Seismic X	88	69.5	34	88	885
Seismic Y	60	21.7	26	60	
Wind X	188	885	59.5	885	
Wind Y	270	610	98.8	610	
Type of Building with maximum value					Steel Wind X

4.2.2 Comparison Drift Values for RCC, STEEL, and Composite:

The maximum values of Drifts is selected through comparing values of Seismic and Wind forces for each type of materials. The results is shown by following Table 5:

Table 5 Comparison of drift values

Comparison Drift values (mm)					
Total Story No	15				
Type of Building	RCC	Steel	Composite	Max Value	The Maximum Value
Seismic X	0.00035	0.003	0.00009	0.003	0.003
Seismic Y	0.00026	0.00208	0.00007	0.00208	
Wind X	0.0008	0.002	0.00012	0.002	
Wind Y	0.00099	0.0022	0.0002	0.0022	
Type of Building with maximum value					Steel Seismic Y

Comparison Drift values (mm)					
Total Story No	25				
Type of Building	RCC	Steel	Composite	Max Value	The Maximum Value
Seismic X	0.000603	0.0005	0.0002	0.000603	0.006
Seismic Y	0.0012	0.0003	0.00015	0.0012	
Wind X	0.002	0.006	0.0004	0.006	
Wind Y	0.002	0.005	0.0006	0.005	
Type of Building with maximum value					Steel Wind X

Comparison Drift values (mm)					
Total Story No	35				
Type of Building	RCC	Steel	Composite	Max Value	The Maximum Value
Seismic X	0.00087	0.0008	0.0004	0.00087	0.008
Seismic Y	0.0006	0.0002	0.0003	0.0006	
Wind X	0.002	0.008	0.0006	0.008	
Wind Y	0.003	0.006	0.001	0.006	
Type of Building with maximum value					Steel Wind X

4.2.3 Comparison Shear Forces Values for RCC, STEEL, and Composite:

The maximum values of Shear Forces is selected through comparing values of Seismic and Wind forces for each type of materials. The results are shown by Table 6:

Table 6 Comparison of Shear force values

Comparison Shear Forces values (KN)					
Total Story No	15				
Type of Building	RCC	Steel	Composite	Max Value	The Maximum Value
Seismic X	758	163	-764	764	3804
Seismic Y	998	226	-764	998	
Wind X	-1729	1686	-1636	1729	
Wind Y	-3804	3545	-3492	3804	
Type of Building with maximum value					Steel Wind Y

Comparison Shear Forces values (KN)					
Total Story No	25				
Type of Building	RCC	Steel	Composite	Max Value	The Maximum Value
Seismic X	985	290	-1052	1052	6976
Seismic Y	992	257	-1052	1052	
Wind X	-3477	-3399	-3049	3477	
Wind Y	-6976	-6760	-6508	6976	
Type of Building with maximum value					RCC Wind Y

Comparison Shear Forces values (KN)					
Total Story No	35				
Type of Building	RCC	Steel	Composite	Max Value	The Maximum Value
Seismic X	-1632	331	-1701	1701	10178
Seismic Y	-1588	272	-1681	1681	
Wind X	-3935	-5179	-4573	5179	
Wind Y	-10132	-10178	-9759	10178	
Type of Building with maximum value					Steel Wind Y

4.2.4 Comparison Overturning Moment Values for RCC, STEEL, and Composite:

The maximum values of Overturning Moment is selected through comparing values of Seismic and Wind forces for each type of materials. The result is shown by following table 7:

Table 7 Comparison of overturning moment

Comparison Overturning Moments values (KN. m)					
Total Story No	15				
Type of Building	RCC	Steel	Composite	Max Value	The Maximum Value
Seismic X	28275	8583	-30577	30577	112325
Seismic Y	22255	6184	30577	30577	
Wind X	-51028	-49841	-48265	51028	
Wind Y	112325	104679	103004	112325	
Type of Building with maximum value					RCC Wind Y

Comparison Overturning Moments values (KN. m)					
Total Story No	25				
Type of Building	RCC	Steel	Composite	Max Value	The Maximum Value
Seismic X	47474	15930	-69636	69636	338127
Seismic Y	51268	14636	69636	69636	
Wind X	-167992	-165901	-147500	167992	
Wind Y	338127	327953	314788	338127	
Type of Building with maximum value					RCC Wind Y

Comparison Overturning Moments values (KN. m)					
Total Story No	35				
Type of Building	RCC	Steel	Composite	Max Value	The Maximum Value
Seismic X	-140799	23395	155368	155368	686988
Seismic Y	136228	25236	-157218	157218	
Wind X	-325847	-351842	-337740	351842	
Wind Y	671568	686988	656763	686988	
Type of Building with maximum value					Steel Wind Y

4.2.5 Comparison Story Stiffness Values for RCC, STEEL, and Composite:

The maximum values of Story Stiffness is selected through comparing values of Seismic and Wind forces for each type of materials. The results is shown by Table 8:

Table 8 Comparison of story stiffness

Comparison Story Stiffness values (KN/ mm)					
Total Story No	15				
Type of Building	RCC	Steel	Composite	Max Value	The Maximum Value
Seismic X	2442	1179	13050	13050	20444
Seismic Y	5260	2075	20205	20205	
Wind X	2381	1311	13934	13934	
Wind Y	5079	2419	20444	20444	
Type of Building with maximum value					Composite Wind Y

