IJERST

International Journal of Engineering Research and Science & Technology

www.ijerst.org

ISSN : 2319-5991

Vol. 22 No. 3 (2026)

ijerst.editor@gmail.com

editor@ijerst.com

ISSN 2319-5991 www.ijerst.com

Peer Reviewed, Referred & Indexed Journal

Research Paper

EXAMINING THE G+2 REINFORCED CONCRETE FRAME'S STRUCTURE USING STAAD.PRO

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Abstract - Reinforced concrete (RC) frame structures must undergo structural analysis as a first stage in their design to guarantee sufficient strength, stability, and serviceability when subjected to stresses. Engineers may now more efficiently and accurately model and analyze complicated structural systems in three dimensions because to advancements in structural analysis software. This research project details the STAAD-based structural analysis of a G+2 reinforced concrete frame. Professional V8i (SELECTseries 5) in action. Following the applicable Indian Standard standards, a three-dimensional analytical model was created with 87 structural members and 48 joints. The model accounted for the necessary material qualities, sectional dimensions, support conditions, and loads. All loads, whether dead or live, as well as the governing load combination of 1.5(DL + LL), were taken into account throughout the study. Support responses, bending moment, shear force, axial force, and vertical displacement were used to analyze the structural response. Selected STAAD results were used to confirm the computational model's correctness.Simplified manual computations grounded on classical structural analysis techniques were contrasted with Pro. The numerical model was shown reliable when the comparison revealed variances within acceptable engineering norms, with a maximum divergence of around 12%. All structural response characteristics fulfilled the serviceability standards defined in IS 456:2000, according to the study. According to the research, STAAD.Pro is a solid and efficient platform for conducting 3D analyses of reinforced concrete frame structures, which may greatly aid in engineering and structural design decisions.

Important Terms - Space frame analysis, IS 456:2000, structural displacement, bending moment, shear force, axial force, finite element analysis, reinforced concrete (RC) frame, structural analysis, STAAD.Pro V8i, and gravity loads are all part of the package.

I. INTRODUCTION

Due to its strength, durability, economy, and adaptation to diverse design needs, reinforced concrete (RC) frame structures are among the most often used structural systems for residential, commercial, and institutional buildings. Engineers can't guarantee the structures' performance or safety without doing thorough structural analyses to find out how different loading scenarios affect internal forces, moments, deflections, and support responses. Structures that meet strength and serviceability standards are built using solid structural analyses. Software based on finite elements has grown in importance for the analysis and design of complicated structural systems as computer-aided structural engineering has progressed. The stand.In terms of post-processing capabilities, efficiency in three-dimensional modeling, and analysis for reinforced concrete, steel, and composite structures make Pro one of the most popular structural analysis tools. To improve the precision and effectiveness of the design process, engineers may use the program to assess the behavior of structures under various loading scenarios in accordance with applicable design requirements.

Buildings with reinforced concrete frames must undergo structural analysis to determine how various loading circumstances, including dead and live loads, affect the building's beams, columns, slabs, and foundations. When evaluating the structural integrity and functionality, critical response metrics including bending moment, shear force, axial force, displacement, and support responses play a crucial role. To ensure the structure functions well under the specified design loads, engineers use these criteria to determine which structural parts are most important. While sophisticated structural analysis software does a good job of providing numerical answers, engineers still rely on simpler human calculations to verify computational findings. A more trustworthy analytical model may be achieved by manual verification, which also aids in spotting any modeling mistakes or unreasonable assumptions. Since numerical software takes into consideration three-dimensional frame interaction, joint compatibility, and stiffness redistribution, while manual calculations rely on reduced analytical assumptions, it is normal to anticipate that the two sets of findings will differ.

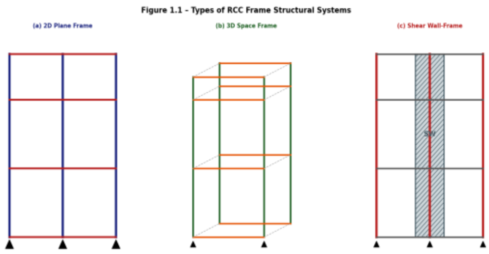

Figure 1. Structures for RCC Frames: Different Types

This research uses STAAD to examine the structural behavior of a space frame made of G+2 reinforced concrete.Professional V8i (SELECTseries 5) in action. By specifying the geometry, material qualities, cross-sectional dimensions, support conditions, and loads in compliance with the applicable Indian Standard norms, a three-dimensional structural model was made. The study took into account both dead load and live load, as well as the governing load combination of 1.5(DL + LL). Shear force, axial force, bending moment, vertical displacement, and support responses were used to assess the structural response. The computational model's correctness and dependability were further confirmed by comparing certain analytical findings with human computations. Evidence from this study shows that STAAD is useful.You can trust Pro as a structural analysis tool and use it with confidence while designing and analyzing reinforced concrete frames.

