iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH
IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 11 Issue: VI Month of publication: June 2023

DOI: https://doi.org/10.22214/ijraset.2023.54408

Comparison between Manual and Software Approach towards Analysis and Design of a Residential Building

Moeketsi M. Mabula [1], Miding Taki[2], Joy Mize [3], Dipankar Dutta[4], Mrinmoy Deka [5], Joi Doni [6], Nandana Goswami[7]
[1, 2, 3, 4, 5, 6] B.Tech. Students, Civil Engineering Department, Scholar's Institute of Technology and Management, Guwahati, Assam, India
[7]Assistant Professor, Civil Engineering Department, Scholar's Institute of Technology and Management, Guwahati, Assam, India

Abstract: In this study, the analysis and design of a G+2 residential building located at Guwahati, seismic zone V of India, has been done using STAADPro software and the results obtained are compared with manual analysis and design calculations. STAADPro software is used to analyze and design the building's beams, columns, and slabs (structural components). The limit state approach is used in the analysis, and the structure's members are designed in accordance with IS:456-2000 requirements. The loads and load combinations for design are based on IS:456-2000, while seismic forces are based on IS:1893-2002. Vertical loads on supports, as well as responses (deflection, axial force, shear force, and bending moment) for column and beam members, are compared using both software and manual calculations. Finally, the conclusion based on the comparison of the STAAD Pro result values and the manual design result values.
Keywords: Seismic Zone V, Analysis, Design, STAADPro, IS 456-2000.

I. INTRODUCTION

The fundamental purpose of this project is to use academic knowledge on the real-world project by building a multi-storey residential construction. The most extensively used structural engineering program for modelling, analysis, and multi-material design is STAADPro. Bridges, containment structures, embedded structures (tunnels and culverts), pipe racks, steel, concrete, aluminum or timber buildings, transmission towers, stadiums and any other simple or complex structure have all been static or dynamically analyzed using STAADPro. Our project involved an analysis and a design of a G+2 residential building by manual calculations and STAADPro. And finally, a conclusion was made based on the findings that resulted from both the calculations methods. We began the project by adopting a real-world G+2 residential building plan in order to resonate with the real-world challenges that such projects are prone to. The annual analysis and design, as well as the STAADPro calculation, were carried out, yielding good findings and results. All load estimates and calculations were adopted in accordance with the Indian Building Code Standards requirements. Static adherence to the loading criteria proposed within this code will ensure the structural safety of building under construction, ensuring the minimum requirements for building structural safety.

II. LITERATURE REVIEW

1) *M.A. Qureshi et.al (2018): Comparison Between Manual Calculation and Software Calculation of G+5 Building Using STAADPro*

They studied and compared a G+5 multi-storey hospital building using manual calculation and STAADPro. The analysis involved the calculation of load and total seismic weight of the building, and from that the base shear is calculated in different zones. Also using dynamic analysis and equivalent static lateral methods, they determined earthquake forces. From the results it was concluded that the value of base shear in STAADPro is more than the value of base shear by manual analysis. Also, the variation of the base shear results compared between the manual analysis and from STAADPro was found to be maximum of 3%.

2) *Rashmi Agashe et.al (2020): To Study Analysis and Design of Multi-Storey building using STAADPro and Comparing with Manual Calculation.*

They studied analysis and design of G+4 story residential building using STAADPro and compared it with manual calculations. The design of all the structural elements were calculated by "Limit State Method" using IS 456: 2000. From the results it was obtained that the analysis and design by using the software and by manual calculation was almost same but the design somewhat different. Also, by using STAADPro the analysis was completed much quickly and easier than the manual calculation. It was concluded that during designing of the building, the structure could sustain all the loads acting on the building.

3) Mr. A. P. Patil et.al (2017): Design & Analysis of Multi Storey Building (G+10) By Using STAADPro V8i (Series 4)

They designed and analyzed G+10 building using manual calculation and later compared it with STAADPro. The analysis of the all the structural elements was done in STAADPro using "Limit State Method," confirming to Indian standard Code of practice. From the results it was concluded that by using STAADPro software consumes more times and work is reduced. And lastly that the wind load combinations are more than earthquake load combinations in bending moment and shear force.

4) K. Shruthi et.al. (2019): Comparative Study of Structure using Conventional and different Software's

The main objective of this project was to analyze and design the G+3 institutional by hand calculations according to IS456 code and compare the results by using STAADPro and ETABS. After Comparison of both software's, STAAD PRO and ETABS, the design result obtained in ETABS gave lesser area of required steel as compared to STAADPRO for the same beam design result. Correspondingly the column design result also gave lesser area in STAAD PRO software as compared to ETABS. Consequently, the final accomplishes ETABS provide lesser area of steel as compare to STAAD PRO in both cases.

