iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 11 **Issue:** VII **Month of publication:** July 2023

DOI: https://doi.org/10.22214/ijraset.2023.54888

Comparative Study of 30-Storey Building with and without Seismic Load Combination by using STAAD PRO

Kusamakar Shukla[1], Dr. Gunjan Shrivastava[2]
[1]*M.Tech.Scholar,* [2]*AssociateProfessor and H.O.D, Department Of Civil Engineering, S.D.B.C.E Indore, M.P, India*

Abstract: This comparative study aims to evaluate the structural behaviour of a 30-storey building using STAAD Pro under two scenarios: with and without seismic load combinations. By comparing the results obtained from both cases, the study seeks to determine the significance of seismic design provisions and the impact they have on the structural performance of the building. The findings of this research will contribute to the understanding of the importance of incorporating seismic load combinations in the design process of high-rise buildings and aid in improving their safety and resilience.Seismic design provisions and load combinations are essential in ensuring the structural integrity of high-rise buildings. These provisions consider the effects of lateral forces generated by seismic activity and aim to minimize structural damage and protect human life during an earthquake. It is crucial to evaluate the performance of buildings under different loading conditions, including seismic load combinations, to ensure they meet safety standards and codes.
Keywords: STAAD Pro., Seismic design,load combinations, Seismic load ,wind load, dead load, Displacement.

I. INTRODUCTION

High-rise buildings are becoming increasingly common in urban areas, providing efficient use of limited space and accommodating growing populations. However, their structural design and performance become critical factors to ensure the safety of occupants, particularly under seismic events.

Earthquakes can exert significant forces on buildings, causing structural damage and compromising their stability.The problem addressed in this study is the lack of comprehensive understanding regarding the impact of seismic load combinations on the structural behavior of 30-storey buildings. While seismic design provisions are essential for ensuring the safety of high-rise structures, there is a need to evaluate their effectiveness and quantify their influence on the building's stability and performance. The use of STAAD Pro software provides a powerful platform for analyzing and designing structures, including the ability to incorporate seismic loads.

However, there is a gap in the research literature regarding a direct comparative study of a 30-storey building with and without seismic load combinations, using STAAD Pro as the analysis tool.

A. Objectives:

1) The primary objectives of this comparative study of a 30-storey building with and without seismic load combination, using STAAD Pro, are as follows:
2) To analyze and model a 30-storey building using STAAD Pro software, considering its geometrical specifications, material properties, and structural components.
3) To simulate and analyze the structural behavior of the building under non-seismic load combinations, such as dead loads and live loads, using STAAD Pro.
4) To simulate and analyze the structural behavior of the building under seismic load combinations, incorporating lateral forces generated by seismic activity, using STAAD Pro.
5) To compare and evaluate the structural response of the building under non-seismic load combinations and seismic load combinations, focusing on parameters such as displacements, member forces, and stresses.
6) To identify and analyze the critical areas within the building that are most affected by seismic load combinations, assessing their vulnerability and potential structural weaknesses.

II. LITERATURE REVIEW

[Mohammed Uvaish Mansoori , Rajesh Misra(2023)] this study is related to the how to design the pre-engineered building instead of Conventional Steel Building (CSB) design by using of Staad pro, software. Research shows that PEB structures are easy to design. These designs are effective and result in rapid construction.

[AbhiyankJoshi, Mr.RahulSharma(2022)]this study is related to the comparison between two different grade of concrete used in the structure. The comparison result shows that using different type of grade of concrete does notaffect the volume of concrete but is severely affect the amount of steel used (mainly inthe columns/vertical members).The building isplanned as peris 456 2000.The checks performed are according to the procedure defined by the Indianstandards.In the projectwith the help of software different figures are taken into account from the software graphs and designs.

[Ibrahim, et.al (April 2019)]: Design and Analysis of Residential Building(G+4): After analyzing the G+4 story residential building structure, conducted that the structure is rate in loading like dead load, live load, wind load and seismic loads. Member dimensions (Beam, column, slab) are assigned by calculating the load type and its quantity applied on it. Auto CAD gives detailed information at the structure members length, height, depth, size and numbers, etc. STADD Pro. has a capability to calculate the program contains number of parameters which are designed as per IS 456: 2000. Beams were designed for flexure, shear and tension and it gives the detail number, position and spacing brief.

[Dunnala Lakshmi Anuja, et.al (2019)]: Planning, Analysis and Design of Residential Building(G+5) By using STAAD Pro.: Frame analysis was by STAAD-Pro. Slab, Beams, Footing and stair-case were design as per the IS Code 456-2000 by LSM. The properties such as share deflection torsion, development length is with the IS code provisions. Design of column and footing were done as per the IS 456-2000 along with the SP-16 design charts. The check like one way shear or two-way shear within IS Code provision. Design of slab, beam, column, rectangular footing and staircase are done with limit state method. On comparison with drawing, manual design and the geometrical model using STADD Pro.

[Mr K. Prabin Kumar, et.al (2018)]: A Study on Design of Multi-Storey Residential Building: They used STADD Pro. to analysis and designing all structure member and calculate quantity of reinforcement needed for concrete section. Various structure action is considered as members such as axial, flexure, shear and tension. Pillar are delineated for axial forces and biaxial ends at the ends. The building was planned as per IS: 456- 2000.

[R.D. Deshpande et al., (2017)] has said that the structural analysis may be a branch that involves resolution of working on construction, so asto forecast the reply of real construction such as buildings, bridges, trusses etc. This project makes an attempt to view the construction working of varied elements inthe multi-storied building. Analysis, scheming and evaluation of multi-storied building has been obsessed for Basement+G+2 Building. According to material properties the dead load is calculated, live loads is taken from code.

III. METHODOLOGY

There are two load combination analysis of a building which can be done by the with seismic load and without seismic load combination .

Building Description and Specifications:

Utility of building: Residential building

Type of structure -multi-storey fixed jointed plane frame. Numberofstories30, (G+29)

1) Floorheight3.5m
2) No ofbays andbaylength4nos,5 m each.
3) MaterialsConcrete(M 35)andReinforcement(Fe500).
4) Sizeofcolumn .8m×.8m.
5) Sizeofbeam.45m×.45m
6) Depthof slab 125mm thick
7) Specificweight ofRCC 25KN/m^3
8) Specificweightof infill19.2 KN/m^3
9) Typeofsoil mediumsoil.
10) ResponsespectraasperIS1893.
11) SeismiczoneV(IS1893 (part1):2002).