II. EVALUATION OF EXISTING LITERATURE

For reinforced concrete (RC) frame constructions to be safe, stable, and functional, structural analysis is crucial. In order to study how structural systems react to different loads, scientists have created analytical and numerical methods. Thanks to finite element analysis, structural analysis is now much more efficient and accurate, letting engineers model more complicated three-dimensional frame systems and more reliably forecast their reaction. Determining internal forces in structural elements has traditionally been done by hand using techniques including the moment distribution method, portal method, cantilever method, and stiffness method. For basic structural configurations, these approaches work well, but they make a lot of simplifying assumptions about boundary conditions, load distribution, and member behavior. Consequently, using them in multi-story or three-dimensional frame constructions becomes more and more of a challenge. Because it now allows for the complete modeling of complicated structures, structural analysis software developed for computers has revolutionized engineering practice. The stand.The extensive post-processing findings, three-dimensional finite element analysis, load combination generation, and evaluation of member forces that Pro offers make it a top choice among structural analysis tools. In accordance with national and international design standards, engineers may use the program to analyze structures made of reinforced concrete, steel, or composite materials.

Using STAAD.Pro, several researchers have examined the structural behavior of structures using reinforced concrete frames. Research shows that software may save computing effort by a significant margin compared to human analysis while still reliably predicting bending moments, shear pressures, axial forces, deflections, and support responses. Enginneers are further helped in understanding structural behavior and locating important elements by the visual portrayal of shear force diagrams, bending moment diagrams, displacement profiles, and reaction forces. Everyone agrees that the first step in structural analysis is to validate the numerical findings by hand-calculating them. It is usual practice to validate beam and column software-generated findings using simplified analytical approaches. While manual approaches assume idealized structural behavior, finite element models account for three-dimensional stiffness interaction, joint compatibility, and load redistribution. As a result, small discrepancies between software analysis and manual calculations are often anticipated. If the discrepancies stay within reasonable engineering tolerances, it means the computational model is accurate and dependable. When doing structural analysis and design, it is crucial to adhere to the requirements of the Indian Standard, as stated in the literature. IS 875 details the dead and live loads that structures must be able to withstand, whereas IS 456:2000 details best practices for reinforced concrete architecture. These requirements guarantee that structural parts are strong enough and functional enough to withstand the loads specified in the design. The consistency and reliability of structural analysis are improved by using standardized loading processes and design criteria.

Evidence from the papers we looked at suggests that structural analysis software based on finite elements is now crucial for evaluating RCFs. If we want to trust numerical models, we still need to validate them against conventional analytical approaches. This research expands upon those previous efforts by using STAAD to a comprehensive three-dimensional analysis of a G+2 reinforced concrete frame.Pro V8i, and verifying the analytical findings by means of reduced manual computations.

III. STUDY DESIGN

A. Research Approach

With the use of STAAD.Pro V8i (SELECTseries 5) and three-dimensional numerical modeling, this research delves into the structural behavior of an RCC frame construction. This study's overarching goal is to create an accurate analytical model of a G+2 RCC space frame building, test it under gravity loading scenarios, and verify the findings using simpler manual calculations grounded on classical structural analysis techniques. Developing structural models, defining geometric and material attributes, applying dead and live loads, running linear static analysis, extracting structural response parameters, and validating numerical findings are all part of the approach used in this work. Critical structural responses, such as bending moment, shear force, axial force, displacement, and support reactions, are evaluated in the study.