5) Nidhi Singh et.al (2021): Analysis and Design of Residential Building

They focused towards the major issue of land scarcity faced by the people in the future and tried to plan, design and analyze the residential building using different software's like AutoCAD for planning and STAAD.pro for design and analysis purpose. From the results they concluded that, the structural elements of building were safe in flexure and shear, storey displacement for conventional slab is 92.6% more than the load bearing wall, and load bearing wall is safer against wind and earthquake loads.

III. METHODOLOGY

1) A plan of a favorable residential building is adopted.
2) Loads and their combinations are decided as per IS 456:2000 and earthquake load as per IS 1893 Part 1:2002.
3) According to the load coming on structure, size of slab, beam, column, and footing are decided.
4) Numbers of columns are selected as per the adopted architectural plan.
5) Manual analysis of the building is carried out;

a) *Gravity Analysis*

- Estimation of loads
- Distribution of loads
- Moment Distribution
- Shear calculations
- Axial load calculations

b) *Seismic Analysis*

- Design of seismic base shear
- Seismic Load calculation
- Lateral Load calculation
- Shear calculations
- Moment calculations
- Load combinations

6) Manual design of the building is carried out;

a) Beam design
b) Column design
c) Slab design
d) Staircase design
e) Foundation design

7) Software analysis and design of the building using STAADPro
8) Manual and Software results comparison

Table 1 Basic Design Data

Data	Dimensions
Grade of Concrete	M25
Grade of Steel	Fe500
Unit Weight of Concrete	25 KN/m^3
Unit Weight of Concrete	20 KN/m^3
Column Size	450 × 450 mm^2
Beam Size	230 × 450 mm^2
Secondary Beam Size	230 × 450 mm^2
Wall Thickness	230 mm
Slab Thickness	150 mm
Height of Ground floor	3000 mm
Floor height between 1st& 2nd floor	3000 mm
Floor height between 2nd floor & roof level	3000 mm
Finish Load of Slab	1 KN/m^2
Finish Load of Stairs	1 KN/m^2
Live Load of Slab on Roof	1.5 KN/m^2
Live Load of Slab on Floors	3 KN/m^2
Live Load of Stairs	3 KN/m^2
Thickness of Waist Slab	175 mm
Tread	300 mm
Rise	150 mm