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue VII Jul 2023- Available at www.ijraset.com

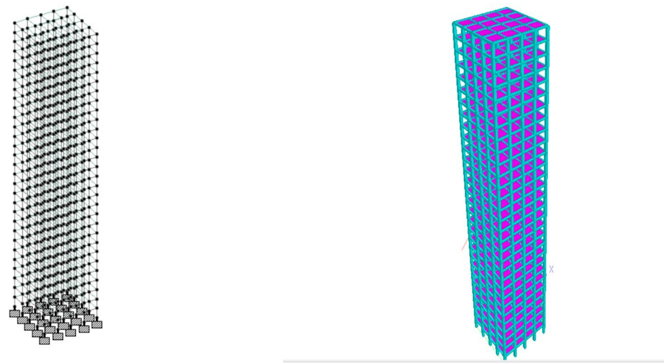


FIGURE A:Structure

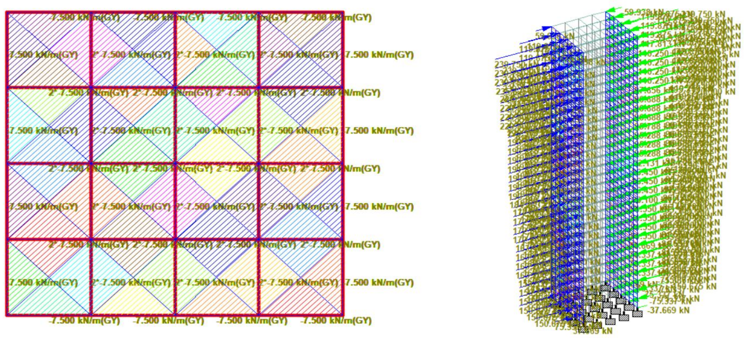
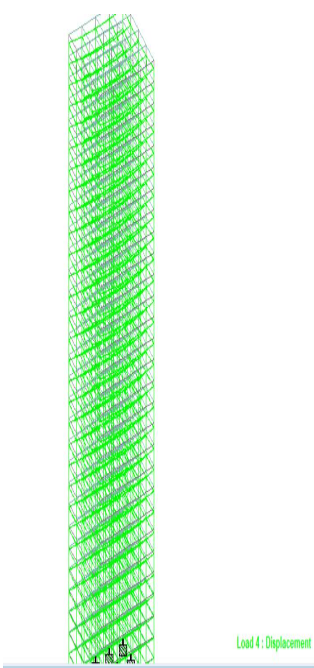
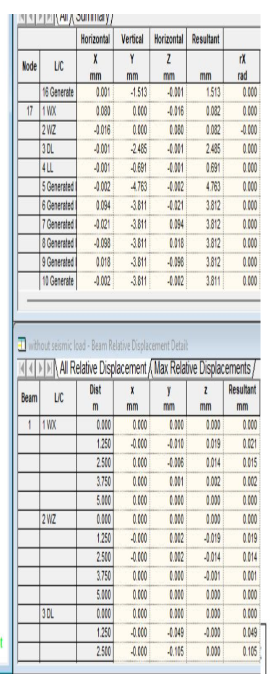


FIGURE B:Loading condition

IV. DESIGNANDANALYSIS

1) *Analysis of the Building without Seismic Load Combination:* Dead load, live load and wind load combination





All | Summary

Node	L/C	Horizontal X mm	Vertical Y mm	Horizontal Z mm	Resultant mm	rX rad
	16 Generate	0.001	-1.513	-0.001	1.513	0.000
17	1 WX	0.080	0.000	-0.016	0.082	0.000
	2 WZ	-0.016	0.000	0.080	0.082	-0.000
	3 DL	-0.001	-2.485	-0.001	2.485	0.000
	4 LL	-0.001	-0.691	-0.001	0.691	0.000
	5 Generated	-0.002	-4.763	-0.002	4.763	0.000
	6 Generated	0.094	-3.811	-0.021	3.812	0.000
	7 Generated	-0.021	-3.811	0.094	3.812	0.000
	8 Generated	-0.098	-3.811	0.018	3.812	0.000
	9 Generated	0.018	-3.811	-0.098	3.812	0.000
	10 Generate	-0.002	-3.811	-0.002	3.811	0.000

without seismic load - Beam Relative Displacement Detail:

All Relative Displacement | Max Relative Displacements

Beam	L/C	Dist m	x mm	y mm	z mm	Resultant mm
1	1 WX	0.000	0.000	0.000	0.000	0.000
		1.250	-0.000	-0.010	0.019	0.021
		2.500	0.000	-0.006	0.014	0.015
		3.750	0.000	0.001	0.002	0.002
		5.000	0.000	0.000	0.000	0.000
	2 WZ	0.000	0.000	0.000	0.000	0.000
		1.250	-0.000	0.002	-0.019	0.019
		2.500	-0.000	0.002	-0.014	0.014
		3.750	0.000	0.000	-0.001	0.001
		5.000	0.000	0.000	0.000	0.000
	3 DL	0.000	0.000	0.000	0.000	0.000
		1.250	-0.000	-0.049	-0.000	0.049
		2.500	-0.000	-0.105	0.000	0.105