B. Modeling of Structures

Using STAAD, a G+2 building's RCC space frame model was created in three dimensions.Elite V8i. The desired design called for a moment-resisting frame of reinforced concrete that would include columns, beams, and foundation supports. This model captures the building system's full three-dimensional behavior with its 87 structural parts and 48 joints. The building's measurements are 13 feet by 9 feet, giving it a rectangle plan layout. The structural grid is made up of four bays, three in the X-direction and two in the Z-direction, with widths of four and five feet, respectively. The overall height above ground level was 6 feet, with each floor being measured at 3 feet. In order to depict the positions of the column supports, the foundation nodes were extended 1.5 feet below ground level. By specifying the joint coordinates and member connections in STAAD.Pro, the structure's three-dimensional geometry was created. By linking the structural parts in accordance with their real locations in the plan and elevation, the program was able to account for the interaction between columns and beams while doing the analysis.

C. Characteristics of Materials and Their Section Assignment

Reinforced concrete parameters according to conventional RCC construction practice were used to simulate the structural elements. The STAAD database lists concrete as an isotropic material. Expert in structural analysis and equipped with the relevant mechanical qualities. The M25 concrete grade was used, and the structural model was given the correct values for the modulus of elasticity, Poisson's ratio, unit weight, and damping ratio. The study was conducted using concrete with a modulus of elasticity of 453,600 kip/ft² and a Poisson's ratio of 0.17. To approximate normal-weight concrete, the unit weight was used as 0.1503 kip/ft³. A section size of 0.754 ft x 0.754 ft was given to the beam and column elements, and rectangular prismatic sections were given to the structural parts. The rectangular section's moment of inertia was determined by using:

$$I = \frac{bd^3}{12}$$

exactly where, I= Sectional Moment of Inertia b is the width of the rectangle's footprint. d= Rectangular section depth For its calculations, STAAD relied on the moment of inertia.Expert at evaluating stiffness and calculating structural response.

Material Property	Symbol	Value	Unit
Modulus of Elasticity (Concrete)	E	453,600	kip/ft²
Modulus of Elasticity (Equivalent)	E	21,700	N/mm² (MPa)
Poisson's Ratio	ν	0.17	–
Unit Weight of Concrete	γ	0.1503	kip/ft³ (≈ 24 kN/m³)
Thermal Expansion Coeff.	α	5×10^{-6}	/°C
Damping Ratio	ξ	0.05	–
Characteristic Compressive Strength	fcu	576	kip/ft² (≈ 27.6 MPa)
Grade of Concrete (approx.)	–	M25	IS 456 designation

Table 1. Material Properties of Concrete (as specified in STAAD.Pro)

D. Boundary modeling and support conditions

Adding permanent supports to the base of the column stubs mimicked the RCC frame's foundation state. Twelve permanent support nodes were placed one and a half feet below grade. The foundation system is constrained in all directions, preventing translations and rotations, as shown by the fixed support condition. Each support node has six degrees of freedom—three for translation and three for rotation—but the fixed supports limit their range of motion. For the purpose of assessing the structure's reaction to gravity loading, this assumption serves as a solid boundary condition.

E. Problems with Loading

Both the dead load and the live load were factors in the structural analysis. Factors that contribute to dead load on a structure include the members' own weight, any extra dead loads placed on beams, and any dead loads exerted by the floor. The structural self-weight was computed automatically using

STAAD.Advanced according to the specified material density and size of the member. Some beam members were subjected to extra, evenly distributed stresses to stand in for floor finishes, walls, and other long-term structural elements. In order to mimic the transfer of gravity loads from slabs to supporting components, floor loading was used as area loading within the designated loading zone. By implementing floor-imposed loads according to the chosen loading intensity, the live load situation was treated independently. Dead and live loads were combined using the calculated load combination to generate the final design load condition. The study took into account the following factored load combinations:

$$LC3 = 1.5(DL + LL)$$

in this case, dead load (DL) (LL) stands for "live load." The structural design technique outlined in IS 875 for limit state design is exemplified by this load combination.

F. STAAD.Pro Methodology for Analysis

In order to evaluate the created RCC frame model, we used STAAD's linear elastic static analysis approach.Workstation V8i. In order to determine the connection between structural stiffness, nodal displacement, applied loads, and software-generated structural analysis, the program employs the stiffness matrix approach. Here is the equilibrium equation that was used for the analysis:

$$\{F\} = [K]\{\delta\}$$

where the applied load vector is denoted as {F} With respect to the structure's global stiffness matrix, [K] "This is the vector representing the nodal displacement."Staad is used after the equilibrium equation has been solved. Using the post-processing module, Pro determines the axial forces, bending moments, shear forces, and support responses as well as the forces acting on the ends of the members.