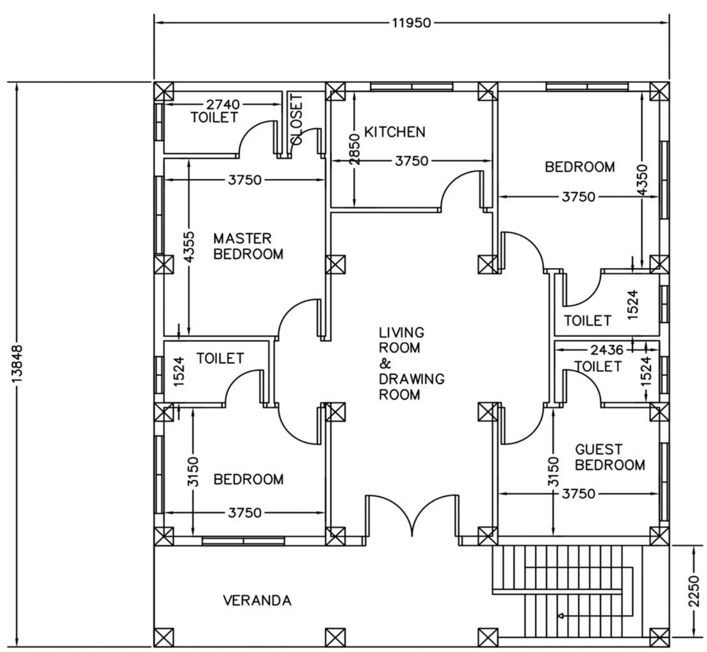


Fig.1 Residential Building plan

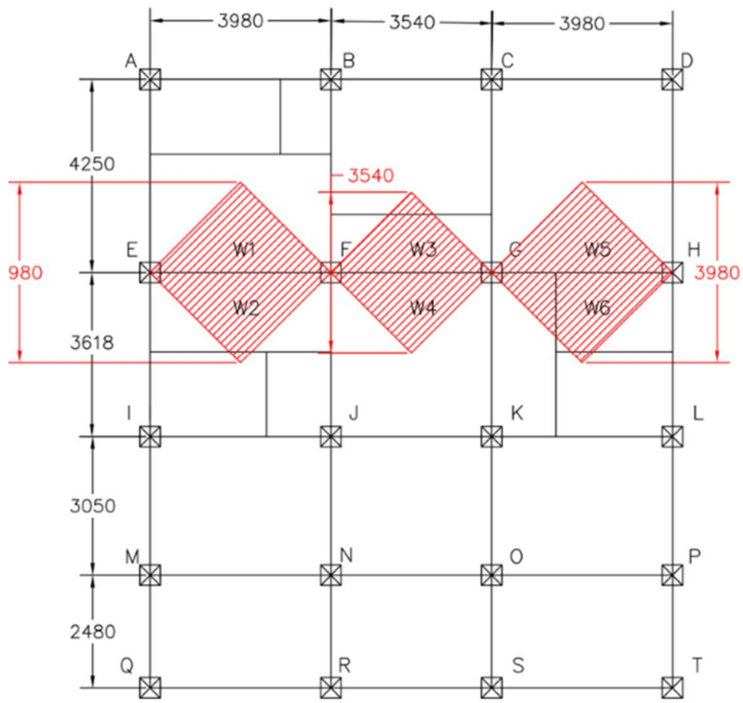


Fig. 2 Critical Frame Considered for Gravity Analysis for Typical Floor

IV. MANUAL CALCULATIONS

A. Base Shear

1) Units - KN Meter
2) Time Period for X 1893 Loading = 0.45 Sec
3) Sa/G Per 1893= 2.50
4) Load Factor= 1.00
5) Factor V Per 1893 At GL= 0.09 X 4161.69
6) Factor V Per 1893 At 30 M = 0.0451 X 4161.69
7) Factor V Per 1893= 0.087 X 4161.69

B. Design of Beam

1) *Design Data*

a) Beam size = 230 × 450 mm²
b) Grade of steel for reinforcement = Fe500
c) Grade of concrete = M25
d) Maximum size of main reinforcement = 16 mm
e) Maximum size of shear reinforcement = 8 mm, Fe500
f) Clear cover 25 mm

2) *Work in Progress*

a) Effective depth of beam = 450 – 25 – 16/2 = 417 mm
b) Maximum steel reinforcement (as per IS 456:2000, Clause 26.5.1.1)

A_{st} = 0.04 (bD) = 0.04 × 230 × 450 = 4140 mm²

c) Minimum steel reinforcement

$A_{st} =$ 0.85bd/fy = 0.85 × 230 × 417 / 500 = 163.05 mm²

d) For sagging moment (+) A_{st} and A_{sc} are provided at the bottom face and top face of the beam section respectively.

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 VI Jun 2023- Available at www.ijraset.com

e) For hogging moment (-) A_{st} and A_{sc} are provided at the bottom face and top face of the beam section respectively.

f) The maximum spacing for vertical stirrups as per IS 456:2000, Clause 26.5.1.1, should be at least of the following;

- 0.75d = 0.75 × 417 = 312.75 mm
- 300 mm
- As calculated

NB: Below calculations are only for Beam GH at Ground Level

Table 1:Details of Tensile and Compressive Reinforcement for Beam

Section		Left		Mid		Right	
M_u		37.54	-84.12	15.18	0	82.64	-38.43
$\frac{Mu}{bd^2}$		0.94	2.1	0.38	-	2.07	0.96
$\frac{Mulim}{bd^2}$		3.33	3.33	3.33	-	3.33	3.33
Designed As.		Singly Reinforced	Singly Reinforced	Singly Reinforced	-	Singly Reinforced	Singly Reinforced
$P_{t\,(\%)}$		0.226	0.543	0.089	-	0.532	0.232
$P_{c\,(\%)}$		-	-	-	-	-	-
Area Of Steel Required	A_{st}	216.76	520.79	85.36	-	510.24	222.51
	A_{sc}	-	-	-	-	-	-
No. Of Bars	A_{st}	2-16Φ	3-16Φ	1-16Φ	-	3-16Φ	2-16Φ
	A_{sc}	-	-	-	-	-	-
Area Of Steel Provided	A_{st}	433.52	1562.37	165	-	1530.72	445.02
	A_{sc}	-	-	-	-	-	-

Table 2:Details of Shear Reinforcement for Beam

Section	Left	Mid	Right
V_u (KN)	27.51	77.88	100.79
$\tau_v = \frac{V_u}{bd}$	0.29	0.81	1.05
P_t	0.4	0.2	0.6
τ_c	0.28	0.21	0.33
V_{us}	0.66	57.74	69.14
$\frac{V_{us}}{d}$	1.57	138.46	165.8
Spacing	300	158	300
Stirrups Provided	2-Legged 8Φ Vertical Stirrups @ 300 mm C/C	1-Legged 8Φ Vertical Stirrups @ 158 mm C/C	3-Legged 8Φ Vertical Stirrups @ 300 mm C/C