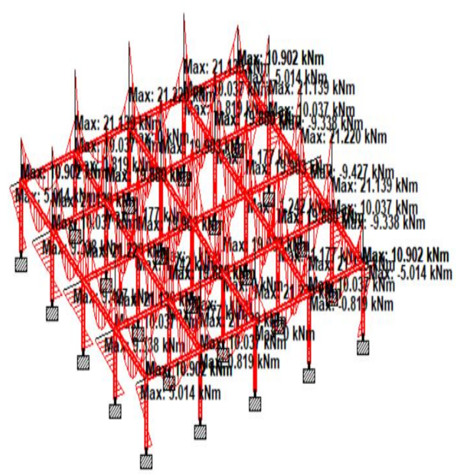
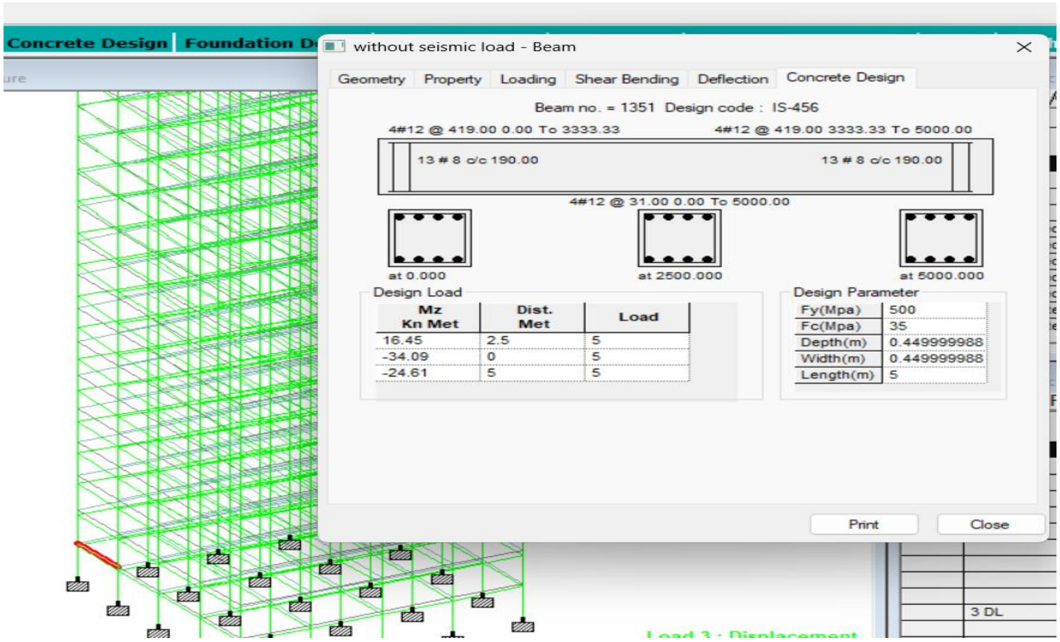
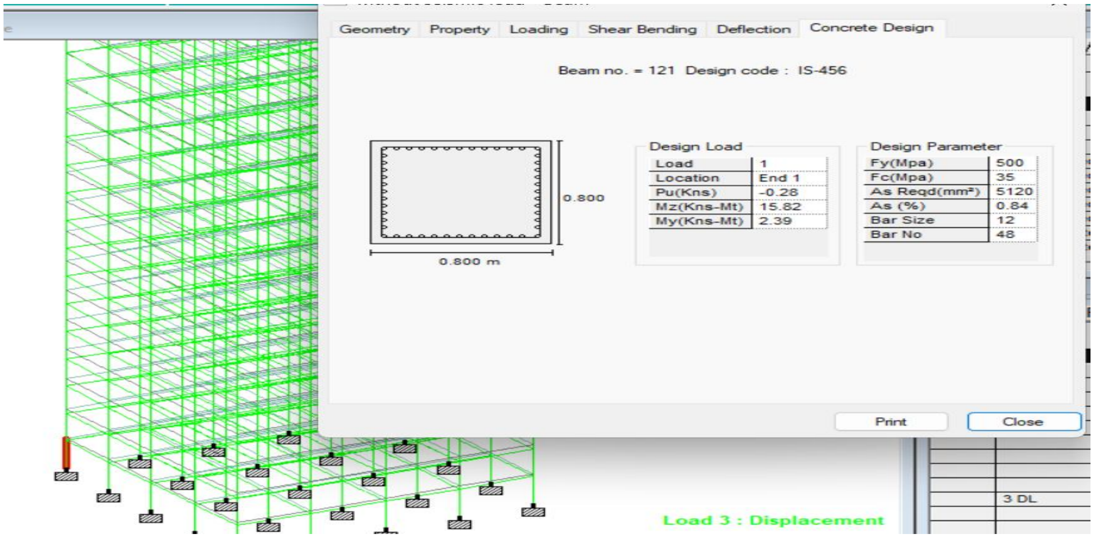


FIGURE C:Deflection Diagram. FIGURE D: Bending momentDiagram




```
---------------------------------------------------------------------------
              B E A M   N O.    1351   D E S I G N   R E S U L T S

      M35                    Fe500  (Main)               Fe500  (Sec.)

    LENGTH:  5000.0 mm      SIZE:   450.0 mm X  450.0 mm   COVER:  25.0 mm

                          SUMMARY OF REINF. AREA (Sq.mm)
---------------------------------------------------------------------------
SECTION        0.0 mm     1250.0 mm    2500.0 mm    3750.0 mm    5000.0 mm
---------------------------------------------------------------------------
 TOP           320.54       320.54       320.54       320.54       320.54
REINF.       (Sq. mm)     (Sq. mm)     (Sq. mm)     (Sq. mm)     (Sq. mm)

BOTTOM         320.54       320.54       320.54       320.54       320.54
REINF.       (Sq. mm)     (Sq. mm)     (Sq. mm)     (Sq. mm)     (Sq. mm)
---------------------------------------------------------------------------


                          SUMMARY OF PROVIDED REINF. AREA
---------------------------------------------------------------------------
SECTION        0.0 mm     1250.0 mm    2500.0 mm    3750.0 mm    5000.0 mm
---------------------------------------------------------------------------
 TOP           4-12í        4-12í        4-12í        4-12í        4-12í
REINF.      1 layer(s)   1 layer(s)   1 layer(s)   1 layer(s)   1 layer(s)

BOTTOM         4-12í        4-12í        4-12í        4-12í        4-12í
REINF.      1 layer(s)   1 layer(s)   1 layer(s)   1 layer(s)   1 layer(s)

SHEAR      2 legged  8í  2 legged  8í  2 legged  8í  2 legged  8í  2 legged  8í
REINF.     @ 190 mm c/c  @ 190 mm c/c  @ 190 mm c/c  @ 190 mm c/c  @ 190 mm c/c
---------------------------------------------------------------------------


SHEAR DESIGN RESULTS AT DISTANCE d (EFFECTIVE DEPTH) FROM FACE OF THE SUPPORT

SHEAR DESIGN RESULTS AT   815.0 mm AWAY FROM START SUPPORT
  VY =    26.12 MX =     0.10 LD=    5
  Provide 2 Legged  8í  @ 190 mm c/c

SHEAR DESIGN RESULTS AT   815.0 mm AWAY FROM END SUPPORT
  VY =   -22.32 MX =     0.10 LD=    5
  Provide 2 Legged  8í  @ 190 mm c/c
```