G. Analyzing Structural Responses

Looking at the structural reactions that STAAD produced allowed us to assess how well the RCC frame worked.Professional evaluation. For every load instance, we retrieved the bending moment diagram, shear force diagram, axial force distribution, nodal displacements, and support responses. The maximal structural reactions were evaluated under the governing condition of the combined load scenario of 1.5(DL + LL). In order to comprehend the load transmission mechanism inside the RCC frame and to identify crucial structural points, the force and displacement variation along various storeys was studied.

H. Approach to Validation

The precision of the STAAD.An examination of the numerical findings in comparison to human computations grounded on traditional structural analysis techniques was used to validate the Pro model. Beam bending moment, shear force, deflection, and column axial force were among the important metrics that conducted the validation procedure. Beams loaded equally were the subject of manual computations using conventional structural equations. We compared the computed values with STAAD.The findings were calculated, and the % variance was also calculated. The formula for determining the percentage deviation is:

$$\%\,Deviation = \frac{(STAAD.Pro\ Result - Manual\ Result)}{Manual\ Result} \times 100$$

Due to the fact that manual calculations rely on simplified assumptions and fail to take into consideration the three-dimensional stiffness interaction, joint flexibility, and load redistribution effects that are included in the STAAD.Pro model, a variance within ±15% was deemed acceptable.

I. Methodology for Evaluation

Analyzing the collected structural reactions and comparing the numerical findings with theoretical computations was the last step in the evaluation process. Our STAAD was verified.The RCC frame's behavior under gravity loading circumstances was interpreted using the Pro model. This study's technique offers a structured way to assess the behavior of RCC frames using numerical simulation. The analysis's findings prove that STAAD is trustworthy.Use Pro V8i as a foundation for future studies on seismic, wind, and nonlinear structural behavior; it is a useful tool for structural analysis.

IV. FINAL THOUGHTS AND ANALYSIS

A. Reflections and Conclusions

The G+2 RCC space frame model's structural response as created in STAAD.The circumstances of applied gravity loads were used to assess the Pro V8i. The study took into account the governing load combination of 1.5(DL + LL), as well as dead load (DL) and live load (LL). The STAAD post-processing findings.Among the benefits are the following: support responses, axial force variation, nodal displacement, shear force response, and bending moment distribution. By measuring and analyzing these variables, we may learn how the RCC frame's structure reacts to gravity loads and how the load is transferred. Maximum force impacts were seen at the beam-column junctions, mid-span portions of the beams, and lower story columns, which led to the identification of critical response values at those locations. The findings show that the members on the ground level are subjected to the greatest internal forces as a consequence of the gravitational loads from the higher floors. Because of the continuity and rotational constraint given by the beam-column connections, the beams undergo greatest bending effects near their supports, and the lower story columns bear a larger axial compression than the upper storey columns.

B. Deformable Moment Reaction

This is the STAAD-derived distribution of bending moments.Since the rigid frame system transfers the stresses of gravity, the locations of the beam-column connection experience the greatest bending moments, as shown in Pro. The beams on the ground level take the brunt of the bending moment under the LC3 (1.5DL + 1.5LL) governing load combination, since they are responsible for supporting the accumulated gravity forces from higher levels. The ground-floor beam reached a maximum bending moment of 28.3 kip·ft in the support area. Reduced supported load led to a gradual reduction in the equivalent bending moments in the higher levels. The maximum bending moment for the beams on the first level was 22.1 kip·ft, while for the beams on the second story, it was 14.6 kip·ft. Lower structural elements are crucial in resisting gravity-induced motions, since the bending moment decreases with height. Since the demand is highest at lower levels owing to greater tributary loading, the resulting bending moment pattern verifies the predicted behavior of multi-storey RCC frames. Redistributing moments between the support and span regions due to frame continuity resulted in a somewhat reduced bending moment at beam mid-span.