C. Design of Column

1) Design Data

a) Column size = 450 x 450 mm

b) Grade of steel for reinforcement = Fe 500

c) Grade of concrete = M25

d) Size of main reinforcement = 16mm and 22mm

e) Size of shear reinforcement = 8mm

f) Clear cover = 25mm

2) Col. 1 Design

a) Value of Mu = 25.76KN
b) Value of Pu = 399.39K
c) Value of D = 450mm
d) Value of b' = 450mm
e) Value of d' = 25 + 16/2 = 33mm

Now,

Ø = d'/D = 33/450 = 0.073

$Mu/fck \times b \times D^2 = 25.76 \times 10^6/25 \times 450 \times 450^2 = 0.0113mm$

Again, $Pu/fck \times b \times D = 399.36 \times 10^3/25 \times 450 \times 450 = 0.0788$

From sp16, page 133, chart 48, fck = 0.05

Therefore, p = 0.05 x 25

Pt = (1 x Ast)/100

Ast = 2531.25mm²

We provide 22mm bar diameter

No. of bars = 8 nos

We provide stirrup spacing 75mm up to 450mm

3) Col.2 Design

a) Value of Mu = 48.135KN
b) Value of Pu = 439.38 KN
c) Value of D = 450mm
d) Value of b = 450mm
e) Value of d' = 25 + 22/2 = 36mm

Ast = 1.5 x 450 x 450/100
= 3037.5mm²

We provide 22 mm bar dia from table 95, page 229, sp16

No. of bars provided =8 bars

We provide spacing 75mm up to 450mm from both ends.

4) Col.3 Design

a) Value of Mu = 57.705 KN
b) Value of Pu = 439.365 KN
c) Value of D = 450mm
d) Value of b = 450mm
e) Value of d' = 36mm

Ast = 2025mm²

We provide 22mm bar diameter

No. of bars provided = 6 bars

We provide stirrup spacing 75mm up to 450mm from both ends.

5) Col. 4 Design

a) Value of Mu = 37.355KN
b) Value of Pu = 399.375mm
c) Value of D = 450mm
d) Value of b = 450mm
e) Value of d' = 25 + 16/2 = 33mm

Ast = 2025mm²

we provide 22mm bar dia.

.•. No. of bars = 6 bars

We provide stirrup spacing 75mm up to 450mm from both ends.

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 VI Jun 2023- Available at www.ijraset.com

V. STAADPRO CALCULATIONS

A. Load Addition and Calculation

1) EL: As per IS 1893-2002
2) DL:
   a) Self-weight with factor of -1
   b) Wall/ brick load = 12.75 KN/m
3) LL: Live Load = 3 KN/m
4) LOAD COMBINATIONS: As per IS 456:2000