. FIGURE F: Reinforce Concrete design detail for beam no.1351




```
          C O L U M N   N O.   121  D E S I G N   R E S U L T S

      M35                       Fe500 (Main)                Fe500 (Sec.)

LENGTH:  3500.0 mm   CROSS SECTION:  800.0 mm X  800.0 mm  COVER: 40.0 mm

** GUIDING LOAD CASE:    1 END JOINT:     2  TENSION COLUMN


REQD. STEEL AREA    :     5120.00 Sq.mm.
REQD. CONCRETE AREA:   634880.00 Sq.mm.
MAIN REINFORCEMENT : Provide  48 - 12 dia. (0.85%,   5428.67 Sq.mm.)
                     (Equally distributed)
TIE REINFORCEMENT  : Provide  8 mm dia. rectangular ties @ 190 mm c/c

SECTION CAPACITY BASED ON REINFORCEMENT REQUIRED (KNS-MET)
----------------------------------------------------------
Puz :  11919.36   Muz1 :    785.02   Muy1 :    785.02

INTERACTION RATIO: 0.02 (as per Cl. 39.6, IS456:2000)

SECTION CAPACITY BASED ON REINFORCEMENT PROVIDED (KNS-MET)
----------------------------------------------------------
WORST LOAD CASE:     5
END JOINT:     2 Puz :  12030.25   Muz :   1327.82   Muy :   1327.82   IR: 0.:
============================================================================
```

. FIGURE G: Detail of Reinforcement for column no.121

```
     **************  CONCRETE  TAKE OFF  **************
           (FOR BEAMS, COLUMNS AND PLATES DESIGNED ABOVE)
NOTE: CONCRETE QUANTITY REPRESENTS VOLUME OF CONCRETE IN BEAMS, COLUMNS, ANI
      REINFORCING STEEL QUANTITY REPRESENTS REINFORCING STEEL IN BEAMS AND (
      REINFORCING STEEL IN PLATES IS NOT INCLUDED IN THE REPORTED QUANTITY.

     TOTAL VOLUME OF CONCRETE =      2895.1 CU.METER

                   BAR DIA          WEIGHT
                   (in mm)          (in New)
                   --------         --------
                        8            340921
                       10             72367
                       12           1285108
                       16             32420
                       20              7741
                              ------------
                     *** TOTAL=      1738557
```

FIGURE H: Total quantity required concrete and steel for structure

2) *Analysis of the Building with Seismic Load Combination:* Under dead load, live load , wind load and seismic load combination.

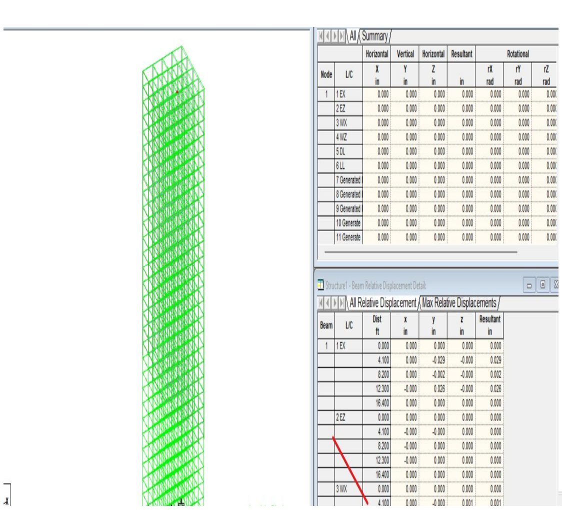


FIGURE I:Deflection Diagram.

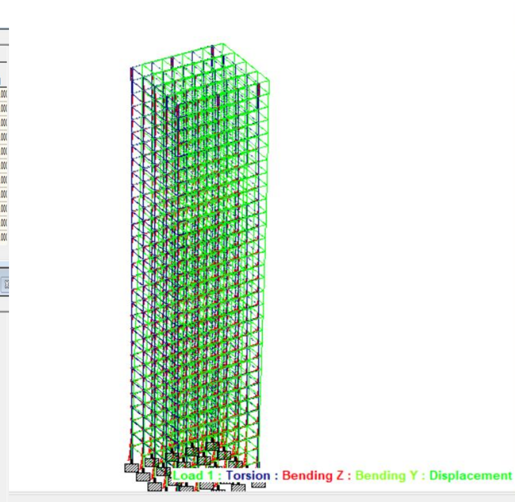
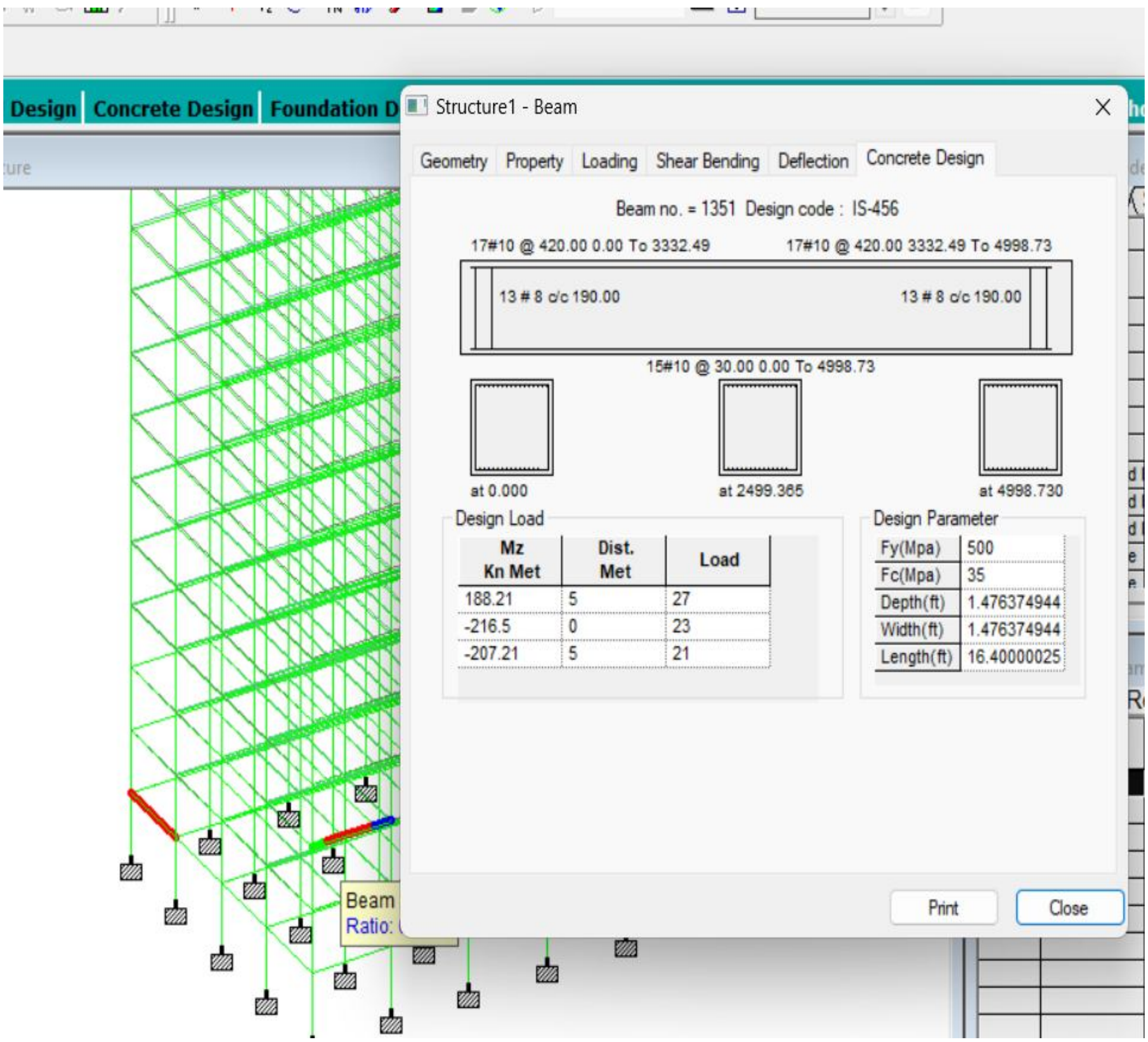


FIGURE J: Bending moment Diagram



```
=============================================================================
              B E A M  N O.   1351   D E S I G N  R E S U L T S

      M35                    Fe500 (Main)                Fe500 (Sec.)

    LENGTH:  4998.7 mm     SIZE:   450.0 mm X  450.0 mm   COVER: 25.0 mm


                      SUMMARY OF REINF. AREA (Sq.mm)
-----------------------------------------------------------------------------
SECTION       0.0 mm     1249.7 mm     2499.4 mm     3749.0 mm     4998.7 mm
-----------------------------------------------------------------------------
 TOP         1330.94       573.98        321.30        543.02       1267.02
REINF.       (Sq. mm)     (Sq. mm)      (Sq. mm)      (Sq. mm)      (Sq. mm)

BOTTOM       1143.39       577.45        321.30        574.64       1144.24
REINF.       (Sq. mm)     (Sq. mm)      (Sq. mm)      (Sq. mm)      (Sq. mm)
-----------------------------------------------------------------------------


                   SUMMARY OF PROVIDED REINF. AREA
-----------------------------------------------------------------------------
SECTION      0.0 mm     1249.7 mm     2499.4 mm     3749.0 mm     4998.7 mm
-----------------------------------------------------------------------------
 TOP      17-10í         8-10í         5-10í         7-10í        17-10í
REINF.   2 layer(s)    1 layer(s)    1 layer(s)    1 layer(s)    2 layer(s)

BOTTOM    15-10í         8-10í         5-10í         8-10í        15-10í
REINF.   2 layer(s)    1 layer(s)    1 layer(s)    1 layer(s)    2 layer(s)

SHEAR   2 legged  8í  2 legged  8í  2 legged  8í  2 legged  8í  2 legged  8í
REINF.  @ 190 mm c/c  @ 190 mm c/c  @ 190 mm c/c  @ 190 mm c/c  @ 190 mm c/c
-----------------------------------------------------------------------------


SHEAR DESIGN RESULTS AT DISTANCE d (EFFECTIVE DEPTH) FROM FACE OF THE SUPPORT

SHEAR DESIGN RESULTS AT   815.0 mm AWAY FROM START SUPPORT
  VY =     92.10 MX =    -0.07 LD=   23
  Provide 2 Legged  8í  @ 190 mm c/c

SHEAR DESIGN RESULTS AT   815.0 mm AWAY FROM END SUPPORT
  VY =   -89.74 MX =     0.08 LD=   21
  Provide 2 Legged  8í  @ 190 mm c/c
```

FIGURE K: Reinforce Concrete design detail for beam no.1351


```
            C O L U M N   N O.   121  D E S I G N   R E S U L T S

         M35                    Fe500 (Main)               Fe500 (Sec.)

   LENGTH:  3499.1 mm   CROSS SECTION:  800.0 mm X  800.0 mm  COVER: 40.0 mm

   ** GUIDING LOAD CASE:     1 END JOINT:      1  TENSION COLUMN


   REQD. STEEL AREA    :      9216.00 Sq.mm.
   REQD. CONCRETE AREA:     630784.00 Sq.mm.
   MAIN REINFORCEMENT : Provide  48 - 16 dia. (1.51%,   9650.97 Sq.mm.)
                        (Equally distributed)
   TIE REINFORCEMENT  : Provide  8 mm dia. rectangular ties @ 255 mm c/c

   SECTION CAPACITY BASED ON REINFORCEMENT REQUIRED (KNS-MET)
   ----------------------------------------------------------
   Puz :  13390.85   Muz1 :    668.46   Muy1 :    668.46

   INTERACTION RATIO: 0.92 (as per Cl. 39.6, IS456:2000)

   SECTION CAPACITY BASED ON REINFORCEMENT PROVIDED (KNS-MET)
   ----------------------------------------------------------
   WORST LOAD CASE:    20
   END JOINT:      1 Puz :  13547.11   Muz :   1781.79   Muy :   1781.79   IR: 0.
   ============================================================================
```

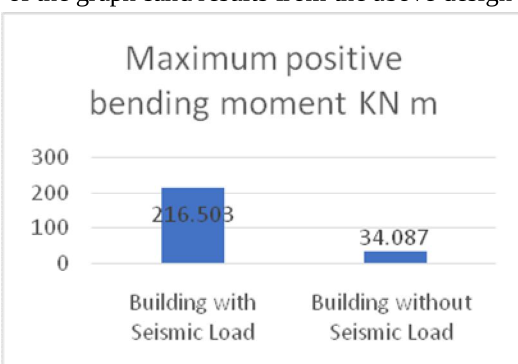
. FIGURE L: Detail of Reinforcement for column no.121