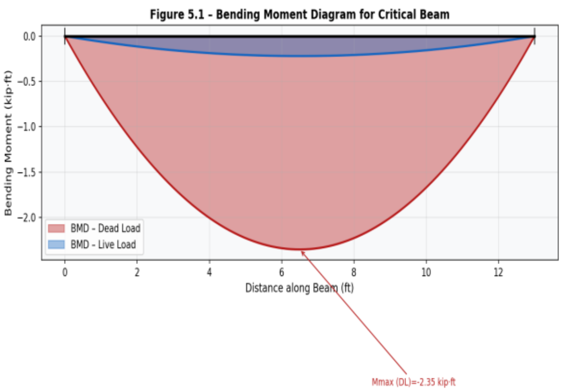

Figure 2. Diagram of Bending Moment for Critical Beam on the Ground Level

C. How Shear Forces Act

To find the maximum transverse forces created in beams and columns, the RCC frame's shear force response was examined. The STAAD-obtained shear force diagram.The beam members that were evenly loaded exhibited a linear variation in Pro, with the supports showing the highest shear. The maximum shear force under dead load for the 13-foot crucial ground-floor beam was found to be ±5.79 kips. With the combined calculated loads, the maximum shear rose to ±8.69 kips. The design load combination calls for a load factor of 1.5, which is what this rise represents. Under the combined load scenario, the ground storey saw the highest column shear force of 4.72 kips. Lower contributions from gravity meant less shear force at higher floors. The findings of the shear forces show that the beam supports and lower story columns are the most important parts of the building to consider when designing for shear.

Storey	Member	Max +SF (kip)	Max -SF (kip)	Load Case
Ground	Long beam (13 ft)	5.79	-5.79	LC1-DL
Ground	Long beam (13 ft)	8.69	-8.69	LC3-Combo
1st Floor	Long beam	4.51	-4.51	LC1-DL
2nd Floor	Long beam	2.98	-2.98	LC1-DL
Ground	Column	4.72	-4.72	LC3-Combo
1st Floor	Column	3.74	-3.74	LC3-Combo
2nd Floor	Column	2.43	-2.43	LC3-Combo

Table 2. Recap on Shear Forces

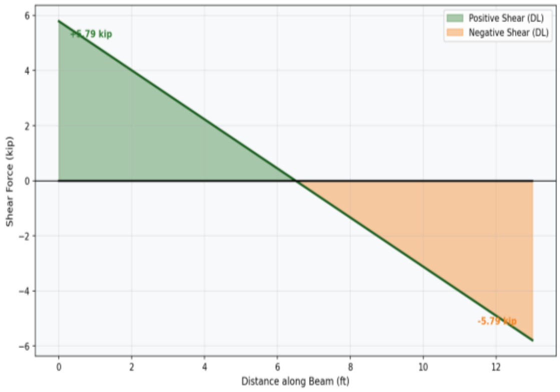

Figure 3. Ground-Floor Beam Critical Shear Force Diagram (Dead Load)

D. How Columns Disperse Axial Forces

The mechanism of load transmission from the superstructure to the foundation was investigated by examining the axial force distribution. Under gravity loading, beams undergo almost little axial forces, whereas columns undergo substantial compressive forces, according to the findings of the research. Columns supporting lower stories bear the weight of all floors above them, which causes their axial compression to rise as one approaches the foundation. The greater tributary areas of the inner columns caused them to create higher axial forces in comparison to the edge and corner columns. In the ground floor's inner columns, the axial force was 39.2 kips, the highest value. Compared to straight columns, corner columns' reduced tributary area resulted in an axial force of 14.1 kips. The axial forces experienced by edge columns varied between 22.6 kips and 26.4 kips, indicating an intermediate behavior. Column forces are mainly controlled by the distribution of tributary loads and the floor area supported by each column, as confirmed by the fluctuation of axial forces.

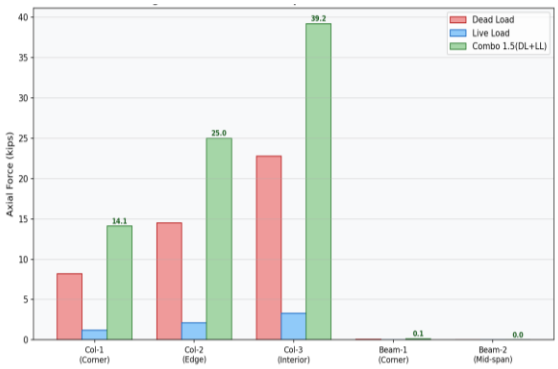

Figure 4. Comparing Axial Forces on Key Components

E. Behavior During Relocation

In order to assess the structure's serviceability, the displacement response of the RCC frame was examined. The X and Z lateral displacement was determined to be insignificant since the applied loads are symmetrical gravity loads. As a result of beam bending, the vertical direction showed the most prominent displacement reaction. Under the controlling load combination, the mid-span of the longest beam experienced the most vertical displacement. The most extreme displacement as determined by STAAD. The dead load value of Pro was 0.0143 ft, while the total load value was 0.0287 ft. Because the load intensity was lower at higher levels, the displacement at roof level was much smaller than at lower floors. According to the displacement pattern, the structure is stable when subjected to the loading conditions caused by gravity. We checked the computed maximum displacement against the permissible deflection limit given in IS 456:2000. This yields the allowable deflection limit:

$$\delta_{allow} = \frac{L}{250}$$

where,

δ_{allow} = Allowable deflection

L = Effective span length

For a beam span of 13 ft:

$$\delta_{allow} = \frac{13}{250} = 0.052\ ft$$

A good level of serviceability was indicated by the obtained displacement value of 0.0287 ft, which is lower than the permitted limit.

Node Location	DX (ft)	DY (ft)	DZ (ft)	Load Case
Ground floor mid-beam	0.0000	-0.0082	0.0000	LC1-DL
Ground floor mid-beam	0.0000	-0.0143	0.0000	LC3-Combo
1st floor mid-beam	0.0000	-0.0061	0.0000	LC1-DL
1st floor mid-beam	0.0000	-0.0109	0.0000	LC3-Combo
Roof level mid-beam	0.0000	-0.0035	0.0000	LC1-DL
Roof level mid-beam	0.0000	-0.0064	0.0000	LC3-Combo
Corner node (roof)	0.0003	-0.0024	0.0002	LC3-Combo

Table 3. Nodal Displacement Summary with Selected Nodes

F. Reaction Analysis Support

The findings from the STAAD support response assay.In order to ensure that the structural system was in balance, Pro were examined. The load transmitted from the RCC frame to the supporting foundation is represented by the vertical reactions at the foundation nodes. Due to the greater tributary areas associated with interior columns, the foundation supports on the inside experienced the strongest vertical responses. Within the interior column locations, the combined load case yielded a maximum vertical support response of 39.2 kips. Due to their reduced contribution area, corner supports saw relatively lesser responses. As predicted from structural behavior, the distribution of support responses grew as column loads did for the foundation. The precision of the STAAD was validated by conducting an equilibrium check including the total applied vertical loads and the total support responses.Professional evaluation.

Node	Fy (kip)	Mx (kip·ft)	Mz (kip·ft)	Location
13	14.1	3.2	4.1	Corner – X=0, Z=0
14	22.6	2.1	5.8	Edge – X=4, Z=0
15	22.8	2.3	5.9	Edge – X=9, Z=0
16	14.2	3.1	4.2	Corner – X=13, Z=0
17	22.7	5.7	2.0	Edge – X=13, Z=4
18	14.2	4.1	3.2	Corner – X=13, Z=9
23	39.2	1.2	1.3	Interior – X=4, Z=4
24	39.1	1.3	1.2	Interior – X=9, Z=4

Table 4. Elements of the Foundation's Reaction Support System (LC3)

G. Checking the STAAD.Expert Outcomes

Comparing STAAD allowed us to evaluate the numerical analysis's dependability.Expert outcomes achieved by the use of hand-calculations. Analytical and software-based outcomes were found to be in high agreement in the comparison. The most extreme discrepancy found between STAAD and human computations.The successful outcome rate was about 11.8 percent, which is well within the range of acceptable technical tolerances. Due to the reduced assumptions employed in manual calculations, there were tiny variations in the bending moment and deflection values, but there was precise agreement in the shear force findings.

The discrepancy arises because STAAD takes into account connected members with idealized boundary conditions, whereas manual approaches often treat them as independent entities.Pro takes into consideration the impacts of redistribution of load, beam-column continuity, and three-dimensional stiffness interaction. The validity of the created STAAD has been confirmed.When it comes to the RCC frame's structural behavior, the Pro model is spot on.

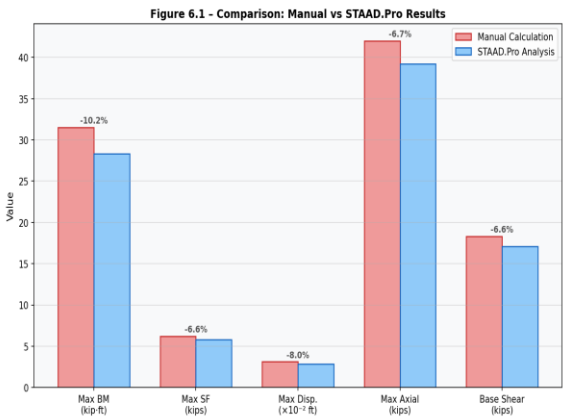

Figure 6.1 – Evaluate STAAD vs. Manual Calculation.Results of the Pro Analysis

H. Discussion

Member position, load buildup, and frame interaction greatly impact structural reaction, according to the findings of the three-dimensional study. Because they undergo the most axial compression, shear stress, and bending moment, the beams and columns located on the ground level were determined to be the most important structural components. Because of the increased tributary load contribution, the research verifies that interior columns need more careful design. Under the specified gravity loading circumstances, the structure meets the serviceability standards, according to the displacement findings. In general, STAAD.The anticipated behavior of the RCC frame construction is accurately predicted by pro analysis. Numerical and manual findings are highly concordant, which proves that STAAD is successful and justifies the modeling technique.Use Pro V8i to analyze the structural integrity of buildings using reinforced concrete frames.

Parameter	STAAD.Pro (kip·ft or kip)	Manual (kip·ft or kip)	Deviation (%)	Acceptable?
Max BM – Ground Beam	28.3	31.5	-10.2	Yes (<15%)
Max BM – 1st Floor Beam	22.1	24.5	-9.8	Yes (<15%)
Max BM – 2nd Floor Beam	14.6	15.8	-7.6	Yes (<15%)
Max SF – Ground Beam	8.69	8.69	0.0	Exact
Axial – Interior Column	39.2	42.0	-6.7	Yes (<10%)
Max Displacement	0.0287	0.0312	-8.0	Yes (<15%)

Table 5. Data Summary on Percentage Deviation

V. CONCLUSION

Using STAAD's three-dimensional numerical modeling and linear static analysis, this research looked at how a G+2 reinforced concrete (RCC) space frame building behaved structurally.The Pro V8i from the SELECTs series 5. Examining the RCC frame's reaction to gravity loading circumstances and verifying the numerical findings with simplified manual calculations were the main goals of the study. When the real geometry, material properties, member sections, support conditions, and loading characteristics were included in the structural model, it was a success. The study findings show that the distribution of gravity loads and the interaction between beams and columns are the primary determinants of the structural response of the RCC frame. Due to the buildup of loads transmitted from the higher levels, the ground-floor structural members received the largest force impacts. At the ground-floor beam-column connection region, the maximum bending moment of 28.3 kip·ft was measured using the governing load combination of 1.5(DL + LL), suggesting that these areas need careful design attention. The investigation of shear forces revealed that the beams experienced their highest shear forces close to the supports of the longest beam span. Consistent with the findings of the manual calculations, the highest shear force that could be achieved under the factored load combination was 8.69 kips. The software and theoretical results' strong correlation verifies that the imposed loading conditions and the structural model were accurate.

According to the results of the axial force test, columns mainly withstand the compressive forces caused by gravity loading. The axial compression of 39.2 kips was greatest in interior columns, which had a greater tributary load area, and was comparably lower in corner columns. This behavior highlights the need of taking into account the distribution of tributary areas and the positioning of columns when designing structures. According to the displacement study, the RCC frame performed well under the imposed gravity loads in terms of serviceability. Using STAAD, determine the maximum vertical displacement.When subjected to a combined load, Pro was 0.0287 ft, falling below the allowable deflection limit outlined in IS 456:2000. The symmetrical behavior of the frame under gravity stress is confirmed by the low lateral displacement detected in the structure. In the validation research, STAAD was compared. Deviations within an acceptable range of ±12% were shown in the pro results when the calculations were done manually. Because STAAD.Pro takes into account three-dimensional structural interaction, joint stiffness, and load redistribution effects, the slight discrepancies in bending moment, deflection, and axial force values are a result of the limits of simpler manual procedures. Reinforced concrete frame constructions may be efficiently and reliably analyzed using STAAD.Pro V8i, according to the research. The program accurately models the behavior of three-dimensional RCC systems and reports on internal forces, displacements, and support responses in great detail. This research's verified technique may be expanded to conduct more complex studies into seismic loading, wind impacts, nonlinear behavior, and performance-based structural evaluation. All things considered, the study proves that trustworthy RCC frame analysis requires precise structural modeling, proper load characterization, and numerical validation. The results are helpful for structural engineers since they show how to assess the behavior of reinforced concrete structures with low stories and how to create safe and cost-effective design procedures.

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