B. Beam Design Parameters

1) FC = 25MPA
2) FY = 500MPA

C. Column Design Parameters

1) FC = 25MPA
2) FY = 500MPA

D. Design Diagrams

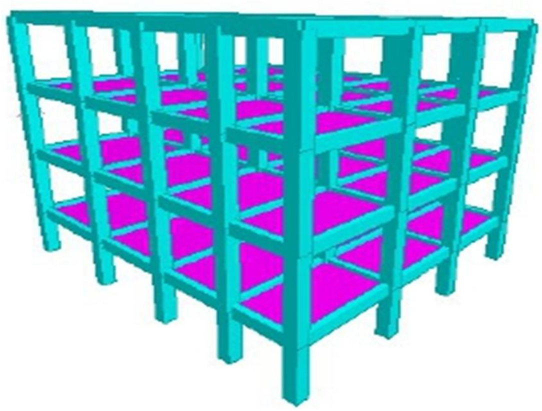


Fig. 3 Typical Elevation of the Structure and Dimensional View

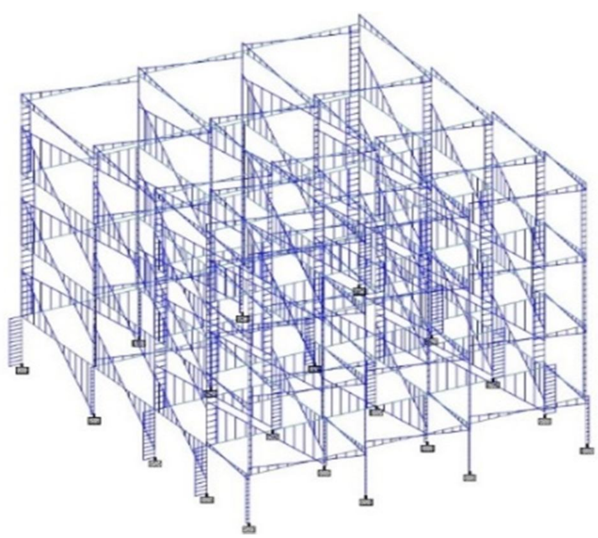


Fig. 4 Shear Force Diagram

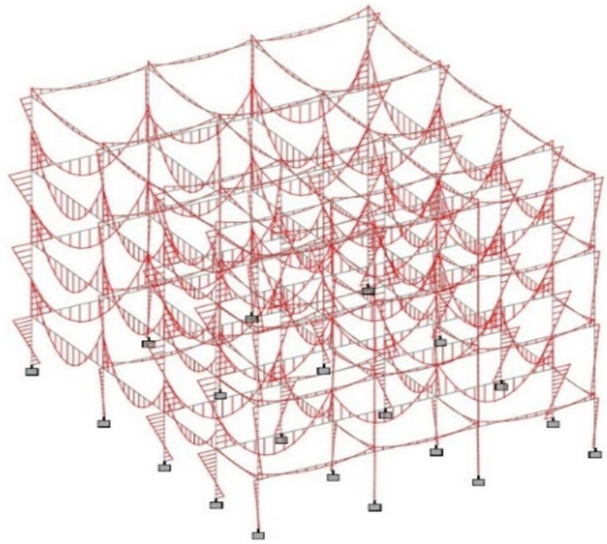


Fig. 5 Bending Moment Diagram

E. Base Shear Results

1) Units - KN Meter
2) Time Period for X 1893 Loading = 0.45301 Sec
3) Sa/G Per 1893= 2.500
4) Load Factor= 1.000
5) Factor V Per 1893 At GL= 0.0900 X 4161.69
6) Factor V Per 1893 At 30 m = 0.0451 X 4161.69
7) Factor V Per 1893= 0.0870 X 4161.69

F. Beam Design Results

1) *Roof Level*

Level	Section	Bending Moment (KN-m)	Shear Force (KN)	Top reinforcement (mm²)	Bottom reinforcement	Shear reinforcement
Roof Level	EF	12.57	20.54	161.87	161.87	2 Legged 8d @ 140 mm c/c
	FG	8.2	17.40	161.87	161.87	2 Legged 8d @ 140 mm c/c
	GH	12.28	20.11	161.87	161.87	2 Legged 8d @ 140 mm c/c
2nd Floor Level	EF	16.72	24.90	192.22	161.87	2 Legged 8d @ 140 mm c/c
	FG	16.72	21.49	161.87	161.87	2 Legged 8d @ 140 mm c/c
	GH	26.1	45.67	306.65	161.87	2 Legged 8d @ 140 mm c/c
1st Floor Level	EF	26.44	27.87	229.45	161.87	2 Legged 8d @ 140 mm c/c
	FG	24.25	25.00	197.50	161.87	2 Legged 8d @ 140 mm c/c
	GH	26.03	48.23	352.69	161.87	2 Legged 8d @ 140 mm c/c
Ground Level	EF	21.21	16.56	161.87	161.87	2 legged 8d @ 140 mm c/c
	FG	20.21	16.13	161.87	161.87	2 legged 8d @ 140 mm c/c
	GH	20.45	42.50	314.71	161.87	2 legged 8d @ 140 mm c/c

G. Column Design Results;

1) Roof Level

Property	COL 1	COL 2	COL 3	C0L 4
Load(P) KN	30.32	65.16	60.42	84.08
Area of steel (%)	0.447	0.447	0.447	0.447
Length (mm)	3000	3000	3000	3000
Size (mm²)	450 × 450	450 × 450	450 × 450	450 × 450
Clear Cover (mm)	40	40	40	40
Area of reinforcement (mm²)	136	210	223	153
Main reinforcement	Provide 12bars #8mmΦ	Provide 12bars #8mmΦ	Provide 12bars #8mmΦ	Provide 12bars #8mmΦ
Tie reinforcement	Provide 8 mm dia. rectangular ties @ 190 mm c/c	Provide 8 mm dia. rectangular ties @ 190 mm c/c	Provide 8 mm dia. rectangular ties @ 190 mm c/c	Provide 8 mm dia. rectangular ties @ 190 mm c/c

2) 2nd Floor Level

Property	COL 1	COL 2	COL 3	C0L 4
Load(P) KN	319.47	169.01	182.69	353.43
Area of steel (%)	0.447	0.447	0.447	0.447
Length (mm)	3000	3000	3000	3000
Size (mm²)	450 × 450	450 × 450	450 × 450	450 × 450
Clear Cover (mm)	40	40	40	40
Area of reinforcement (mm²)	229	346	339	254
Main reinforcement	Provide 12bars #8mmΦ	Provide 12bars #8mmΦ	Provide 12bars #8mmΦ	Provide 12bars #8mmΦ
Tie reinforcement	Provide 8 mm dia. rectangular ties @ 190 mm c/c	Provide 8 mm dia. rectangular ties @ 190 mm c/c	Provide 8 mm dia. rectangular ties @ 190 mm c/c	Provide 8 mm dia. rectangular ties @ 190 mm c/c

3) 1st Floor Level

Property	COL 1	COL 2	COL 3	C0L 4
Load(P) KN	517.68	669	735.92	587.38
Area of steel (%)	0.447	0.447	0.447	0.447
Length (mm)	3000	3000	3000	3000
Size (mm²)	450 × 450	450 × 450	450 × 450	450 × 450
Clear Cover (mm)	40	40	40	40
Area of reinforcement (mm²)	371	480	528	421
Main reinforcement	Provide 12bars #8mmΦ	Provide 12bars #8mmΦ	Provide 12bars #8mmΦ	Provide 12bars #8mmΦ
Tie reinforcement	Provide 8 mm dia. rectangular ties @ 190 mm c/c	Provide 8 mm dia. rectangular ties @ 190 mm c/c	Provide 8 mm dia. rectangular ties @ 190 mm c/c	Provide 8 mm dia. rectangular ties @ 190 mm c/c

4) Ground Level

Property	COL 1	COL 2	COL 3	C0L 4
Load(P) KN	673.17	830.46	936.3	779.25
Area of steel (%)	0.447	0.447	0.447	0.447
Length (mm)	2000	2000	2000	2000
Size (mm^2)	450 × 450	450 × 450	450 × 450	450 × 450
Clear Cover (mm)	40	40	40	40
Area of reinforcement (mm^2)	483	596	672	559
Main reinforcement	Provide 12bars #8mmΦ	Provide 12bars #8mmΦ	Provide 12bars #8mmΦ	Provide 12bars #8mmΦ
Tie reinforcement	Provide 8 mm dia. rectangular ties @ 190 mm c/c	Provide 8 mm dia. rectangular ties @ 190 mm c/c	Provide 8 mm dia. rectangular ties @ 190 mm c/c	Provide 8 mm dia. rectangular ties @ 190 mm c/c

VI. MANUAL AND SOFTWARE RESULTS COMPARISON

A. Base Shear Results

Property	STAADPRO Calculations	Manual Calculations
Time period in sec	0.45301	0.45
SA/G	2.500	2.5
Load Factor	1.000	1
Ah	0.0870	0.08

B. Beam Design Results

For beam results comparison, GL beam GH from both STAADPRO and manual calculations are used.

Property	STAADPRO Calculations	Manual Calculations
Length (mm)	3980	3980
Size (mm^2)	230 × 450	230 × 450
Clear Cover (mm)	30	25
Effective Depth (mm)	420	417
Bending Moment (KN-m)	20.45	37.54
Shear Force (KN)	42.50	27.51
Top reinforcement (mm^2)	314.71	-
Bottom reinforcement (mm^2)	161.87	216.76
Shear reinforcement	2 Legged 8d @ 140 mm c/c	2-legged 8d @ 300 mm c/c

C. Beam Shear Force Results

1) For Dead Load UDL, GL beam EF from STAADPRO and manual calculations are used.

Section	STAADPRO Calculation	Manual Calculation
Left	8.82	5.15
Mid	1.99	2.58
Right	-8.77	-5.15

2) For Live Load UDL, RL beam FG from STAADPRO and manual calculations are used.

Section	STAADPRO Calculation	Manual Calculation
Left	14.48	9.4
Mid	1.77	4.7
Right	-14.1	-9.4

D. Column Axial Load Results

For both Dead Load and Live Load, 1^{ST} FL Col 1 for STAADPRO and manual calculations are used.\\

Load	STAADPRO Calculations	Manual Calculations
DL	297.86	202.69
LL	83.24	63.28

E. Column Design Results;

For Column results comparison, 2^{nd} FLOOR Column1 from both STAADPRO and manual calculations are used.

Property	STAADPRO Calculations	Manual Calculations
Load (P) KN	319.47	399.36
Area of steel (%)	0.447	1.25
Length (mm)	3000	3000
Size (mm²)	450 × 450	450 × 450
Clear Cover (mm)	40	33
Area of reinforcement (mm²)	229	2531.25
Main reinforcement	Provide 12bars #8mmΦ	Provide 8bars #22mmΦ
Tie reinforcement	Provide 8 mm dia. rectangular ties @ 190 mm c/c	Provide 22 mm dia. rectangular ties @ 450 mm c/c

VII. CONCLUSION

After conducting the analysis and design of a G+2 building using both STAAD Pro software and manual calculations, the following comprehensive conclusions can be drawn:

1) The design process for the building was successfully executed, utilizing both STAAD Pro software and manual design methods, in accordance with the relevant codes and standards, particularly IS 456:2000 and IS 1893:2002.
2) The comparison of base shear results under seismic loading indicated consistent values between STAAD Pro (time period = 0.45301) and manual (time period = 0.45) calculations. This agreement demonstrates the reliability and accuracy of both approaches in determining seismic forces, which is crucial for ensuring structural safety.
3) During the evaluation of beam shear forces, slight variations were observed between the results obtained from STAAD Pro (8.82) and manual (5.15) calculations. However, these differences were deemed acceptable and did not significantly impact the overall structural integrity. Therefore, it can be concluded that both methods are reliable and provide satisfactory results for beam design.
4) The analysis of column axial loads for all floors, except the ground level, yielded highly satisfactory results in both manual and STAAD Pro calculations. This implies that the structural analysis and design performed using the software and manual calculations were comparable, with minor differences in the design parameters.
5) A notable discrepancy was observed when comparing the area of reinforcement in percentage between STAAD Pro and manual calculations. In the case of column design, the STAAD Pro software indicated an area of reinforcement of 0.447%, while the manual calculation resulted in 1.25% area of reinforcement. This variation in reinforcement percentage warrants further investigation to identify the underlying factors causing the disparity.

6) Additionally, it is worth noting that the diameter of bars in the designs slightly differed between STAAD Pro and manual calculations. However, both designs were found to satisfy the requirements specified in the IS code book, which ensures the structural elements' strength and durability.
7) The comparison of beam moment values for beam design exhibited minor variations between STAAD Pro and manual calculations. Nevertheless, these differences were within an acceptable range and did not compromise the structural stability. Hence, both methods can be considered reliable and dependable for the analysis and design of multi-storey buildings.

In conclusion, this project has demonstrated the effectiveness and reliability of both STAAD Pro software and manual calculations in the analysis and design of multi-storey buildings. The results obtained from both methods were generally satisfactory, with minor discrepancies observed in certain design parameters. These findings provide valuable insights into the application and performance of these design approaches, contributing to the continuous improvement and refinement of structural engineering practices.

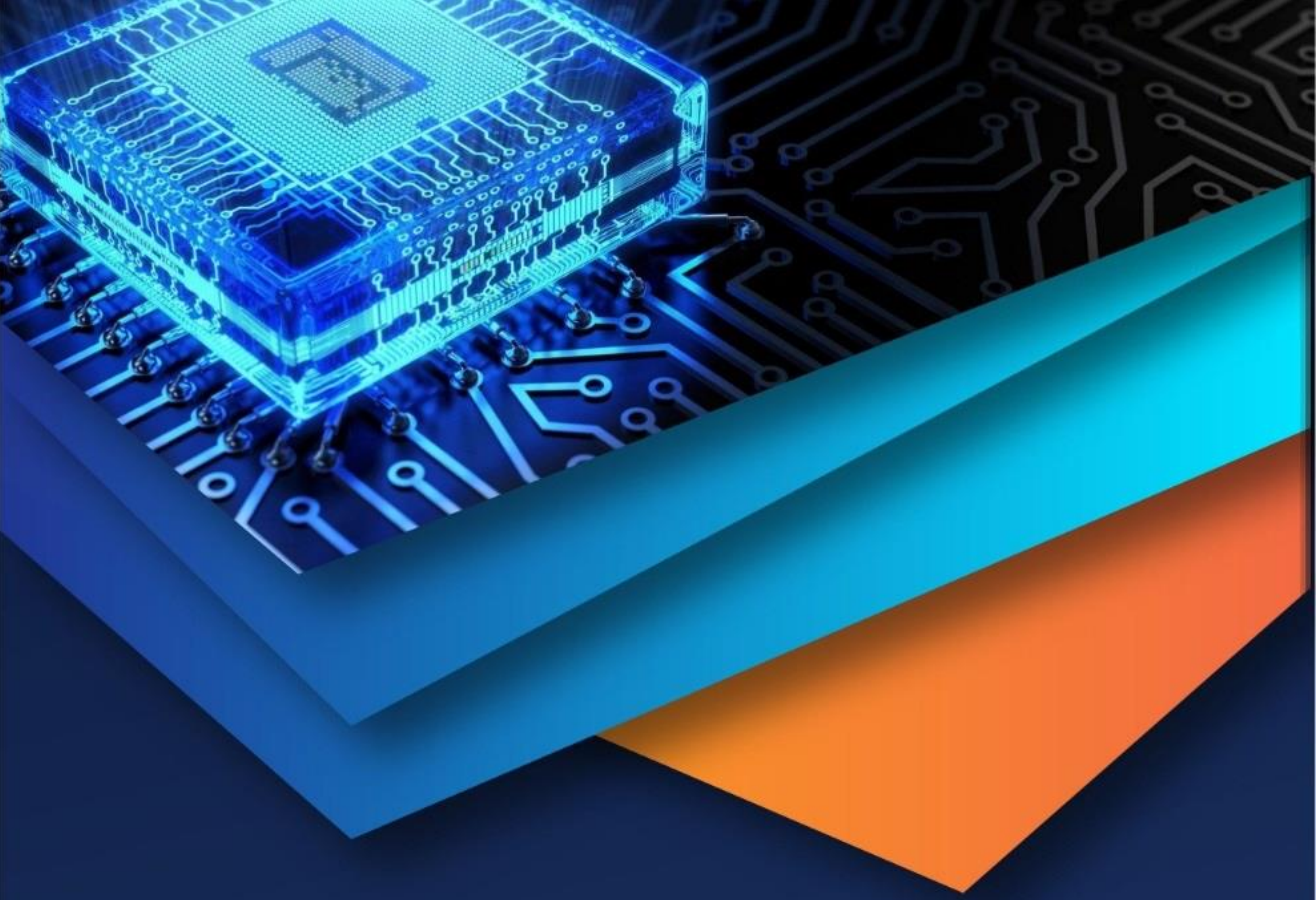
VIII. ACKNOWLEDGEMENT

Firstly, we would like to express our heartfelt gratitude to Professor Niky Kalita, Head of the Civil Department at SITM, Guwahati, for granting us the opportunity to undertake and execute our semester project work. We are thankful for her support and trust in our abilities, allowing us to embark on this challenging endeavor. Her guidance and encouragement have played a vital role in shaping our project and enhancing our skills as aspiring civil engineers.

We would also like to extend our sincerest appreciation to Professor Nandana Goswami, a revered Professor at SITM, Guwahati. We are immensely grateful to her for accepting our project and wholeheartedly dedicating her time and efforts as our mentor. Her expertise, unwavering commitment, and perseverance have been instrumental in guiding us throughout the project. Her invaluable guidance, insightful suggestions, and constructive feedback have significantly contributed to the success of our project.

REFERENCES

[1] IS: 1893:2002 for Live Loads and Floor Loads, Indian Standard Code of Practice for Design Loads for Buildings and Structures, Bureau of Indian Standards.
[2] IS: 1893:2002 for Earthquake Loads, Indian Standard Code of Practice for Design Loads for Buildings and Structures, Bureau of Indian Standards.
[3] IS 456-2000, Indian standard code of practice for plain and reinforced concrete (fourth revision), Bureau of Indian Standards, New Delhi, July 2000.
[4] SP: 16-1980, Design aids for reinforced concrete
[5] IS: 456: 2000, Bureau of Indian standards, New Delhi, 1980.
[6] M.A. Qureshi et.al (2018): Comparison Between Manual Calculation and Software Calculation of G+5 Building Using STAADPro.
[7] Rashmi Agashe et.al (2020): To Study Analysis and Design of Multi-Storey building using STAADPro and Comparing with Manual Calculation.
[8] Mr. A. P. Patil et.al (2017): Design & Analysis of Multi Storey Building (G+10) By Using STAADPro V8i (Series 4)
[9] K. Shruthi et.al. (2019): Comparative Study of Structure using Conventional and different Software's
[10] Shaikh Ibrahim et.al (2019): Design and Analysis of Residential Building
[11] Ravi Singh (2019): Analysis, and Design of G+ 7 Storey's Residential Building by using IS Code Methods and by Software's
[12] Nidhi Singh et.al (2021): Analysis and Design of Residential Building
[13] AutoCAD 2023 Version
[14] STAADPro. Connect Edition 2023



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY