ELK ASIA PACIFIC JOURNAL OF CIVIL ENGINEERING AND STRUCTURAL DEVELOPMENT
ISSN 2394-9341 (Online); Volume 6 Issue 1 (2020)

SEISMIC ANALYSIS OF COMPOSITE STEEL FRAME BUILDING AGAINST DIFFERENT EARTHQUAKE AND WIND EFFECT

RANI DHANRAJ GAIKWAD	D.H TUPE	G.R GANDHE
[1]P.G. Student Deogiri Institute of Engineering and management studies-431002, Maharashtra, India.	[2]Assistant Professor, the Department of civil Engg, Deogiri Institute of Engineering and Management Studies, Aurangabad-431002, Maharashtra, India.	[3]Professor, the Department of civil Engg, Deogiri Institute of Engineering and Management Studies, Aurangabad-431002, Maharashtra, India.

ABSTRACT

In this paper study behaviour of composite and steel building has been checked for sesmic and wind effects. The study has carried out at a location of pune city for zone III and for hard soil by using IS 1893-2016. Composite building is more stiffer than the steel building. Composite means concrete slab is connected with steel beam by using shear connectors. composite building has more advantages over steel frame building. composite building has less displacement than steel building, because steel having more elongation than the steel concrete composite building.Composite building imparts more sesmic load. Analysis of both the building has been carried out by using Etab software. after getting results it has been concluded that steel-concrete composite building has more base shear, less displacement ,less storied drift and less time period as compared to Steel building.

Keywords: HARD SOIL, WIND EFFECTS, STORIED DRIFT, ETAB, DISPLACEMENT

Introduction

The recent trend is that composite configuration mode offers several advantages over traditional system configurations. The composite structure has both steel and concrete, it satisfies both the dynamic properties of the material (concrete in compression, steel in tension)) and results in a fast track structure. Become. According to experience in other countries, this is not due to the economic shortage of steel as a construction material. Increasing the amount of steel in the construction of building structures has been needed by developing countries like India over the last decade. Steel structural members are usually manufactured as components consisting of sheet metal and shell elements, which result in local and lateral buckling under load.

Therefore, while structural elements of concrete are generally thick enough to resist buckling, failures due to buckling and instability need to be checked. But they undergo creep and contraction over time. Therefore, a new technology called composite structure of steel and concrete has emerged, connecting the dynamic properties of both materials. For framed structural systems, reinforced concrete composite structural systems have proven to be the most economical solution for ensuring that rigid and strength engineering design requirements are met.

Current research is to analyze complex buildings with Etab 2016. ETABS is used for parametric inspection. (G+16) buildings robbed and dead Load, live load, All of The

basic load combinations are framed. If you have this Must be a compound building, the presence of pillars & Beam is composite & After the survey, the power of the pillar, joint displacement, floor acceleration, Story drift, story maximum displacement, story firmness are considered.

Objectives (Times New Roman 12 Bold)

Briefly describes the various components of a building's steel-concrete frame system.

i. Investigate key parameters such as time, seismic response of reinforced concrete composite frames to traditional reinforced concrete frames and steel frames for building structures.
ii. Modeling of multi-story steel composite buildings.
iii. Study various components of complex elements.
iv. Study of structural parameters such as foundation shear, floor drift, displacement of steel composite buildings.

Methodology

1. Preliminary Data Considered for the Analysis:

- Area covering - 24.2m x 53.75 m.
- Total Height of the building - 51 m
- Floor to Floor Height - 3.2m

1.2 Column Section

- Steel building - ISWB 600
- Composite building - 300mm X 600mm
- EMBEDDED WITH - ISMB 600

1.3 Beam Section

- Steel building = ISHB 450
- Composite building = ISHB 450

2. Following are codes considered for the analysis:

- R.C.C. design : IS 456: 2000
- Earthquake design : IS1893: 2016
- Code for Dead load : IS875: Part 1
- Code for Live load : IS875: Part 2
- Code for Wind load : IS875: Part 3
- Composite design: AISC 360-05
- Steel design : IS 800

The above graph shows Drift values for steel and composite building for Static Eq and Dynamic Eq in both x and y directions.

Conclusion:

Following are the conclusion we have obtained from above analysis results are:-

1. In case of Time period the values where obtained is higher in Mode 01,02,03, in the steel building frame due to its elongation property as well as steel are less in stiffness when it compared with the composite.
2. But in case of Base shear the value Composite building is higher due to its mass as the mass increases the base shear values will also be increases.
3. Displacement is depends on the stiffness so therefore the displacement for the steel is higher and composite is less.
4. Drift values for both steel and composite are under control. But the values of steel is higher due to steel is less stiff and not able to resist the earthquake force as the composite can resist.

From the above conclusion it is confirmed that the composite building is having more stiffness and better performance while

comparing with the steel building respectively.

References :

[1] Giovanni Brambillaa,, Monica Lavagnaa, George Vasdravellisb, Carlo Andrea Castiglionia "Environmental benefits arising from demountable steel-concrete composite floor systems in buildings"

[2] Liangjie Qi , Jianyang Xue , , Lei Zhai , Xuan Zhao , Roberto T. Leon "Experimental and numerical studies on seismic performance of traditional style steel-concrete composite frame" Department of Civil Engineering, Xi'an University of Architecture and Technology, Xi'an 710055, China Department of Civil and Environmental Engineering, Virginia Tech, Blacksburg, 24060, USA

[3] Panos Pantidis , Simos Gerasimidis , "Progressive collapse of 3D steel composite buildings under interior gravity column loss" Department of Civil and Environmental Engineering, University of Massachusetts, 30 Natural Resources Road, Amherst, MA 01003, USA.

[4] S. Jeyarajan , J.Y. Richard Liew , "Robustness analysis of 3D Composite buildings with semi-rigid joints and floor slab" Department of Civil and Environmental Engineering, National University of Singapore,& Engineering Drive 2, Singapore 117576 College of Civil Engineering, Nanjing Tech University, China

[5] Mark D. Denavita, Jerome F. Hajjar, Tiziano Perea , Roberto T. Leon" Elastic flexural rigidity of steel-concrete composite columns"

[6] Utsab Katwal, Zhong Tao , Md Kamrul Hassan," Finite element modelling of steel-concrete composite beams with profiled steel sheeting"

[7] Ankur Tailor ,Sejal P. Dalal, Atul K.Desai "Comparative Performance Evaluation of Steel Column Building & Concrete Filled Tube Column Building under Static and Dynamic Loading"

[8] Mohammed Imran, Shaikh Abdulla,S.M Hasmi Comparative analysis of reinforced concrete and composite structure subjected to static and dynamic loads :IJAERD Volume 4, Issue 8, August -2017.

[9] Baldev D. Prajapati, D.R. Panchal,"Study of Seismic and Wind Effect on Multi Storey R.C.C., Steel and Composite Building",International Journal of Advances in Engineering & Technology, Sept. 2013, ISSN:22311963.

[10] Mahesh Suresh Kumawat and L G Kalurkar,"Analysis and Design of Multistory Building Using Composite Structure",ISSN 2319 – 6009 Vol. 3, No. 2, May 2011

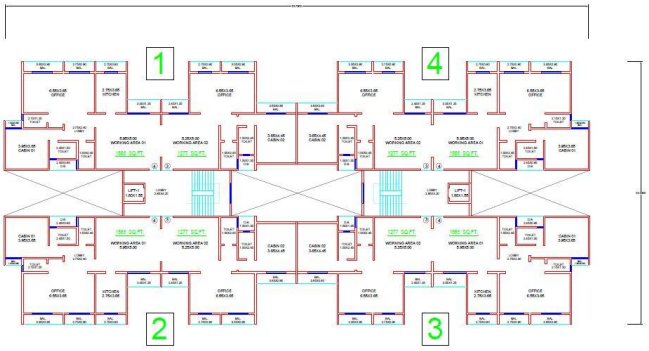


Fig: The Plan Of The Building

Results:

Table 1.Time Period

Sr.No	Mode	Steel(Sec)	Composite(Sec)
1.	Mode 01	3.12	2.82
2.	Mode 02	2.83	2.60
3	Mode 03	2.69	2.51

The model time period indicates that the steel building takes the more time to oscillate for the first mode as compared with the composite building.

Table 2. Base Shear

	Steel Frame	Composite Frame
Base Shearfor Static Eq X	4508.93 KN	4854.52 KN
Base Shear For Static Eq Y	4508.93KN	4854.53 KN
Base Shear For Dynamic SpecX	1518.51 KN	1756.00 KN
Base Shear For Dynamic SpecY	1424.77 KN	1608.30 KN

Base Shear is more in case of Composite frame because the base shear is depends on the mass of the building as the mass is increasing the base shear is also increasing.

Table 3. Displacement details

Directions	Steel Frame	Composite Frame
Max storey displacement for EQX	0.081 M	0.068M
Max storey displacement for EQY	0.097M	0.080M
Max storey displacement for SPEC X	0.021M	0.019M
Max storey displacement for SPEC Y	0.027M	0.023M
Max storey displacement for WIND X	0.013M	0.010M
Max storey displacement for WIND Y	0.025M	0.019M

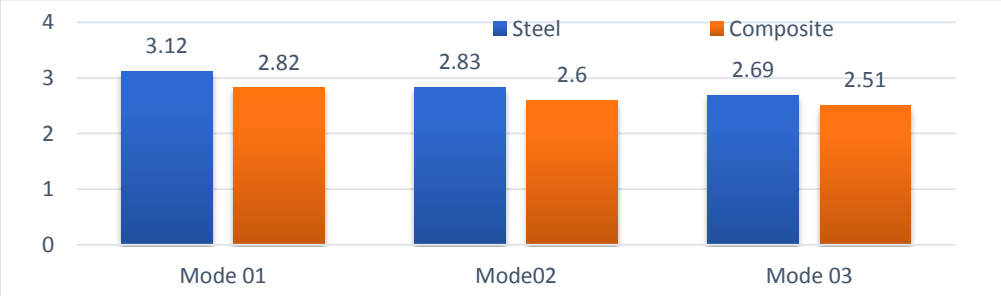
Displacement of steel building is higher in case of wind as well as Earthquake in static and dynamic both the cases respectively.

Table 4. Drift details

Directions	Steel Frame	Composite Frame
Max storey Drift for EQX	0.0027	0.0017
Max storey Drift for EQy	0.0024	0.0020
Max storey Drift for SPEC X	0.00058	0.00052
Max storey Drift for SPEC Y	0.00068	0.00060

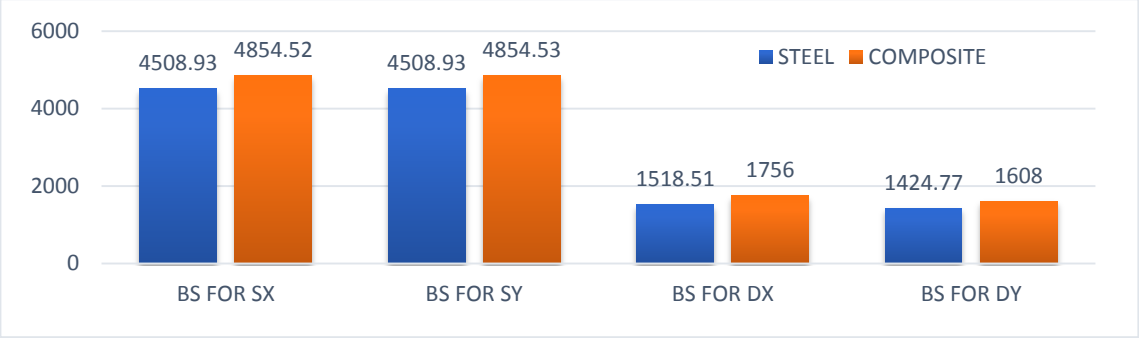
Graph:

Time period:



The above graph shows the time period values in sec for steel and composite building for mode 01, 02 and mode 03 respectively.

Base shear:



The above graph shows Base shear values in KN for steel and composite building for Static Eq and Dynamic Eq in both x and y directions.

Drift Details: