Design and Analysis of Soft Storey G+17 Rectangular Shaped Building Using STAAD Pro V8i Software

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A R T I C L E I N F O

Keywords:

Soft Storey, Storey Drift, Base Shear, Shear Force, Shear wall STAAD.Pro

A B S T R A C T

Soft storey is a typical feature in modern multi-storey constructions in urban India; though G+17-story buildings with soft storey floor are inherently vulnerable to collapse due to earthquake, their construction is still widespread in developing countries like India. Functional and social need to provide car parking space at ground level and throughout the building. Since parking space for residential apartments in populated cities has become a major problem due to rising population since the past few years, constructions of multistoried buildings with open first storey has become a common practice Offices with open stories at various structural levels greatly outweigh the engineering community's caution against such structures. The primary goal of the research was to evaluate the impact of a soft storey in earthquake zones by using static analyses in STAAD.Pro. V8i software, whereby the use of software has significantly reduced the complexities of various aspects in the analysis and design of projects. Fast computers have made software usage in civil engineering possible.

This paper presents the results of an examination into the seismic behavior of Software STAAD.Pro for soft story buildings. Static analysis is carried out using STAAD.Pro V8i software, and parameters including base shear, storey drift, and shear force in seismic zone are examined for improved performance.

1. Introduction

These days, soft storeys are a common feature of modern urban construction in India. At these soft storeys, the rigidity of the structure is interrupted due to the absence or lack of infill walls. Typically, soft or weak storeys occur at the ground floor level, but they can occur at any other storey level of the building. Parking for residential apartments in populated cities has become a major problem due to rising population in recent years.] As a result, multi-story buildings with open first stories are constructed worldwide. These buildings lack infill masonry walls in the ground floor but have all upper storeys filled with walls made of stone. identifying it as a "Open Ground Storey Building" or "Soft Storey" The term "soft storey building" refers to a structure where one storey is significantly less stiff than adjacent storeys. This is caused by the absence of infill walls at that storey, while other storeys have full infill, which makes the storey without infill less stiff than another storey. Therefore, we left the ground floor open for parking, which is known as the "soft storey," since it lacks infilled masonry walls to withstand lateral forces that an earthquake may induce on the building. Buildings with several stories above ground are referred to as multi-stored buildings. Depending on the materials used and the cost of land in the area, multi-story buildings seek to maximize the building's floor space without expanding the amount of the land they are constructed on, therefore conserving both money and land.Along with creativity and imaginative thinking, the design of a multi-story structure necessitates a solid understanding of structural engineering science and practical considerations like current design standards and bylaws, which are supported by a wealth of knowledge, experience, and expertise.

Structures are a key determinant of the county's social development. Owning a cozy home is a wish shared by all people, however usually with one obligation. These are the main causes of the person's extreme effort and sacrifice of hard-earned savings to become a home owner. Building houses is now an important contributor to the county's social advancement. Every day, new methods are created to build homes more swiftly, cheaply, and in accordance with community standards. Architects and engineers handle the design work.

Note: - We Design & Analysis the wind and earthquake effect on soft storey of G+17 building using STAAD. Pro

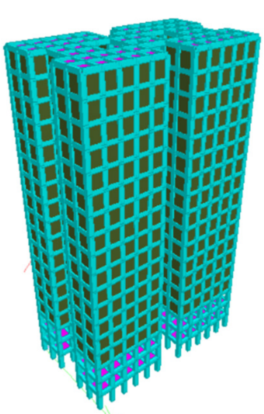


Fig.1 G+17 Residential Building (3D View)

1.1 Objective of Soft Storey (G+17) Building

Parking for vehicles is a major concern these days due to increased occupancy, which is why RC buildings with open first floors are nothing more than (soft storey) buildings. Additionally, the earthquake that mostly occurred in has revealed that a large number of existing, particularly soft storey buildings, are vulnerable to damage and serve social needs like car parks, lobbies, and large spaces, among other things. These kinds of buildings are soft storey, and we provide a soft storey to reduce the displacement at higher levels under the force check the deformation and the deflection of storey rigidity using STAAD.pro

2. LITERATURE REVIEW

Akshay shaji, Amrutha Binu, Dibi Divakaran, Swaraj V Angitha Sasidharan, Seismic Analysis of soft storey buildings - Seismic analysis of soft story buildings were performed, and the study's efficacy was compared to ground level at different building levels. The increased performance results in storey displacement, inter-storey drift, storey stiffness, and base shear.

Shamshad Ali, Farhan Malik, Tanmay sonone, Bhushan Kalbande, Harshala Agale Analysis of Building with Soft Storey during Earthquake has examined the motivation for a number of social needs, such as those for space, lobbies, and parking. displacements, storey drift, and bare shear. This study considers the G+6 building and looks at the effects of soft story building frames. Storey displacement, foundation shear, and storey drift were the metrics used to collect the results.

Pravesh Gairola, Mrs. Sangeeta Dhyani Seismic Analysis of open Soft Storey Building for Different Models This study looks at how different models—such as bare frames, infill frames, bracing frames, and shear wall frames—respond to seismic loads in soft storey buildings.

Sourabh rajoriya, Nitesh bhure, Narendra rahangdale. Analysis of soft storey Building in Different seismic Zones by staad pro. V8i Software (2016) Analyzed the building and conducted a comparative study of G+5 RCC residential building collapse scenarios in seismic zones 3 and 5 in India.1) The ground level provides a soft story for parking needs.2) Less than 70% of the building's object floor has lateral stiffness. Deflection [Result term gathered as 1] shear force, 2] bending moment, and 3] 4] support response. Zone 3 is nearly twice as safe as Zone 5 in deflection and above all other criteria.

Vipin V. Halde, Aditi H. Deshmukh Effect of Soft Storey on Structural Response of High-Rise Building has been researched to find out how different scenarios will be affected by soft level, multi-story high rise buildings using the same architectural plans. Equivalent diagonal trusts are provided, as suggested by FEMA 273. missionary in its stead to create an infill effect [2] SAP 200 analysis is used to change different floors and models with the same static analysis. These provisions reduce the stiffness of the lateral load.

3. MODELLING AND LOADING DEATAILS

Area covering	30 m × 17 m
Soft Storey Height	3.4 m
Each Storey Height	3 m
Total Height of Building	54 m
Column Size	0.70 m × 0.60 m
Beam size	0.70 m × 0.50 m
Slab Thickness	150 mm
Grade of concrete	M30/ Fe550
Live Load on Floor	2 kN/m^2
Shear Wall Thickness	230 mm
Stair Case Loading	3 kN/m^2 As per IS 875 Part 2
Floor Finish Load	1.5 kN/m^2

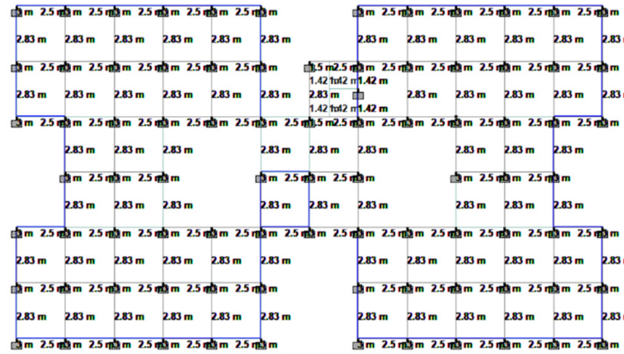


Figure 2. Plan(2D) of G+17 Residential Building

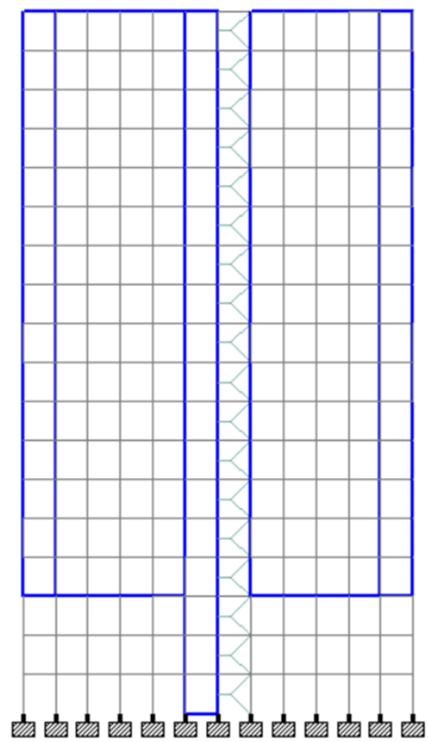


Fig.3 Elevation of G+17 Residential Building

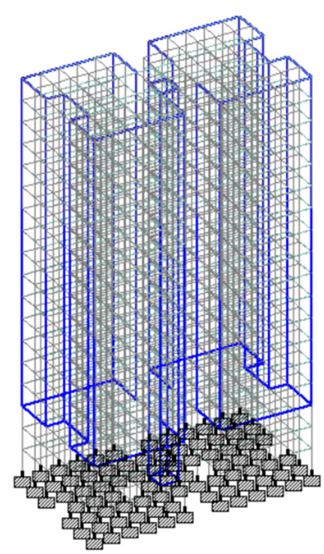


Fig.4 Shear wall of G+17 Residential Building

3.1 Is codes Details

IS 456 (Part 4] - Indian Standard Code of Practice for Reinforced and Unreinforced Concrete was published in 2000 by the Bureau of Indian Standards.

IS: 875 (Part 3) — For buildings and structures, the Indian Standard Code of Practice for Design Loads (Other Than Earthquake) was adopted in 1987 for Wind Loads.

IS: 875 (Part 2) — Indian Standard Code of Practice for Design Loads (Other Than Earthquake), For Buildings and Structures, 1987 for Imposed Loads.

IS: 875 (Part 1] - Indian Standard Code of Practice for Design Loads (Other Than Earthquake) For Buildings & Structures was established in 1987 for Dead Loads.

IS: 1893{Part1} - Indian Standard Standards for Designing Buildings to Withstand Earthquakes, 2002

3.2 Earthquake Loads as Per IS 1893

Earthquake Zone	II
Reduction Factor	5.36
Important Factor	1
Soil Type	Medium Soil
Damping Ratio	0.05%
Zone Factor	0.16

4. RESULTS

4.1 Storey Drift in X & Z Direction (cm):

No. of Story	Height (m)	X-Direction	Y-Direction
1	3	0.0127	0.0002
2	6	0.0330	0.0013
3	9	0.0195	0.0006
4	12	0.0387	0.0035
5	15	0.0090	0.0005
6	18	0.0128	0.0010
7	21	0.0100	0.0033
8	24	0.0092	0.0008
9	27	0.0130	0.0006
10	30	0.0135	0.0007
11	33	0.0109	0.0058
12	36	0.0130	0.0003
13	39	0.0082	0.0057
14	42	0.0091	0.0011
15	45	0.0124	0.0009
16	48	0.0142	0.0030
17	51	0.0081	0.0013
18	54	0.0121	0.0012

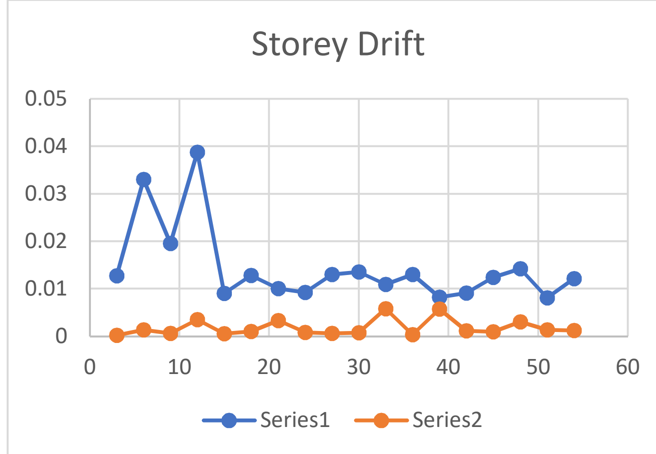
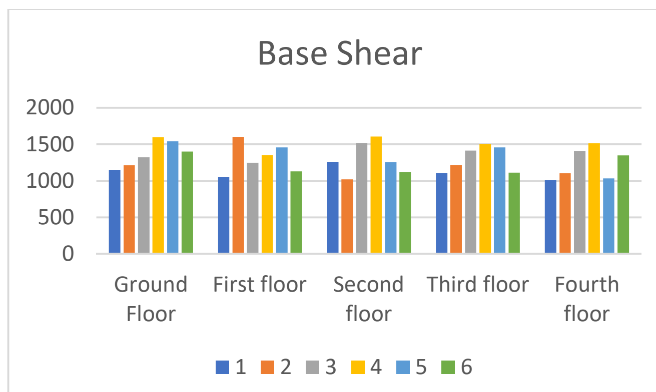


Chart 1: Storey Drift X & Y Direction (Floor Vs Drift)

The storey drift results indicate a noteworthy decrease in drift when the static method configuration is employed.

4.2 Base Shear in X- Direction (cm):

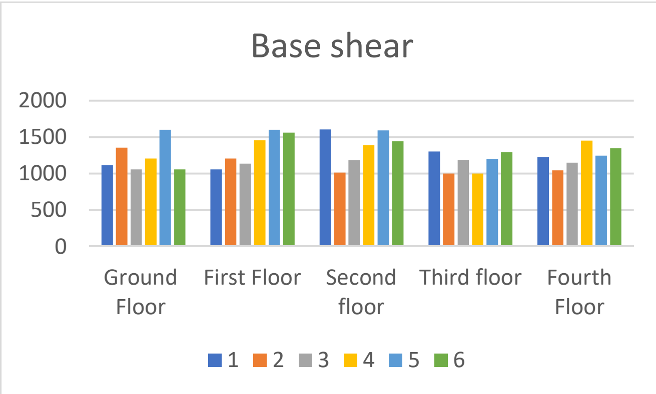
Beam No.	Ground Floor	First floor	Second floor	Third floor	Fourth floor
1	1153.95	1053.97	1259.47	1107.49	1012.13
2	1211.25	1601.44	1019.43	1218.14	1103.32
3	1322.70	1249.91	1520.29	1413.89	1408.65
4	1600.21	1355.25	1605.35	1504.92	1516.10
5	1542.54	1456.53	1258.42	1458.42	1032.86
6	1401.70	1128.80	1120.19	1110.19	1348.92



Result show from above data Decreasing in base shear according to building and height of building. It shows maximum base shear in soft storey compare to Normal storey in X- Direction and it is base shear in maximum at second floor with 1605.35 kN

4.2.1 Base Shear in Y-Direction (cm):

Beam No.	Ground Floor	First Floor	Second floor	Third floor	Fourth Floor
1	1113.35	1057.60	1605.35	1300.69	1228.43
2	1353.25	1207.37	1013.27	1000.33	1044.05
3	1059.29	1134.29	1184.86	1190.10	1150.29
4	1205.35	1456.95	1391.18	1002.07	1450.19
5	1601.23	1600.88	1592.08	1202.70	1245.07
6	1058.19	1558.89	1442.05	1292.02	1345.45



Result show Decreasing in base shear according to building and height of building. It shows maximum base shear in soft storey compare to Normal storey in Y- direction and it is base shear in maximum at second floor with 1605.35 kN.

4.3 Base Shear Details

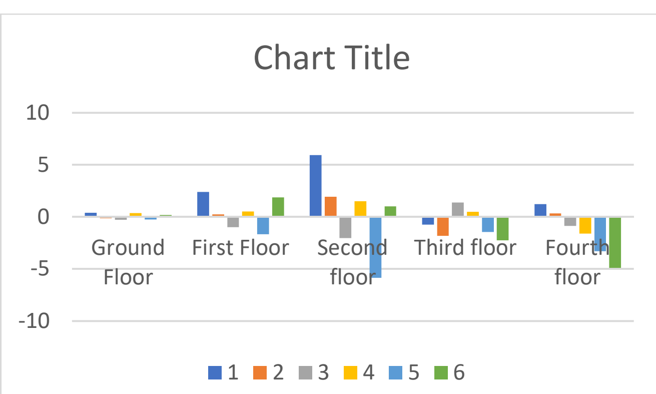
Case	RCC Bare Frame
Base shear Static X	1605.35 kN
Base shear static Y	1605.35kN

As a result, the maximum base shear for G+17 is as per 1893, depending on the building's height and layout 1605.35 kN

4.4 Shear Force in X- Direction (kN):

Shear Force play a crucial role in the design and analysis of structure, excessive shear force can lead to structural failure also shear force is taken +ve if it produces a clockwise moment and it is taken -ve when it produces an anticlockwise moment

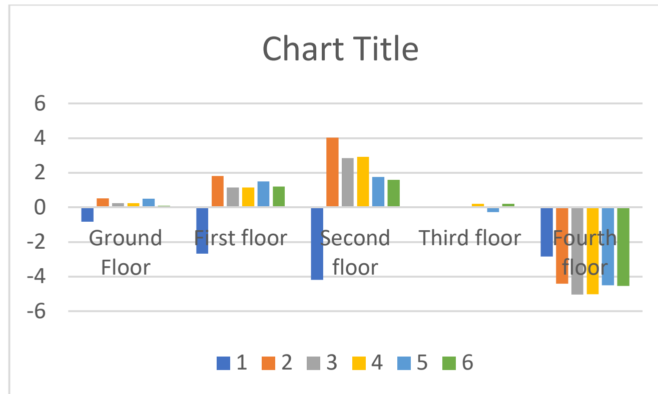
Beam No.	Ground Floor	First Floor	Second floor	Third floor	Fourth floor
1	0.395	2.397	5.947	-0.749	1.213
2	-0.125	0.244	1.943	-1.814	0.332
3	-0.270	-0.991	-2.029	1.389	-0.865
4	0.379	0.525	1.489	0.492	-1.610
5	-0.254	-1.653	-5.842	-1.453	-3.286
6	0.170	1.880	1.019	-2.255	-4.892



Result shows the Maximum Shear force in X-Direction at second Floor with 5.947 kN. It is help to structural failure and Minimum Shear force is -5.824kN.

4.4.1 Shear Force in Y- Direction (kN):

Beam No.	Ground Floor	First floor	Second floor	Third floor	Fourth floor
1	-0.820	-2.664	-4.185	0.067	-2.843
2	0.525	1.814	4.039	0.033	-4.405
3	0.254	1.148	2.843	0.010	-5.029
4	0.253	1.143	2.915	0.207	-5.019
5	0.499	1.503	1.761	-0.270	-4.507
6	0.093	1.207	1.596	0.202	-4.545



Result shows the Maximum Shear force in Y-Direction at second Floor with 4.039 kN. It is help to structural failure and Minimum Shear force is -5.029 kN.

5 CONCLUSION

Based on the current investigation, it can be said that the multiplication factor value listed in IS1893:2002/2005 is overestimated. This article reports on a study conducted to determine the seismic response of the G+17 RC Frame structure with soft storeys at varying story levels. Following analysis, the following conclusions were reached:

1) When compared to nearby floor levels, the storey drift is greatest at the floor with soft story.
2) Because it has a shear wall, this kind of RCC frame building can safely endure seismic activity
3) Shear walls are excellent for lowering lateral loads.
4) The seismic performance of a building is seen to be quite low due to its soft story.
5) This outcome will assist the design engineer in quickly and accurately evaluating the effects of soft storey
6) The model without a shear wall has the highest base shear when compared to another model.

6 ACKNOWLEDGEMENTS

We wish to express our sincere gratitude to our project guide, "Asst. Prof. Tinu M. Khandale" played an instrumental role in the successful completion of this research on this project. We extend our heartfelt thanks to our entire "civil engineering department" at J. D. college of engineering and management. "DBATU," for their unwavering support as well as appreciate the contributions of my group member who all contributed equally to this project

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