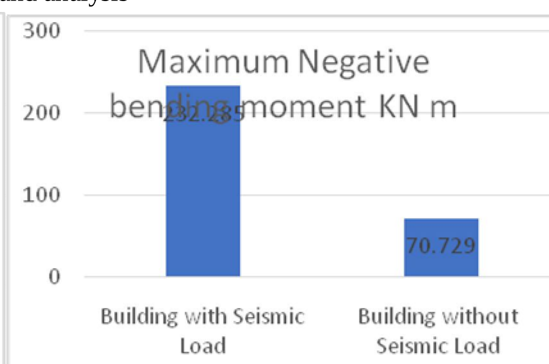
```
STAAD SPACE                                                    -- PAGE NO. 1509

       **************  CONCRETE  TAKE OFF  **************
             (FOR BEAMS, COLUMNS AND PLATES DESIGNED ABOVE)
 NOTE: CONCRETE QUANTITY REPRESENTS VOLUME OF CONCRETE IN BEAMS, COLUMNS, ANI
       REINFORCING STEEL QUANTITY REPRESENTS REINFORCING STEEL IN BEAMS AND (
       REINFORCING STEEL IN PLATES IS NOT INCLUDED IN THE REPORTED QUANTITY.

       TOTAL VOLUME OF CONCRETE =       2894.3 CU.METER

                      BAR DIA          WEIGHT
                      (in mm)          (in New)
                     --------         --------
                          8             347489
                         10             101531
                         12            1361483
                         16             210654
                         20             290728
                         25             245993
                                  ------------
                      *** TOTAL=       2557878
```

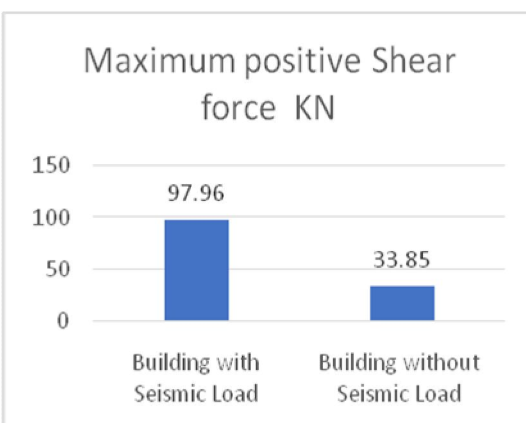
. FIGURE L: Total quantity required concrete and steel for structure under seismic load

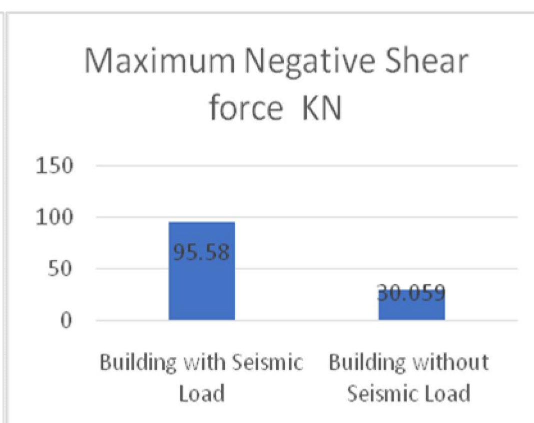
V. RESULTAND DISCUSSION

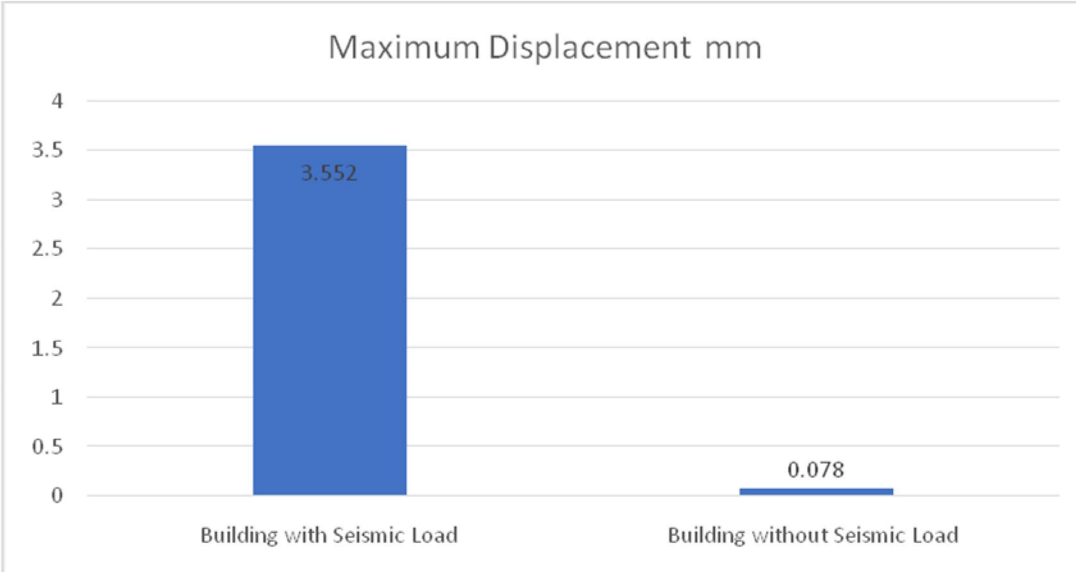
Here are some of the graph sand results from the above design and analysis