Comparison Story Stiffness values (KN/ mm)					
Total Story No	25				
Type of Building	RCC	Steel	Composite	Max Value	The Maximum Value
Seismic X	2283	1774	13913	13913	23725
Seismic Y	5228	3343	20871	20871	
Wind X	2306	1802	15826	15826	
Wind Y	5146	3553	23725	23725	
Type of Building with maximum value					Composite Wind Y

Comparison Story Stiffness values (KN/ mm)					
Total Story No	35				
Type of Building	RCC	Steel	Composite	Max Value	The Maximum Value
Seismic X	4155	1856	20439	20439	36293
Seismic Y	7831	4017	28472	28472	
Wind X	4451	1965	24391	24391	
Wind Y	8722	3933	36293	36293	
Type of Building with maximum value					Composite Wind Y

4.3 Comparison Highest Values for RCC, STEEL, and Composite:

The maximum values of Displacements, Drifts, Shear Forces, Overturning Moment, and Story Stiffness is selected through comparing values of Seismic and Wind forces for each type of materials. All the results are shown through Figures 4,5,6,7,8

Displacement highest value (mm)	Story no	RCC	Steel	Composite
Story no	15	40.55	93	8.5
	25	155	454	42
	35	270	885	98.8

Figure 4 Comparison Displacement Highest Values for RCC, STEEL, and Composite

Drift highest value (mm)	Story no	RCC	Steel	Composite
Story no	15	0.00099	0.003	0.0002
	25	0.0012	0.006	0.0006
	35	0.003	0.008	0.001

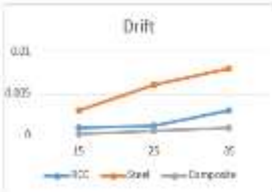


Figure 5 Comparison Drift Highest Values for RCC, STEEL, and Composite

Shear Forces highest value (Kn)	Story no	RCC	Steel	Composite
Story no	15	3804	3545	3492
	25	6976	6760	6508
	35	10132	10178	9759

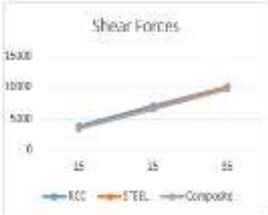


Figure 6 Comparison Shear Forces Highest Values for RCC, STEEL, and Composite

Overturning Moment highest value (Kn.m)	Story no	RCC	Steel	Composite
Story no	15	112325	104679	103004
	25	338127	327953	314788
	35	671568	686988	656763

Figure 7 Comparison Overturning Moment Highest Values for RCC, STEEL, and Composite

Story Stiffness highest value (Kn/mm)	Story no	RCC	Steel	Composite
Story no	15	5079	2419	20444
	25	5146	3553	23725
	35	8722	4017	36293

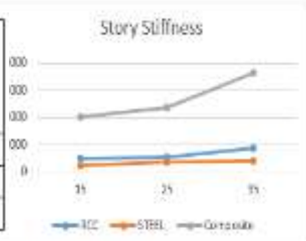


Figure 8 Comparison Story Stiffness Highest Values for RCC, STEEL, and Composite

5. CONCLUSION

1. Wind forces as a lateral effect for displacement is stronger than Seismic load on tall buildings. Wind Load is 70% stronger for RCC, 89% is stronger for Steel, 63% is stronger for Composite

2. Wind forces on tall building is sever on Steel structure than RCC, and Composite structure i.e. 64% higher than RCC, 89% higher than Composite.

3. The highest values of lateral forces of Wind and Seismic loads is higher on the longest dimension of the building which needs to add extra supports such as shear walls and Bracing System to avoid the collapse under Wind and Seismic loads.

4. Displacement on different variation of building shows that the highest Displacement is under Wind load for steel structure. For G+15, Steel Displacement is higher 56% RCC and 90 % Composite. For G+25, Steel Displacement is higher 66% RCC and 90% Composite. For G+35, Steel Displacement is higher 70% RCC and 89% Composite.

5. Drift on different variation of building shows that the highest Drift is under Wind load for steel structure Drift for steel is higher 70% RCC and 91% Composite.

6. Shear Forces on different variation of building shows that all material of building hold slightly same values of each one for each variation of height. The values show that RCC structure under wind load has a slight value bigger than Steel, And Composite. RCC is higher 2% for Steel And 5% for Composite.

7. Overturning Moments on different variation of building shows that all material of building have slightly same values of each one for each variation of height. The values show that RCC structure under wind load has a slight value bigger than STEEL, And Composite. RCC is higher 0.5% for Steel And 5% for Composite.

8. Story Stiffness on different variation of building shows that the Composite structure has three or four times higher values than RCC and Steel Structures for story Stiffness. Composite is higher 77% for RCC And 88% for Steel.

9. Comparison of all above materials with the different parameters shows that the Composite building is the best option for most of the tall building considerations to resist Seismic and Wind loads.

10. Comparison of all above materials with the different parameters shows that the RCC building can be an option for tall building, if the parameters values can be reduced by adding mixtures to the concrete and use high resisted reinforcement steel bar to the tension and buckling.

11. Comparison of all above materials with the different parameters shows that the STEEL building must to be supported with various type of systems such as bracing system to be considered to use for tall building, this will make the STEEL building more difficult to construct and less trusted.

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