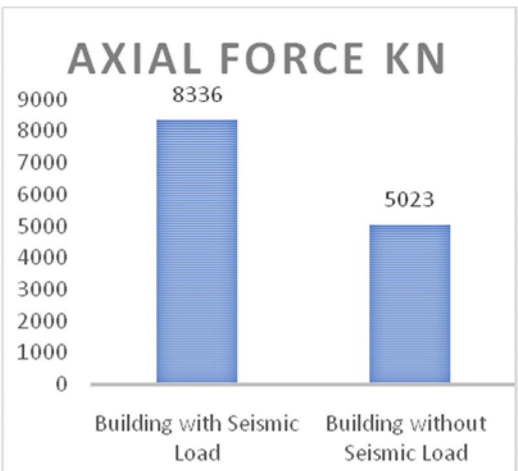


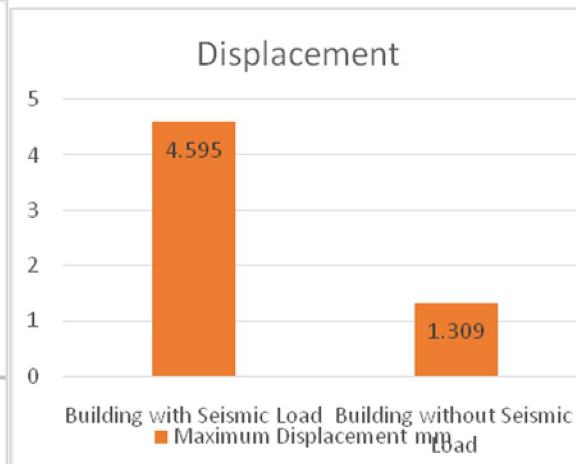


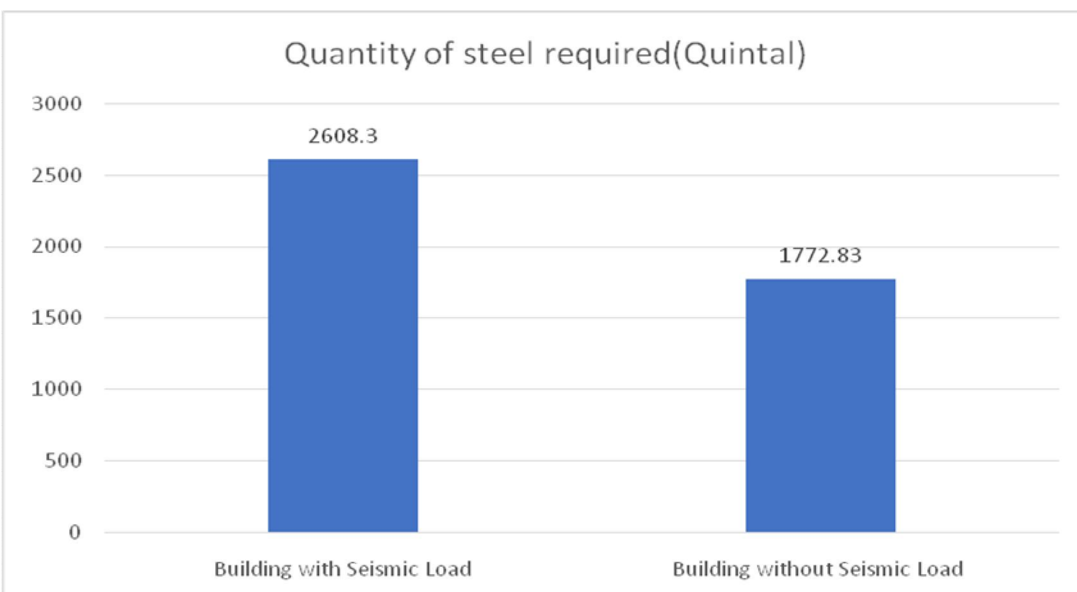





Maximum Displacement mm
4
3.5
3
2.5
2
1.5
1
0.5
0
3.552
0.078
Building with Seismic Load
Building without Seismic Load


AXIAL FORCE KN
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
8336
5023
Building with Seismic Load
Building without Seismic Load


Displacement
5
4
3
2
1
0
4.595
1.309
Building with Seismic Load
Building without Seismic Load
Maximum Displacement mm


Quantity of steel required(Quintal)
3000
2500
2000
1500
1000
500
0
2608.3
1772.83
Building with Seismic Load
Building without Seismic Load

VI. FUTURESCOPE

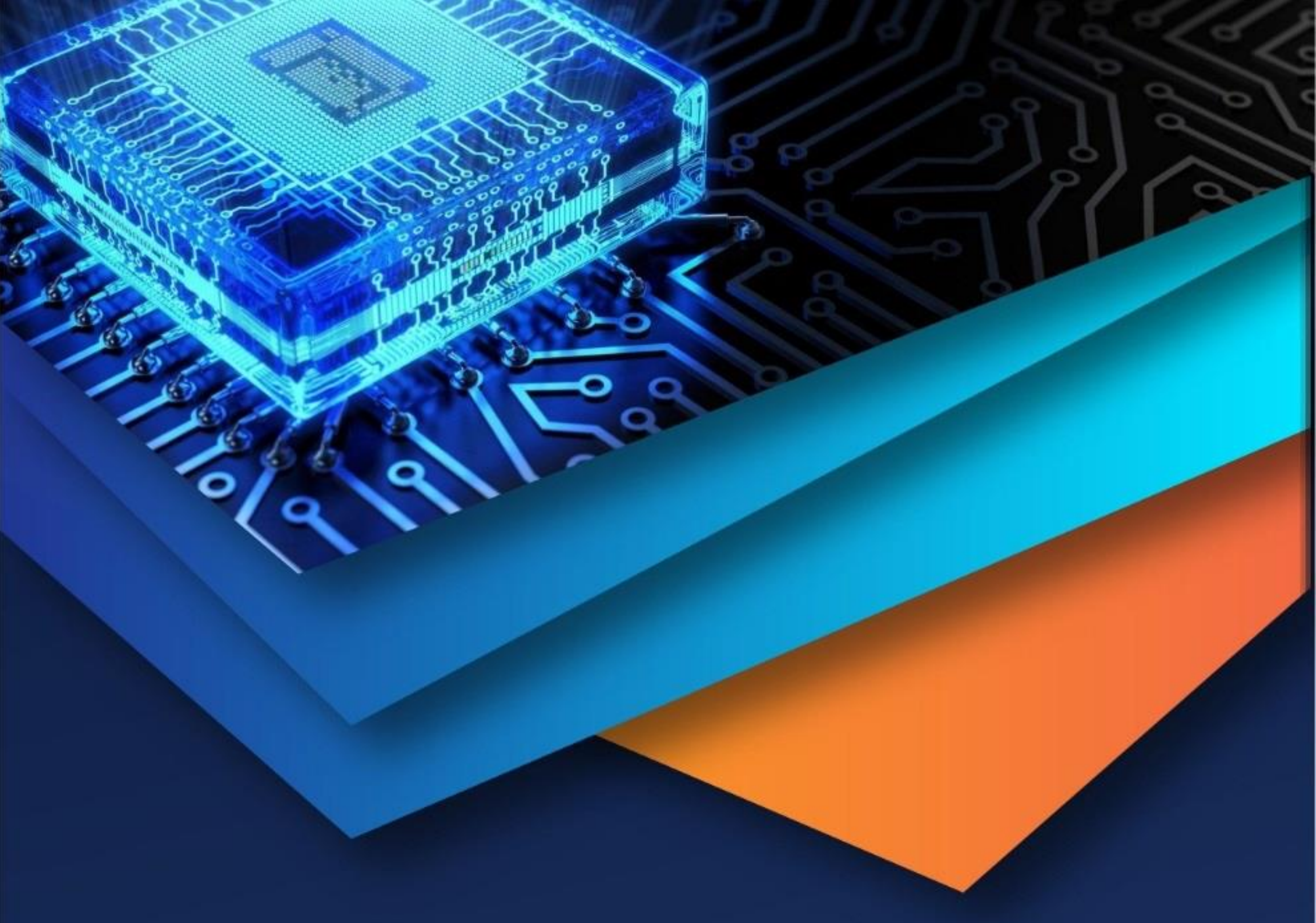
1) Advanced Seismic Analysis Techniques.
2) Performance-Based Design Approaches.
3) Optimization of Seismic Design Strategies.
4) Seismic Design for Non-Structural Components.
5) Integration of New Materials and Technologies.
6) Field Studies and Post-Earthquake Assessments.
7) Socioeconomic Implications.
8) Public Awareness and Education.

VII. CONCLUSION

From the above comparison between two 30-storey build in gtaking same beam and column size using differen tload combination beamandcolumnsizeusingdifferentloadcombinationitwasclearlyvisible that the top beams of a building in seismic load combination required more reinforcement than the building gunder wind load combination (for example beam no 1351 required 17 no of 10 mmØ and 15 no of 10 mmØ bars whereas for wind load combination it required 4 nos of 12 mmØ and4nos of 12 mmØ).but the deflection and shear bending is more in wind load combination compare to seismic. But in lower beams more reinforcement is required for wind load combination. For column the area of steel and percentage of steel always greater required for wind load combination than the seismic load combination. The inclusion of seismic loads significantly improves the structural performance and resilience of the building. It reduces lateral displacements and accelerations, enhancing the stability and integrity of the structure during seismic events.

REFERENCES

[1] Mohammed Uvaish Mansoor ,Rajesh Misra].Comparative Study of Analysis and Design of Pre-engineered- Buildings Using Staad Pro Software. International Journal for Research in Applied Science & Engineering Technology (IJRASET)Volume 11 Issue II Feb 2023.
[2] AbhiyankJoshi, Mr.RahulSharma]A Research Paper on Design and Analysis of aMultistoreyBuilding(G+4)UsingStaad.Pro withDifferentGradeofConcrete.International Journal for Research in Applied Science & Engineering Technology (IJRASET)) Volume 10 Issue I Jan 2022.
[3] Shaikh Ibrahim, Md Arifuzzaman, Jisan Ali Mondal, Md TaukirAlam, Sanuwar Biswas, Sagar Biswas, Design and Analysis Of Residential Building, International Research Journal Of Engineering And Technology (IRJET), Volume: 06 Issue: 04 | Apr 2019.
[4] Dunnala Lakshmi Anuja, V.S.Nagasai, Planning, Analysis And Design Of Residential Building (G+5) By Using STAAD Pro. International Journal of Engineering Development andResearch (IJEDR), Volume 7, and Issue 3 | ISSN: 2321-9939. 2019
[5] Mr. K. Prabin Kumar, R. Sanjaynath, A Study On Design Of Multi Storey Residential Building -A Review, International Journal Of Pure And Applied Mathematics(IJPAM), Volume 119 No. 17 2018, 2797-2802 ISSN: 1314-3395.
[6] Imam Usman Shekh, UdaysinhRedekar, Kartar Rathod, Sagar Sabale, Sachin Ghatule, Pranay Khare, N. L. Shelke, Analysis, Design And Estimation Of G +7 Storey Building Structure By Using IS Code Methods And By Software's, International Journal Of Engineering And Management Research (IJEMR), Volume-7, Issue 2, March-April 2017, Page Number: 522-528.
[7] Anoop. A FousiyaHussian, Neeraja.R, Rahul Chandran, Shabina.S, Varsha.S, "Planning Analysis and Design of Multi Storied Building by Staad.Pro.v8i", International Journal of Scientific & Engineering Research, Volume 7, Issue 4, April-2016.
[8] Nasreen. M. Khan, 'Analysis and Design of Apartment Building', International Journal of InnovativeScience, Engineering and Technology, Volume 03, Issue: 03, ISSN 2348- 7698, March-2016.R.D. Deshpande, Manoj. N. Pai, N. Pawan, Aashish.P. Pednekar, 'Analysis, Design and Estimation ofBasement+G+2 Residential Building', International Research Journal of Engineering and Technology(IRJET), Volume: 04, Issue: 06, e-ISSN: 2395 -0056, pISSN: 2395-0072, June -2017.
[9] R.D. Deshpande, Manoj. N. Pai, N. Pawan, Aashish.P. Pednekar, 'Analysis, Design and Estimation of Basement+G+2 Residential Building', International Research Journal of Engineering and Technology (IRJET), Volume: 04, Issue: 06, e-ISSN: 2395 -0056, p-ISSN: 2395-0072, June -2017.
[10] SK Saleem, B. Ravi Kumar, 'Analysis and Design of Multi Storeyed Building by Using STAADPRO', Anveshana's International Journal of Research in Engineering and Applied Sciences, Volume 2, Issue: 1, ISSN-2455-6300, Jan-2017.
[11] Deevi Krishna Chaitanya, L. Santhosh Kumar, 'Analysis and Design of a (G + 6) Multi Storey Residential Building Using STAAD.PRO', Anveshana's International Journal of Research in Engineering and Applied Sciences, Volume 2, Issue: 1, ISSN-2455-6300, Jan-2017.
[12] Sreeshna K.S1, "Analysis and Design of an Apartment building", International Journal of Innovative Science, Engineering & Technology, Vol. 3 Issue 3, March 2016., ISSN 2348 – 7968. Page 456-479



doi crossref
10.22214/IJRASET

INDEX COPERNICUS
45.98

ISRA JIF
IMPACT FACTOR:
7.129

TOGETHER WE REACH THE GOAL
IMPACT FACTOR:
7.429

ISI

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY