

"The comparative Descriptive Research and Analysis of RCC Twisted and Traditional Buildings Using Software for Indian and American Codes"

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Abstract— The goal of this project is to use Response spectrum analysis to investigate how a twisted building responds to earthquake and wind loads. ETABS 2018 is used to carry out the analysis. In the study, a building model with G+25, G+30, and G+35 storeys and a constant storey height of 3.1m was used. For this study, analysis and design are done in accordance with Indian Standard Code. A tall building's stiffness can be viewed as an indirect indicator of how vulnerable it is to dynamic forces. This effect is influenced by the wind speed and the building's aerodynamic characteristics. As a building's height grows, the wind load value rises. High spatial stiffness raises the natural vibration frequency, which for low values might be hazardous for construction, while reducing the acceleration linked to a structure's horizontal displacements. At certain wind speeds, the structure can enter a resonance that results in severe stresses and vertical displacement.

The aerodynamic twisted design has the benefit of disrupting the direction of the wind's impact around the building, which helps to significantly lessen wind excitation. While designing all the forces that induce on the building were considered and in Post analysis of the structure, maximum shear forces, bending moments, maximum storey displacement, behaviour of building to seismic force, storey stiffness, storey drift and other reactions are computed.

Keywords: RCC Frame Structure, Twisted Building, ETAB, Storey Drift, Storey Acceleration, Base Shear etc.

INTRODUCTION

An earthquake is a natural tragedy that has claimed millions of lives throughout known and unwritten history [1], [2]. An earthquake is a disruptive disturbance that generates surface shaking owing to subsurface movement along a fault line or volcanic activity [3]. The produced forces are irresponsible and only last a brief time. Humans are puzzled by its ambiguity in terms of occurrence time and nature. However, with the advancement of knowledge throughout the years, a degree of probabilistic predictability has been reached [3].

The ability to predict the recurrence and strength of earthquakes for a certain region has improved, but this only solves one half of the

problem: knowing what's coming! The second phase is structural seismic design – to resist the storm! This component of the problem has evolved throughout the previous century, with advancements in design philosophy and methodology continually investigated, proposed, and implemented [4], [6]. This chapter introduces the notion of foundation isolation for earthquake-resistant structure design. The usefulness of seismic isolation is proved by modeling and analysis of multi-storey buildings, bridges, and pools [6], [8], [9].

The trend of RCC high-rise structures has increased nowadays in India [14], [16]. Many different amenities, gardens, etc., have been provided in high-story buildings which are very attractive from an aesthetic point of view, but they can be dangerous from a structural point of view [15], [16]. If they break for some reason and all the water rushes out, it would destroy some interior and possibly some windows. In most cases, the extra water mass will help the building resist earthquakes by acting as a liquid mass dampener [7], [9], [10]. Tall buildings carry very large gravity and lateral loads [4], [5].

Twisted tall buildings of various heights, height-to-width aspect ratios, and rates of twist are designed and their structural efficiency is investigated [14], [16], [35], [38]. Due to the unique geometric configurations of twisted forms, structural buildings are quite different from those employed for tall buildings of rectangular box forms. Twisted forms involve not only structural but also architectural and constructional challenges [1], [4], [14].

- This project investigates the optimum twist angle of the RCC building [14].
- To increase value in certain buildings there are associated risks that we take [14].
- The amenities provided in high-storey buildings are attractive from an aesthetic point of view [15].
- This project represents the structural behaviour of RCC twisted buildings subjected to static load [14].
- In this project, the non-linear static method is being used [14].

In the era of urbanization and vertical growth, the structural performance of high-rise buildings under dynamic loads such as wind

and seismic forces has become a critical subject of study [5], [13], [14]. With the increasing demand for tall structures due to limited land availability in urban regions, engineers are constantly exploring innovative architectural and structural configurations to ensure stability, safety, and efficiency [1], [4]. One such architectural trend is the introduction of twisted or torsional building designs, which not only add aesthetic value but also significantly influence the structural behavior under lateral loads [14], [38].

Traditionally, reinforced cement concrete (RCC) buildings have followed rectangular or square geometries that offer simplicity in design and analysis. However, such conventional buildings often face greater challenges under dynamic loads, especially as height increases [16], [17], [41]. The stiffness, mass distribution, and geometric shape of a building play a major role in determining its response to earthquakes and wind forces. A twisted building, which is geometrically altered along its vertical axis, provides better aerodynamic performance, helping to reduce wind-induced vibrations and structural resonance [38], [39].

This study is a comparative descriptive research and analytical investigation of twisted versus traditional RCC high-rise buildings. The research focuses on understanding the response of these structures when subjected to earthquake and wind forces, using Response Spectrum Analysis (RSA) as the principal methodology [14], [41]. RSA is particularly effective in evaluating the maximum response of structures during seismic events, capturing the modal characteristics and providing insight into potential vulnerabilities [14].

The ETABS 2018 software is utilized for the modeling and analysis of RCC structures with G+25, G+30, and G+35 storeys, all with a consistent floor height of 3.1 meters. The design and analysis are conducted in accordance with both Indian (IS) and American (ACI/ASCE) standard codes [14], [41], [42], allowing a comparative understanding of how different international building regulations impact structural performance.

The parameters such as storey drift, base shear, natural frequency, storey displacement, bending moments, shear forces, and storey stiffness are evaluated [14]. The twisted configuration is analyzed for its capability to disrupt wind flow paths, thereby minimizing lateral excitation [38]. The relationship between a building's stiffness and its dynamic behavior is emphasized, especially considering the effect of resonance phenomena that can lead to large deformations and potential structural failure [14], [16].

Through this research, the comparative performance of twisted and traditional buildings is quantified, providing engineers and designers with valuable insights into optimal structural configurations for high-rise buildings in seismic and wind-prone zones [14], [38], [41].

As cities grow vertically, the demand for structurally safe, sustainable, and architecturally innovative high-rise buildings is increasing rapidly [1], [4]. Traditional RCC structures have been the backbone of construction for decades, but the advent of complex geometries such as twisted towers has opened new possibilities in both architectural aesthetics and structural performance [35], [38]. Twisted buildings, with their torsional configurations and aerodynamic advantages, offer improved resistance to dynamic loads such as wind and earthquakes. However, their behavior under these forces needs to be scientifically validated through advanced computational techniques [14], [39].

This study provides a comparative descriptive research and analytical evaluation of twisted and traditional RCC buildings using ETABS 2018 software, with reference to both Indian (IS 456:2000, IS 1893:2016) and American (ACI 318, ASCE 7-16) design codes [14], [41]. The research focuses on assessing the seismic and wind performance of high-rise buildings through Response Spectrum Analysis (RSA), a dynamic method widely used in earthquake engineering to estimate structural response based on natural vibration modes [6], [7], [14].

[41] This paper investigates the comparative effectiveness of seismic-resisting elements—specifically shear walls, X-type bracing, and their combined use—in multistoried RCC buildings. Using analytical

methods and simulation models, the study evaluates how these structural configurations impact lateral load resistance, storey drift, displacement, and overall stability during seismic events. The results highlight that the combination of shear wall and bracing significantly improves performance over using either element alone.[42] This study uses Finite Element Analysis (FEA) to evaluate the behavior of dry mechanical connections in precast beam-column joints. [42] the research aims to enhance the ductility, strength, and energy dissipation capacity of precast structures without relying on traditional wet joints. Findings suggest that dry mechanical connectors can improve ease of assembly and seismic performance, offering a sustainable and time-efficient solution for precast construction.

[43] This paper presents a comparative analysis of precast and monolithic (cast-in-situ) RCC structural systems. It focuses on aspects such as construction time, cost efficiency, structural integrity, seismic resistance, and sustainability. [43] the study concludes that while precast systems offer speed and quality control, monolithic structures tend to perform better under seismic conditions due to their monolithic continuity. Recommendations are made for hybrid approaches combining benefits of both systems.

Novelty of the Study

- **Dual Code-Based Analysis:** The research is unique in its comparative approach using both Indian and American codes, which is rare in existing literature.
- **Focus on Twisting Geometry:** While many studies address regular buildings, this project emphasizes aerodynamically twisted buildings, showcasing how such geometries can reduce wind-induced excitation.
- **Height-Wise Comparison:** Inclusion of three different building heights (G+21, G+30, G+31) helps reveal how building behavior scales with vertical growth in twisted vs. traditional designs.
- **Comprehensive Parameter Evaluation:** Most existing works focus only on drift and base shear; this research includes story-wise acceleration, stiffness degradation, modal participation factors, and more.

Model Development [14], [41]: Three different high-rise structures (G+25, G+30, and G+35 storeys) are modelled, each with a uniform storey height of 3.1 meters. Two geometric configurations are considered for each: a conventional (rectilinear) layout and a twisted architectural form.

Software Tool: ETABS 2018 is used for modeling, analysis, and design. The software allows precise computation of modal parameters, story-wise deformation, and internal forces.

Loading Conditions:

- Static Dead and Live Loads.
- Lateral dynamic loads due to seismic activity (as per Zone V for India) and wind loads (with variable wind pressure based on height).

Design Codes Used:

- Indian Codes [41]: IS 456:2000 for RCC design, IS 875 for loads, IS 1893:2016 for earthquake analysis.
- American Codes [42]: ACI 318 for RCC, ASCE 7-16 for load combinations and wind/seismic considerations.

Response Spectrum Analysis (RSA): This method helps determine how structures behave under different modes of vibration, capturing the maximum expected response to earthquake ground motions.

Parameters Studied:

- Storey Drift and Storey Displacement
- Base Shear and Overturning Moments
- Storey Stiffness Distribution
- Natural Time Periods and Frequency
- Maximum Bending Moments and Shear Forces

• Lateral Acceleration and Resonance Behavior

The project compares building behavior at different heights, analyzing twisting impact. It compares Indian and American building codes, examining their influence on safety margins and reinforcement requirements. The study evaluates structural performance metrics, including comfort and serviceability.

Research Statement

A twisted RCC building exposed to seismic loads utilizing ETab. The twist rate of RCC twisted buildings will be studied. Each level grows at its own rate. ETab will model. Base shear and storey displacement data will be shown. This project's goal is to find the best angle.

Goal of Study

“To find optimum angle of twist and position of RCC twisted buildings under seismic loads.”

Research Objectives

The objectives of this study are as the following:

- To design and analysis Symmetrical building and normal RCC frame a building model with G+21, G+30, and G+31 storeys by using ETAB Software using Indian Code
- To design & analysis of twisted building of G+21, G+30, and G+31 storeys using American Code
- To compare the technical parameter like storey drift, storey acceleration, storey stiffness etc.
- Comparatively Study Design and analysis of RCC twisted building with Normal Building for G+21, G+30 & G+31 by using ETAB

RESEARCH METHODOLOGY

The Methods of Earthquake Analysis

Two broad approaches of earthquake analysis of multi – storied structures are

A. I) Static Analysis –

B. II) **Equivalent Static Method** – its linear static method. In this method formulas are developed to approximately represent behavior of regular structures. Base shear is calculated and distributed to various floor levels. This method is not used for irregular structures.

- **Response Spectrum Method** – It is a linear dynamic method. This method estimates peak values of response quantities. It can be used for any type of building and at all locations.
- The work consists of G+21, 30 & 31, buildings and each building has given angle of twist using Indian and American Code. For each angle of twist there will be seven buildings considering.
- For modeling and analysis of buildings ETab will be used.
- In this project Response Spectrum Method is used for dynamic analysis of RCC twisted building as designer is not often bothered about the structure's response at every instance of time, maximum response is enough information to design the structure.
- The parameters storey displacement, storey drift and base shear will be checked and their graphical representation will be made.
 - Results
 - Conclusion

Assumption:

- Material grade m10 fe100
- Beam = 0.811X0.4m
- Colum = 0.18X0.8m
- Colum = 1.3X1.3m
- Wall = 0.3m
- Wall = 0.4m
- Load pattern

- - 1) Dead load
 - 2) Live load
 - 3) Super red load
 - 4) Earth quake: x direction
 - 1) Earth quake: Y direction
 - 6) Wind load: x direction
 - 7) Wind load: Y direction
- Response spectrum analysis
- Grade of concrete M10

DESIGN & MODELLING

Design of G+25 of 1.1 Angle Degrees for RCC Building

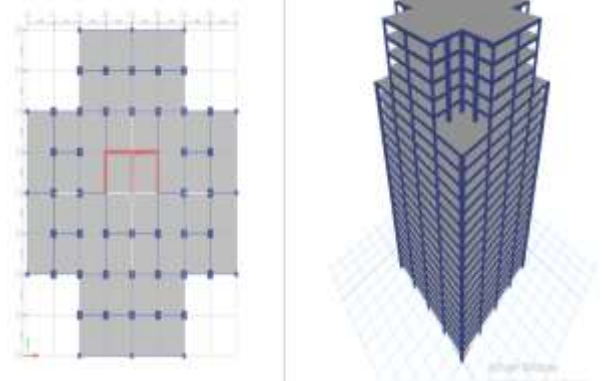


Fig1.78: American Model Normal G+25 Plan & 3D View

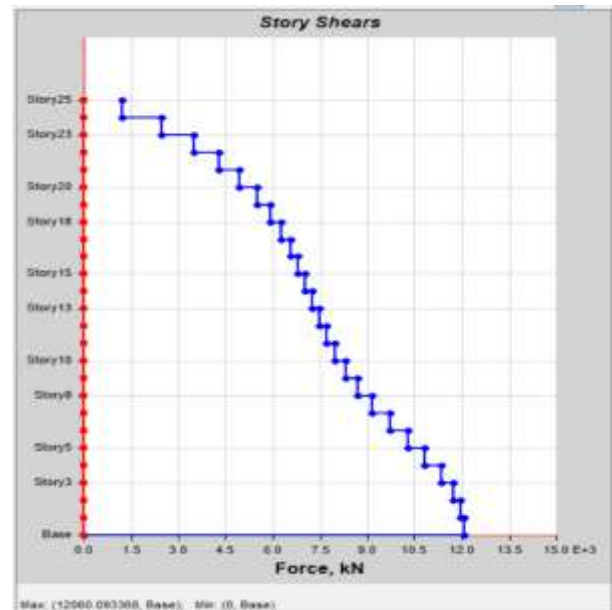


Fig 1.1 Indian Model Regular G+25 Story Shear

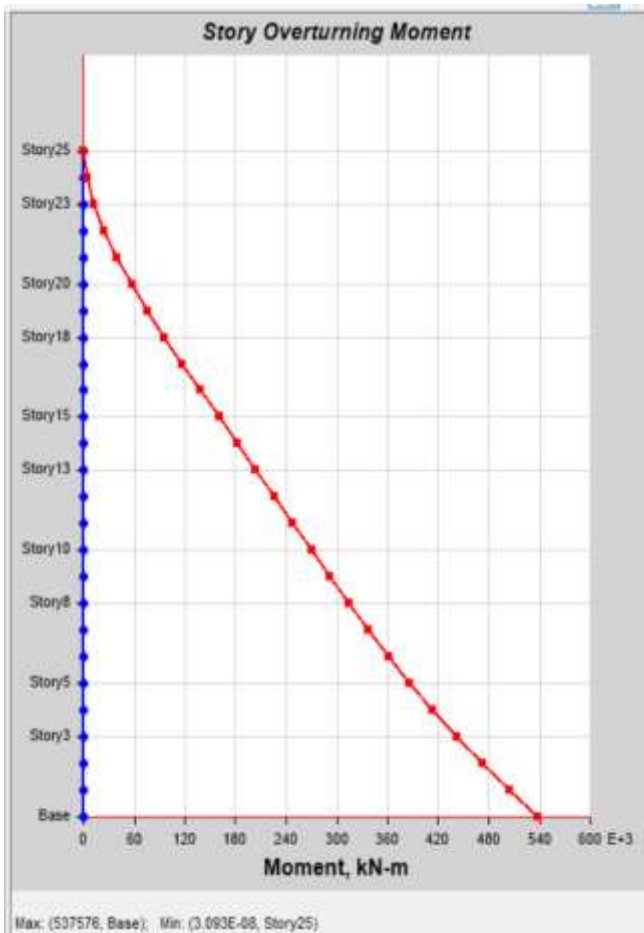


Fig 1.2 Indian Model Regular G+25 Story Overturning Moment

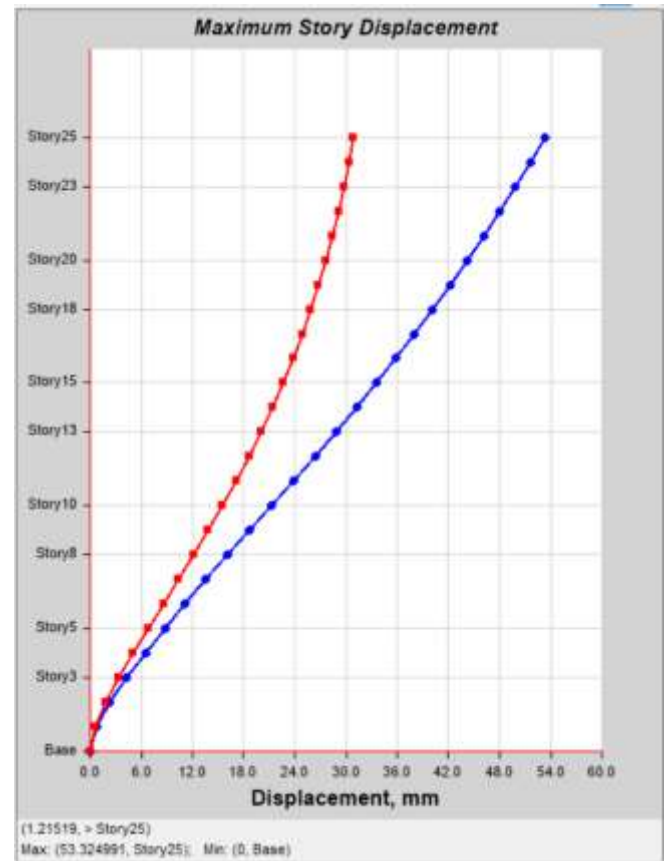


Fig 1.4 Indian Model Regular G+25 Maximum Story Displacement

Table 1.5 Indian Model Regular G+25 Max Story Displacement

Max Story Displacement	
Story	X-Dir
	Mm
Story25	53.325
Story24	51.648
Story23	49.873
Story22	48.032
Story21	46.133
Story20	44.189
Story19	42.197
Story18	40.142
Story17	38.02
Story16	35.829
Story15	33.568
Story14	31.233
Story13	28.828
Story12	26.358
Story11	23.831
Story10	21.26
Story9	18.664
Story8	16.064
Story7	13.486
Story6	11.085
Story5	8.819
Story4	6.542
Story3	4.328

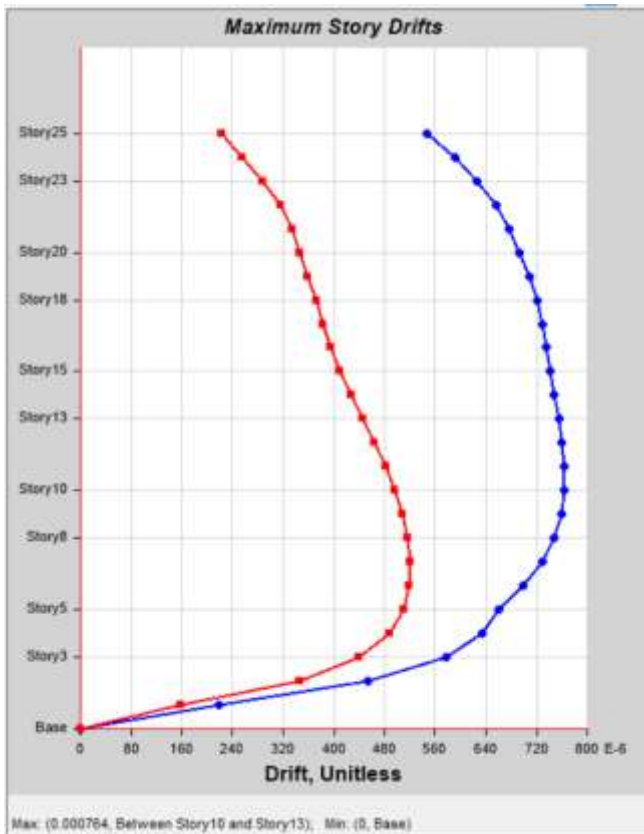
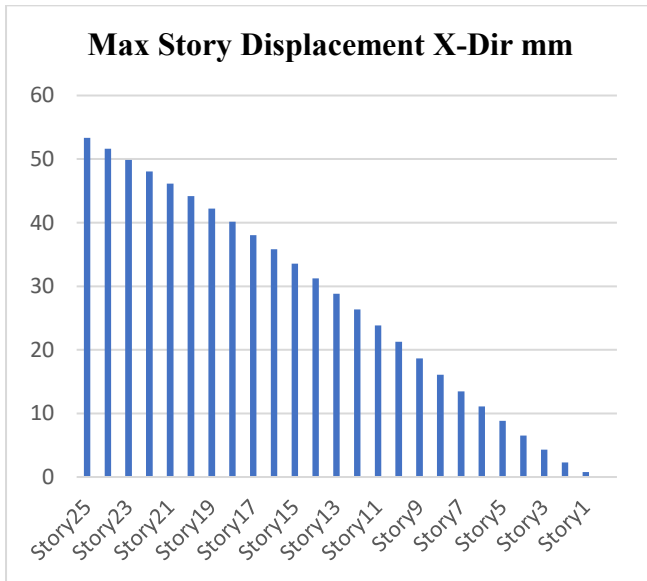


Fig 1.3 Indian Model Regular G+25 Maximum Story Drifts

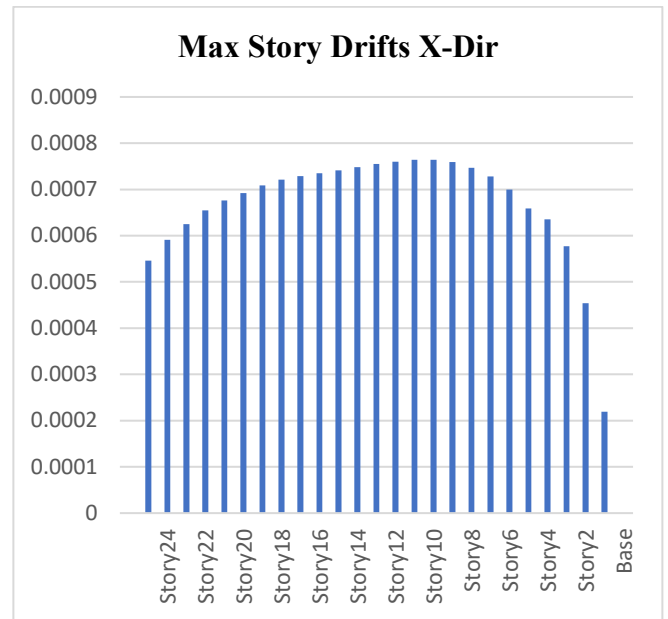
Story2	2.309
Story1	0.768
Base	0



Graph 1.6 Indian Model Regular G+25 Max Story Displacement X-Dir mm

Table1.7 Indian Model Regular G+25 Max Story Drifts

Max Story Drifts	
Story	X-Dir
Story25	0.000546
Story24	0.000591
Story23	0.000625
Story22	0.000655
Story21	0.000676
Story20	0.000692
Story19	0.000709
Story18	0.000721
Story17	0.000729
Story16	0.000735
Story15	0.000741
Story14	0.000748
Story13	0.000755
Story12	0.00076
Story11	0.000764
Story10	0.000764
Story9	0.000759
Story8	0.000747
Story7	0.000728
Story6	0.0007
Story5	0.000659
Story4	0.000635
Story3	0.000577
Story2	0.000454
Story1	0.000219
Base	0

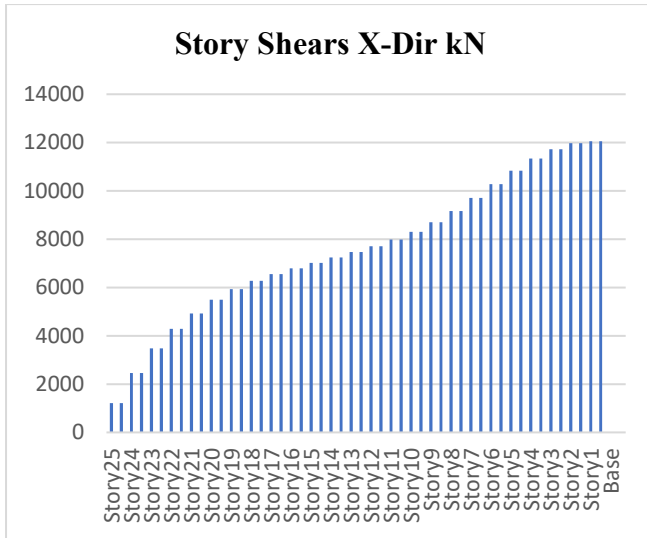


Graph 1.8 Indian Model Regular G+25 Max Story Drifts X-Dir

Table 1.9 Indian Model Regular G+25 Story Shears

Story Shears	
Story	X-Dir
	K N
Story25	1214.954
	1214.954
Story24	2451.721
	2451.721
Story23	3476.75
	3476.75
Story22	4293.15
	4293.15
Story21	4918.587
	4918.587
Story20	5494.036
	5494.036
Story19	5932.111
	5932.111
Story18	6272.364
	6272.364
Story17	6551.674
	6551.674
Story16	6795.835
	6795.835
Story15	7021.398
	7021.398
Story14	7240.044
	7240.044
Story13	7462.948
	7462.948
Story12	7703.589
	7703.589
Story11	7978.49
	7978.49
Story10	8305.675
	8305.675
Story9	8700.588
	8700.588
Story8	9169.81
	9169.81
Story7	9704.413
	9704.413
Story6	10276.22
	10276.22
Story5	10839.8
	10839.8
Story4	11340.83
	11340.83
Story3	11728.61
	11728.61
Story2	11969.6

	11969.6
Story1	12060.09
	12060.09
Base	0
	0

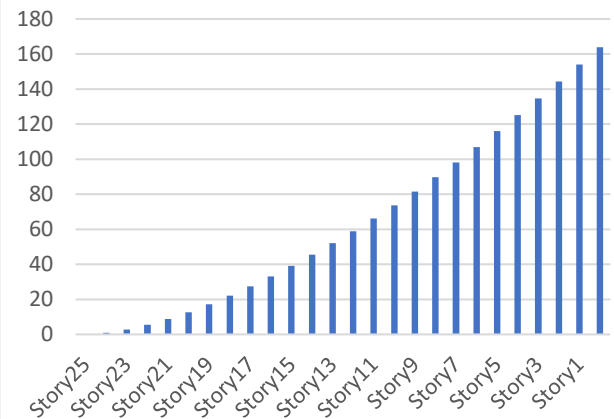


Graph 1.10 Indian Model Regular G+25 Story Shears X-Dir Kn

Table 1.11 Indian Model Regular G+25 Overturning Moment

Overturning Moment	
Story	X-Dir
	kN-m
Story25	0
Story24	0.934
Story23	2.7694
Story22	5.414
Story21	8.7629
Story20	12.7056
Story19	17.1924
Story18	22.1399
Story17	27.4767
Story16	33.1511
Story15	39.1327
Story14	45.4112
Story13	51.9904
Story12	58.8803
Story11	66.091
Story10	73.6277
Story9	81.49
Story8	89.6715
Story7	98.159
Story6	106.933
Story5	115.9667
Story4	125.2273
Story3	134.6773
Story2	144.2773
Story1	153.9888
Base	163.7784

Overturning Moment X-Dir kN-m



Graph 1.12 Indian Model Regular G+25 Overturning Moment X-Dir Kn-m

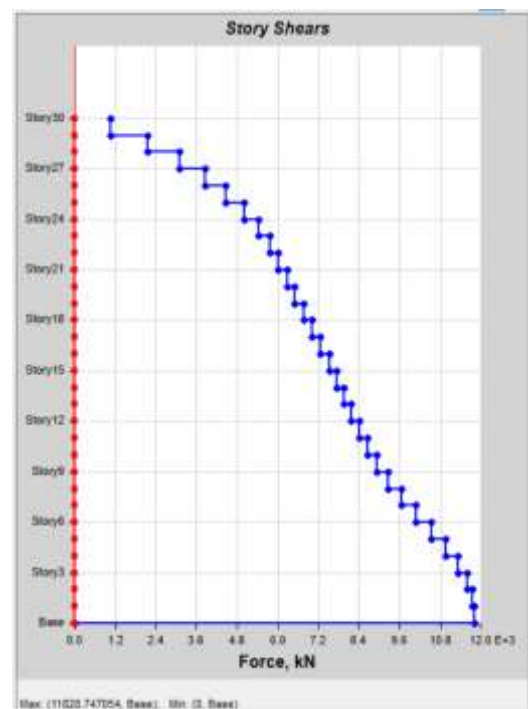
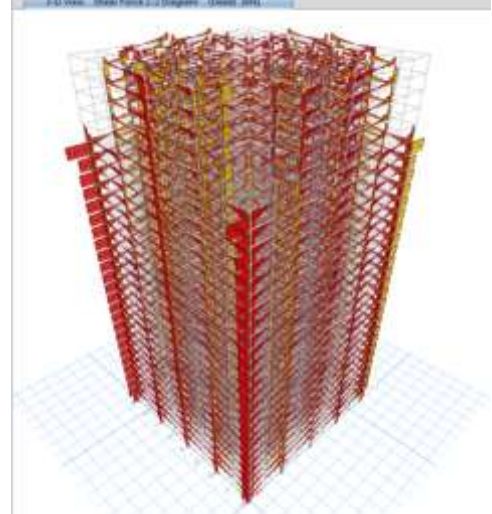


Fig 1.13 Indian Model Regular G+30 Story Shears



Structure 1.14 Indian Model Regular G+30 3-D View Shear Force 2-2 Diagram (Dead) [Kn]

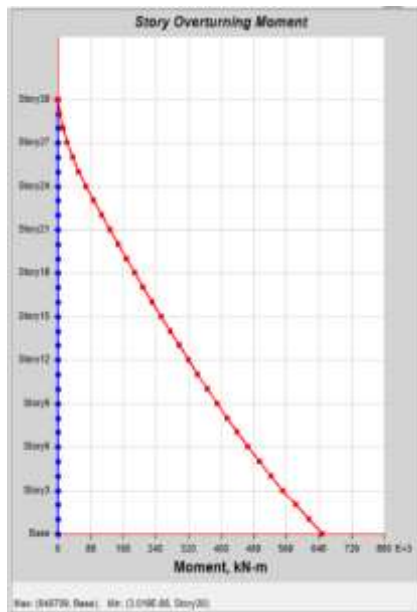


Fig 1.15 Indian Model Regular G+30 Story Overturning Moment

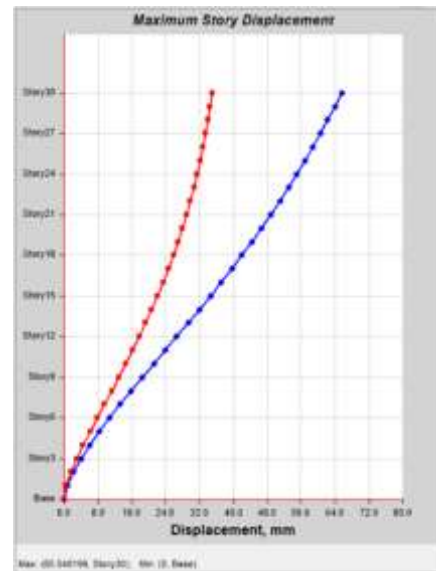
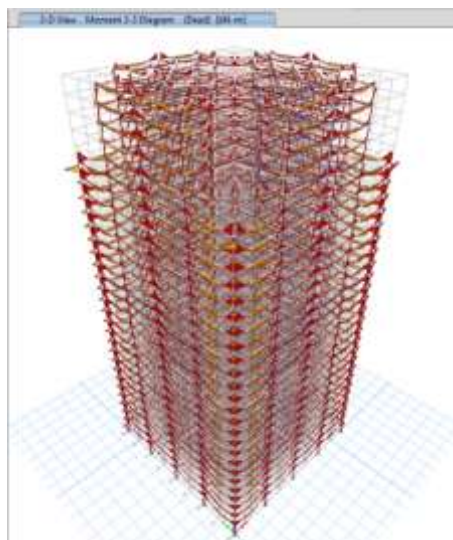


Fig 1.18 Indian Model Regular G+30 Maximum Story Displacement



Structure 1.16 Indian Model Regular G+30 3-D View Shear Force 3-D Diagram (Dead) [Kn]

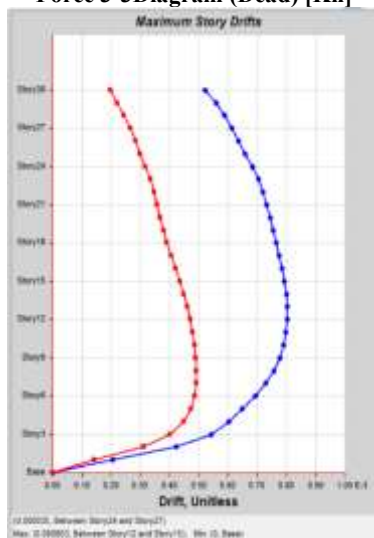
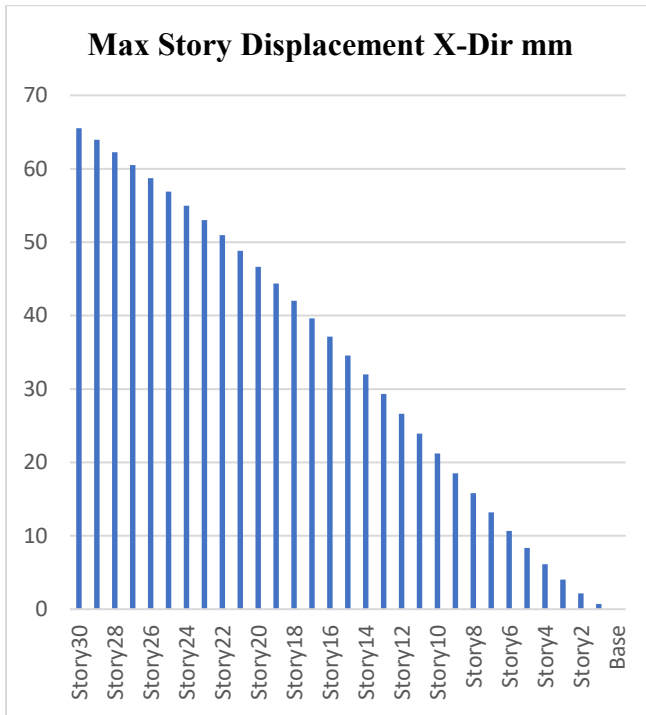


Fig 1.17 Indian Model Regular G+30 Maximum Story Drifts

Table 1.19 Indian Model Regular G+30 Max Story Displacement

Max Story Displacement	
Story	X-Dir mm
Story30	65.54
Story29	63.942
Story28	62.257
Story27	60.515
Story26	58.718
Story25	56.869
Story24	54.965
Story23	52.991
Story22	50.943
Story21	48.823
Story20	46.629
Story19	44.362
Story18	42.02
Story17	39.606
Story16	37.122
Story15	34.574
Story14	31.969
Story13	29.318
Story12	26.63
Story11	23.92
Story10	21.201
Story9	18.493
Story8	15.815
Story7	13.193
Story6	10.657
Story5	8.337
Story4	6.144
Story3	4.038
Story2	2.141

Story1	0.72
Base	0

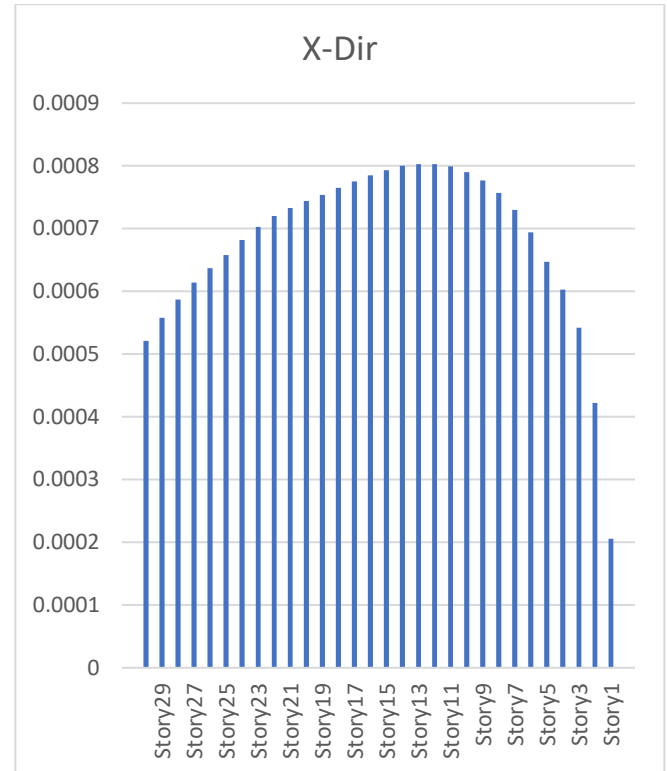


Graph 1.20 Indian Model Regular G+30 Max Story Displacement X-Dir mm

Table 1.21 Indian Model Regular G+30

Story	X-Dir
Story30	0.000521
Story29	0.000558
Story28	0.000587
Story27	0.000614
Story26	0.000637
Story25	0.000658
Story24	0.000682
Story23	0.000703
Story22	0.00072
Story21	0.000733
Story20	0.000744
Story19	0.000754
Story18	0.000765
Story17	0.000775
Story16	0.000785
Story15	0.000793
Story14	0.0008
Story13	0.000803
Story12	0.000803
Story11	0.000799
Story10	0.00079
Story9	0.000777
Story8	0.000757
Story7	0.00073
Story6	0.000694

Story5	0.000647
Story4	0.000603
Story3	0.000542
Story2	0.000422
Story1	0.000206
Base	0

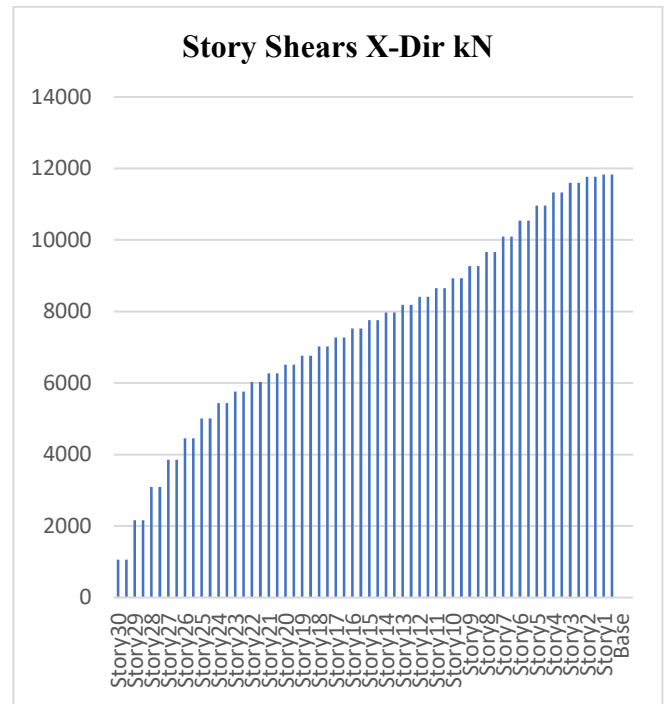


Graph 1.22 Indian Model Regular G+30 X-Dir

Table 1.23 Indian Model Regular G+30 Story Shears

Story Shears	
Story	X-Dir
	kN
Story30	1060
	1060
Story29	2162.583
	2162.583
Story28	3095.934
	3095.934
Story27	3857.402
	3857.402
Story26	4454.558
	4454.558
Story25	5011.811
	5011.811
Story24	5435.639
	5435.639
Story23	5761.579
	5761.579
Story22	6030.04
	6030.04
Story21	6274.374

	6274.374
Story20	6516.366
	6516.366
Story19	6765.261
	6765.261
Story18	7020.2
	7020.2
Story17	7274.607
	7274.607
Story16	7520.808
	7520.808
Story15	7753.764
	7753.764
Story14	7973.578
	7973.578
Story13	8186.758
	8186.758
Story12	8406.1
	8406.1
Story11	8648.772
	8648.772
Story10	8932.315
	8932.315
Story9	9268.969
	9268.969
Story8	9659.96
	9659.96
Story7	10092.07
	10092.07
Story6	10538.3
	10538.3
Story5	10962.6
	10962.6
Story4	11327.37
	11327.37
Story3	11601.51
	11601.51
Story2	11767.71
	11767.71
Story1	11828.75
	11828.75
Base	0
	0

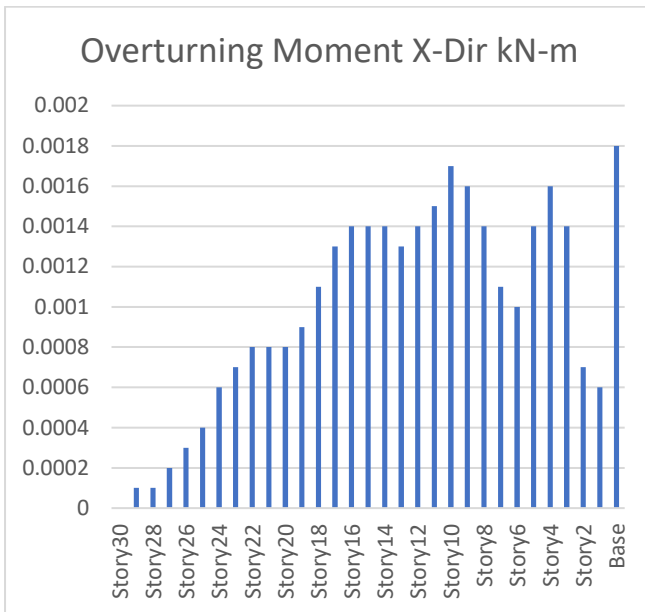


Graph 1.24 Indian Model Regular G+30 Story Shears X-Dir Kn

Table 1.25 Indian Model Regular G+30
Overturning Moment
Overturning Moment

Story	X-Dir
	kN-m
Story30	0
Story29	0.0001
Story28	0.0001
Story27	0.0002
Story26	0.0003
Story25	0.0004
Story24	0.0006
Story23	0.0007
Story22	0.0008
Story21	0.0008
Story20	0.0008
Story19	0.0009
Story18	0.0011
Story17	0.0013
Story16	0.0014
Story15	0.0014
Story14	0.0014
Story13	0.0013
Story12	0.0014
Story11	0.0015
Story10	0.0017
Story9	0.0016
Story8	0.0014
Story7	0.0011
Story6	0.001
Story5	0.0014
Story4	0.0016

Story3	0.0014
Story2	0.0007
Story1	0.0006
Base	0.0018



Graph 1.26 Indian Model Regular G+30 Overturning Moment X-Dir kN-m

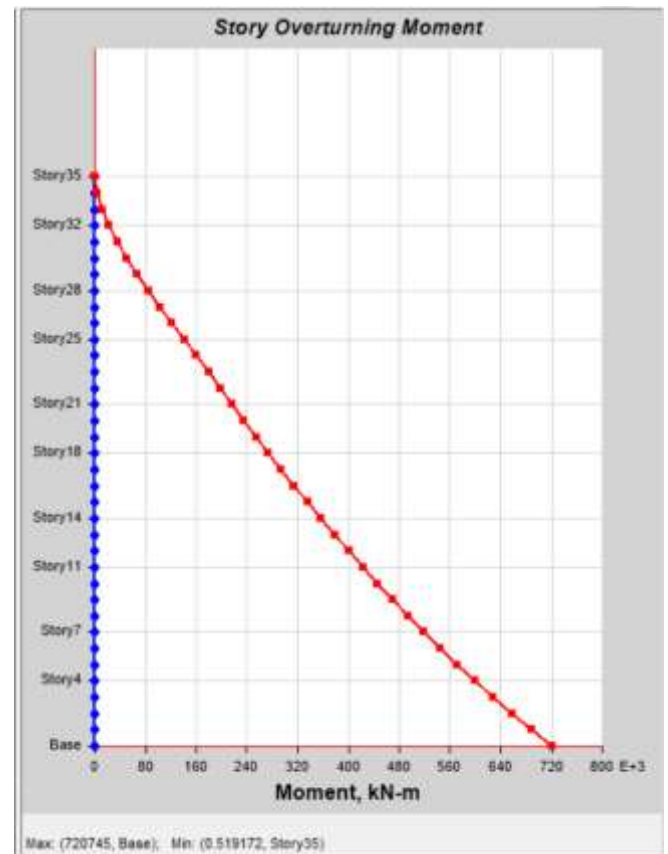


Fig 1.28 Indian Model Regular G+35 Story Overturning Moment

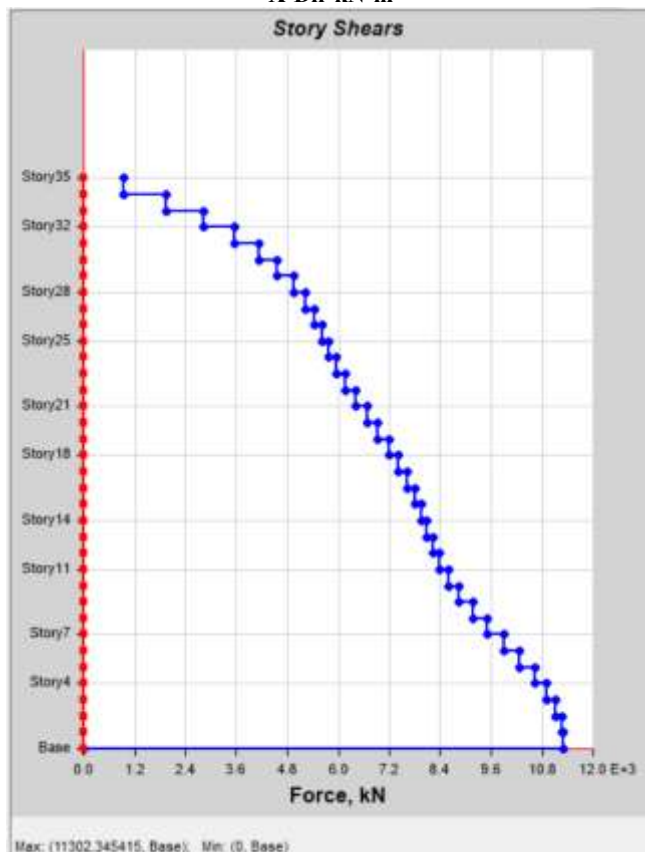


Fig 1.27 Indian Model Regular G+35 Story Shears

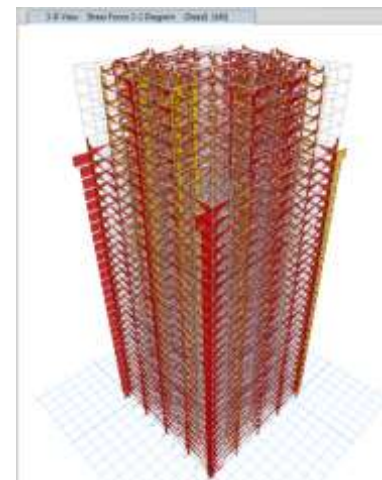


Figure1.29 Indian Model Regular G+35 30 3-D View Shear Force 2-2 Diagram (Dead) [Kn]

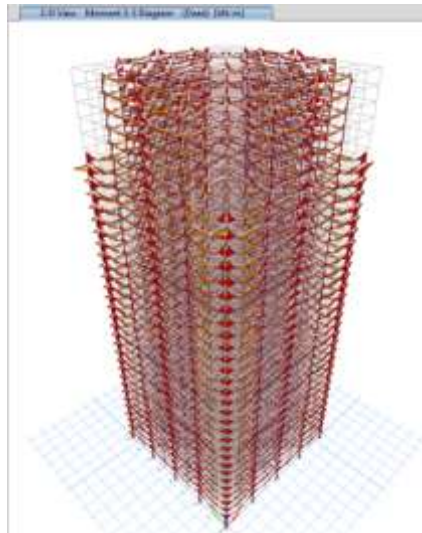


Figure:1.30 Indian Model Regular G+35 30 3-D View Shear Force 3-3 Diagram (Dead) [Kn]

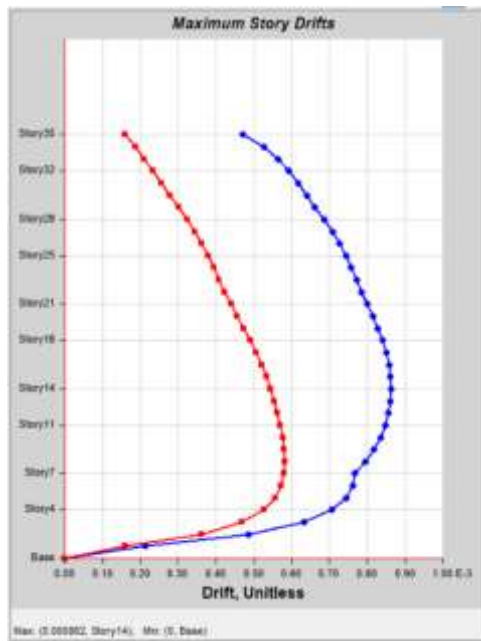


Fig 1.31 Indian Model Regular G+35 Maximum Story Drifts

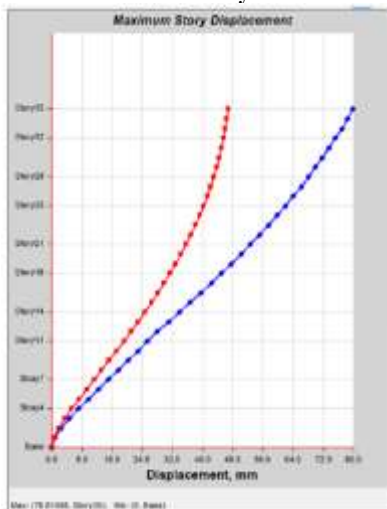
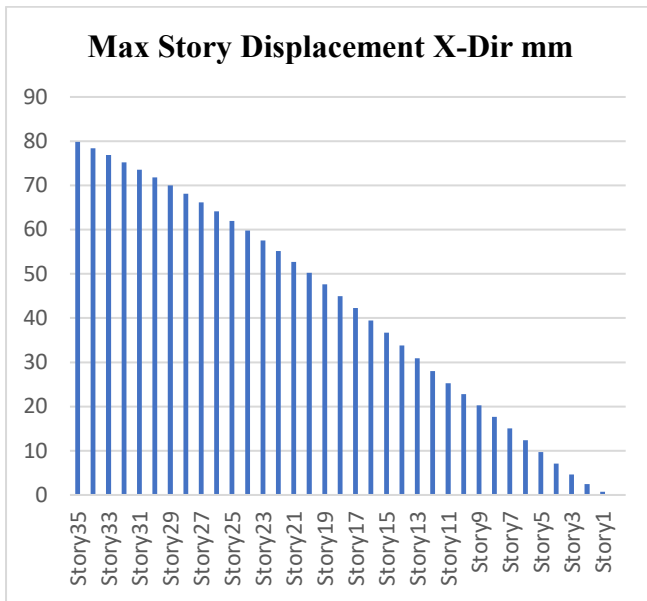


Fig 1.32 Indian Model Regular G+35 Maximum Story Displacement

Table 1.33 Indian Model Regular G+35 Maximum Story Displacement

Max Story Displacement	
Story	X-Dir
	mm
Story35	79.815
Story34	78.42
Story33	76.871
Story32	75.236
Story31	73.54
Story30	71.783
Story29	69.967
Story28	68.09
Story27	66.135
Story26	64.099
Story25	61.983
Story24	59.788
Story23	57.512
Story22	55.156
Story21	52.721
Story20	50.208
Story19	47.622
Story18	44.967
Story17	42.251
Story16	39.483
Story15	36.669
Story14	33.819
Story13	30.941
Story12	28.046
Story11	25.288
Story10	22.791
Story9	20.245
Story8	17.655
Story7	15.028
Story6	12.376
Story5	9.727
Story4	7.126
Story3	4.655
Story2	2.449
Story1	0.748
Base	0

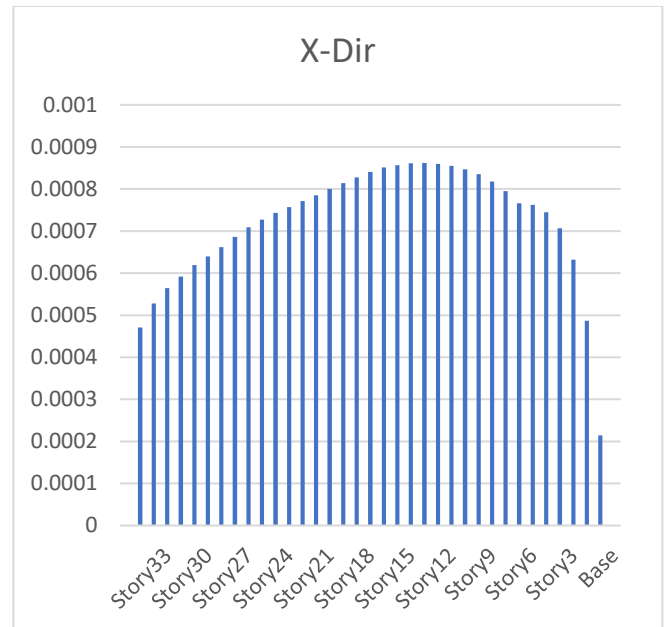


Graph 1.34 Indian Model Regular G+35 Maximum Story Displacement X-Dir mm

Table 1.35 Indian Model Regular G+35 Max Story Drifts

Max Story Drifts	
Story	X-Dir
Story35	0.000471
Story34	0.000528
Story33	0.000564
Story32	0.000592
Story31	0.000619
Story30	0.00064
Story29	0.000662
Story28	0.000686
Story27	0.000709
Story26	0.000727
Story25	0.000743
Story24	0.000757
Story23	0.000771
Story22	0.000785
Story21	0.0008
Story20	0.000814
Story19	0.000828
Story18	0.000841
Story17	0.000851
Story16	0.000857
Story15	0.000861
Story14	0.000862
Story13	0.00086
Story12	0.000855
Story11	0.000847
Story10	0.000835
Story9	0.000818
Story8	0.000795
Story7	0.000766

Story6	0.000762
Story5	0.000745
Story4	0.000707
Story3	0.000632
Story2	0.000487
Story1	0.000214
Base	0

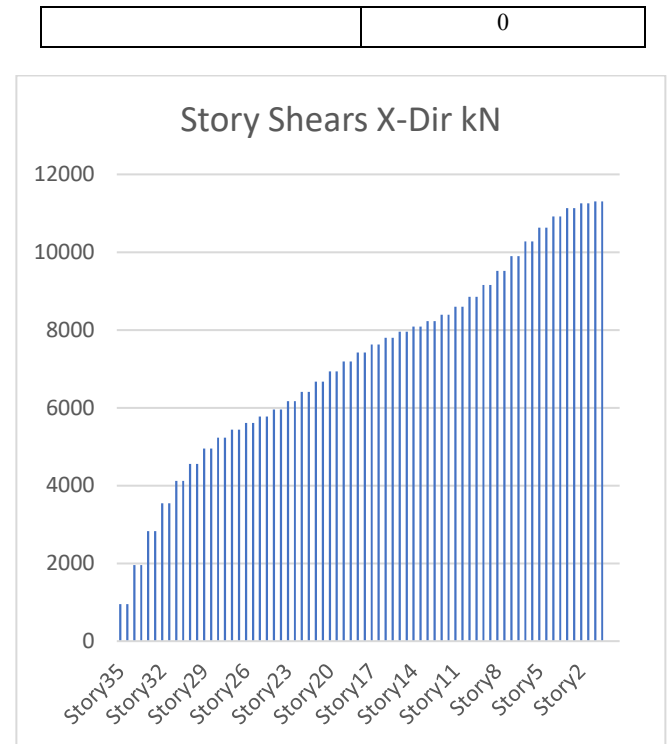


Graph 1.36 Indian Model Regular G+35 X-Dir

Table 1.37 Indian Model Regular G+35 Story Shears

Story Shears	
Story	X-Dir
kN	
Story35	952.4219
Story34	952.4219
Story33	1955.919
Story32	1955.919
Story31	2824.685
Story30	2824.685
Story29	3545.895
Story28	3545.895
Story27	4121.179
Story26	4121.179
Story25	4559.904
Story24	4559.904
Story23	4947.827
Story22	4947.827
Story21	5230.57
Story20	5230.57
Story19	5439.401
Story18	5439.401
Story17	5610.503
Story16	5610.503
Story15	5775.979

	5775.979
Story24	5958.928
	5958.928
Story23	6170.599
	6170.599
Story22	6410.569
	6410.569
Story21	6669.588
	6669.588
Story20	6933.751
	6933.751
Story19	7188.551
	7188.551
Story18	7422.032
	7422.032
Story17	7626.908
	7626.908
Story16	7801.826
	7801.826
Story15	7951.942
	7951.942
Story14	8088.737
	8088.737
Story13	8228.828
	8228.828
Story12	8391.449
	8391.449
Story11	8594.591
	8594.591
Story10	8850.423
	8850.423
Story9	9161.302
	9161.302
Story8	9517.866
	9517.866
Story7	9900.011
	9900.011
Story6	10280.43
	10280.43
Story5	10629.53
	10629.53
Story4	10920.52
	10920.52
Story3	11133.5
	11133.5
Story2	11258.81
	11258.81
Story1	11302.35
	11302.35
Base	0



Graph 1.38 Indian Model Regular G+35 Story Shears X-Dir kN

Table 1.39 Indian Model Regular G+35 Overturning Moment

Overturning Moment	
Story	X-Dir
	kN-m
Story35	0.5192
Story34	0.5378
Story33	1.0242
Story32	1.6194
Story31	2.2565
Story30	2.9154
Story29	3.5914
Story28	4.2726
Story27	4.955
Story26	5.6342
Story25	6.3108
Story24	6.9795
Story23	7.6467
Story22	8.3121
Story21	8.9832
Story20	9.6695
Story19	10.3767
Story18	11.1075
Story17	11.8697
Story16	12.6663
Story15	13.4975
Story14	14.3558
Story13	15.2421
Story12	16.1533
Story11	17.0828
Story10	18.0278

Story9	18.9873
Story8	19.9633
Story7	20.9614
Story6	21.9884
Story5	23.0517
Story4	24.1578
Story3	25.3102
Story2	26.5093
Story1	27.7537
Base	29.0321

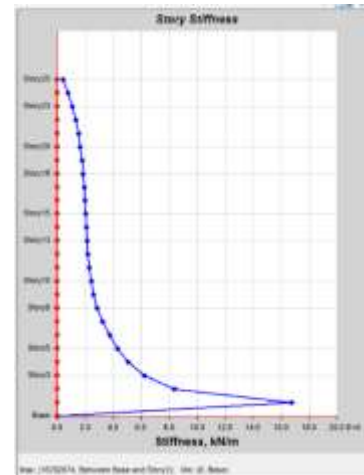
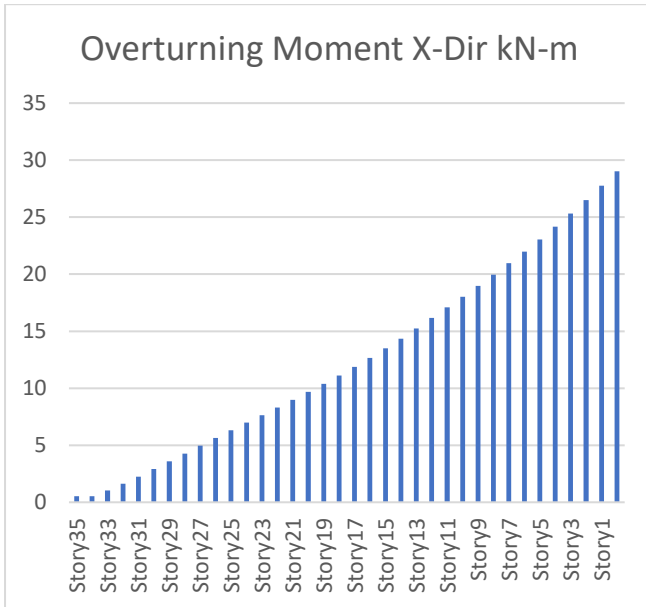
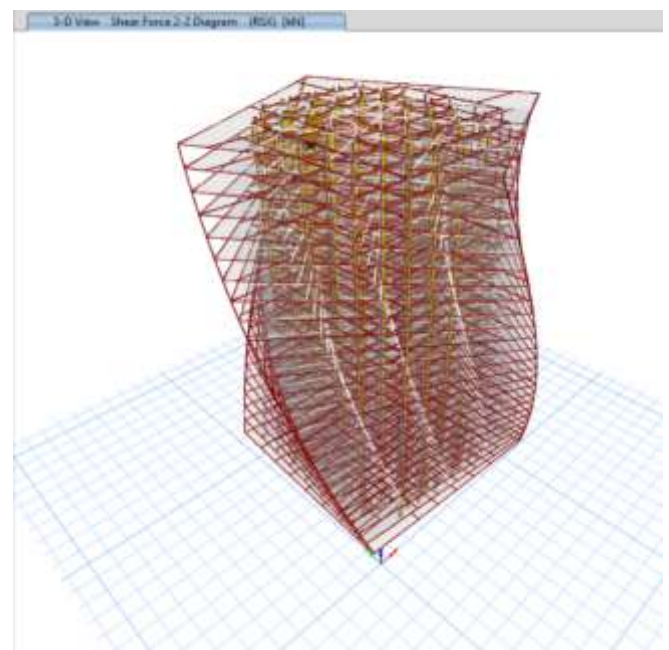


Fig 1.42 Indian Model Twisted G+25 Story Stiffness



Graph 1.40 Indian Model Regular G+35 Overturning Moment X-Dir Kn-m



Structur 1.43 Indian Model Twisted G+25 3-D View Shear Force 2-2 Diagram (Dead) [kN]

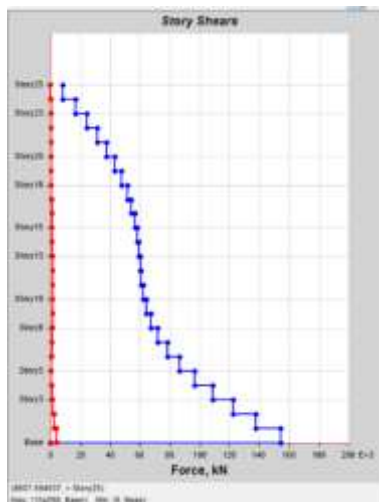


Fig 1.41 Indian Model Twisted G+25 Story Shears

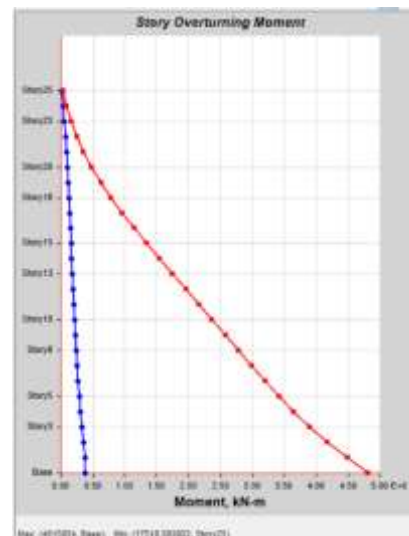
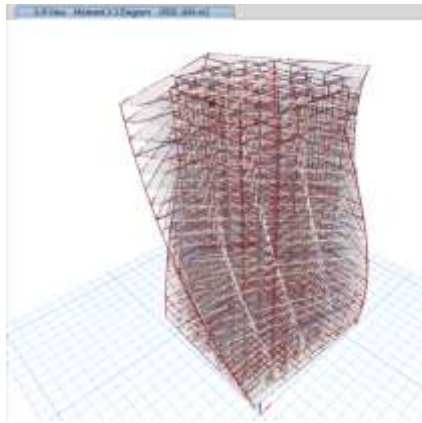


Fig 1.44 Indian Model Twisted G+25 Story Overturning Moment



Structur 1.45 Indian Model Twisted G+25 3-D View Shear Force 3-3 Diagram (Dead) [Kn]

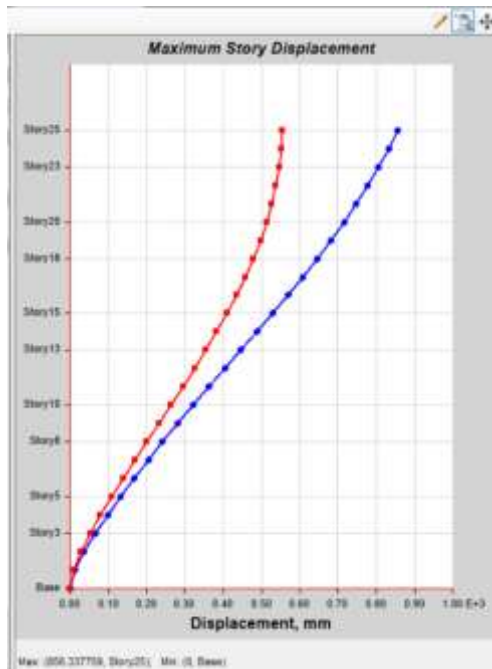
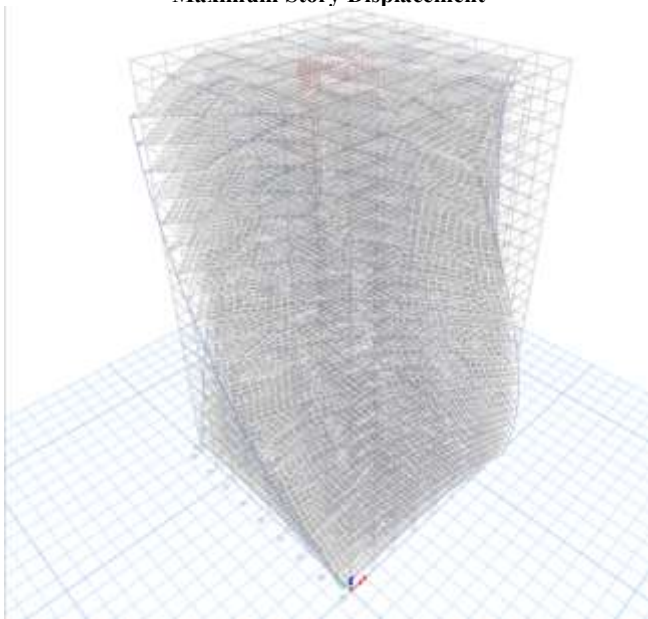


Fig 1.46 Indian Model Twisted G+25 Maximum Story Displacement



Structur 1.47 Indian Model Twisted G+25

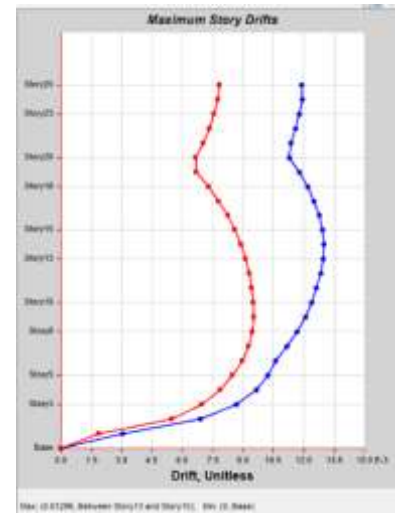
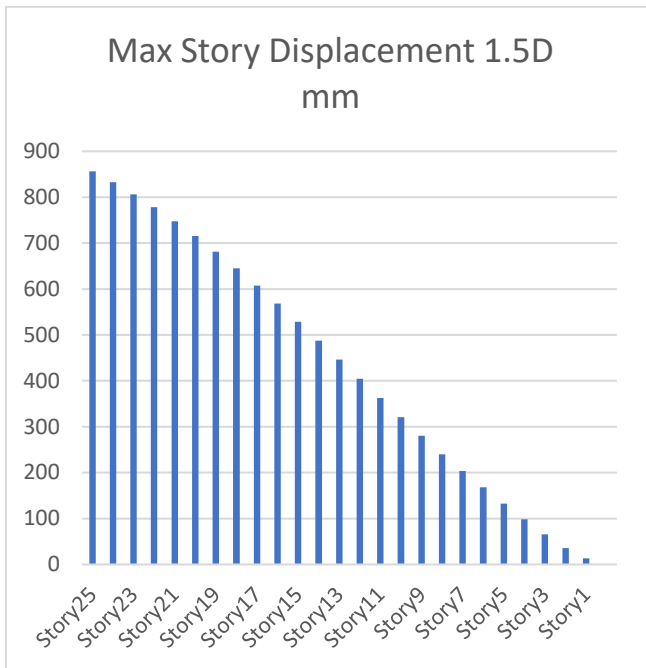


Fig 1.48 Indian Model Twisted G+25 Maximum Story Drifts

Table 1.49 Indian Model Twisted G+25 Max Story Displacement

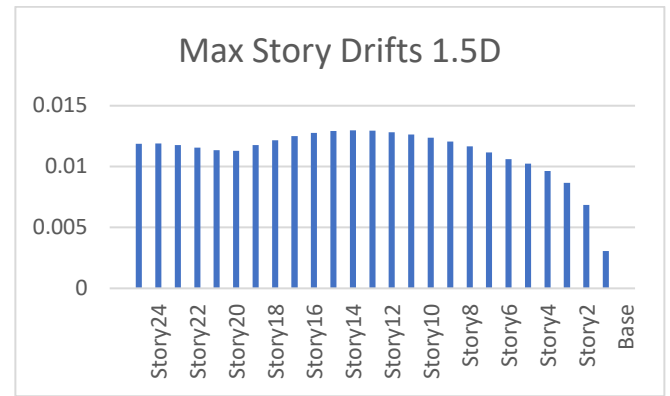
Max Story Displacement	
Story	1.5D
	mm
Story25	856.338
Story24	832.612
Story23	806.326
Story22	778.04
Story21	747.733
Story20	715.385
Story19	681.167
Story18	645.189
Story17	607.639
Story16	568.719
Story15	528.641
Story14	487.686
Story13	446.125
Story12	404.311
Story11	362.576
Story10	321.166
Story9	280.255
Story8	240.124
Story7	203.845
Story6	168.117
Story5	132.783
Story4	98.284
Story3	65.317
Story2	35.741
Story1	13.024
Base	0



**Graph 1.49 Indian Model Twisted G+25
Max Story Displacement 1.5D mm**

Table 1.50 Indian Model Twisted G+25 Max Story Drifts

Max Story Drifts	
Story	1.5D
Story25	0.011869
Story24	0.01191
Story23	0.01177
Story22	0.011568
Story21	0.011336
Story20	0.011291
Story19	0.011766
Story18	0.012175
Story17	0.012509
Story16	0.012761
Story15	0.012919
Story14	0.01299
Story13	0.012955
Story12	0.012822
Story11	0.012622
Story10	0.01238
Story9	0.012067
Story8	0.01167
Story7	0.011175
Story6	0.010611
Story5	0.010231
Story4	0.009642
Story3	0.008665
Story2	0.006862
Story1	0.003056
Base	0



**Graph 1.50 Indian Model Twisted G+25
Max Story Drifts 1.5D**

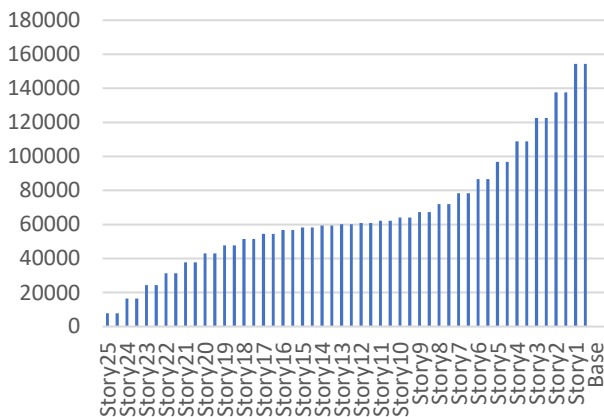
Table 1.51 Indian Model Twisted G+25 Story Shears

Story Shears	
Story	1.5D
Story25	7888.335
Story24	16477.85
Story23	24315.15
Story22	31401.22
Story21	37663.04
Story20	43063.46
Story19	47677.53
Story18	51448.87
Story17	54422.05
Story16	56639.97
Story15	58220.33
Story14	59307.95
Story13	60110.67
Story12	60909.63
Story11	62090.9

	62090.9
Story10	64061.39
	64061.39
Story9	67191.35
	67191.35
Story8	71865.05
	71865.05
Story7	78315.1
	78315.1
Story6	86625.75
	86625.75
Story5	96820.76
	96820.76
Story4	108816.2
	108816.2
Story3	122479.9
	122479.9
Story2	137705.9
	137705.9
Story1	154297.8
	154297.8
Base	0
	0

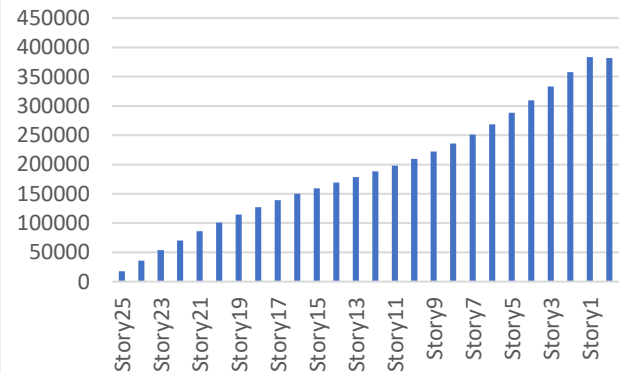
Story21	86071.08
Story20	100910.2
Story19	114640.4
Story18	127324.9
Story17	139028.3
Story16	149752.6
Story15	159548.2
Story14	169139.4
Story13	178495.5
Story12	188064.2
Story11	198206.1
Story10	209393.3
Story9	222146.2
Story8	236001.1
Story7	251412.4
Story6	268843.3
Story5	288239.1
Story4	309818.4
Story3	333097.9
Story2	357997.3
Story1	383534.4
Base	381595.7

Story Shears 1.5D kN



Graph 1.51 1.51 Indian Model Twisted G+25
Story Shears 1.5D kN

Story Overturning Moment 1.5D
kN-m



Graph 1.52: Indian Model Twisted G+25
Story Overturning Moment 1.5D kN-m

Table 1.52 Indian Model Twisted G+25 Story Overturning
Moment

Story Overturning Moment	
Story	1.5D
	kN-m
Story25	17518.58
Story24	35854.7
Story23	53764.31
Story22	70359.63

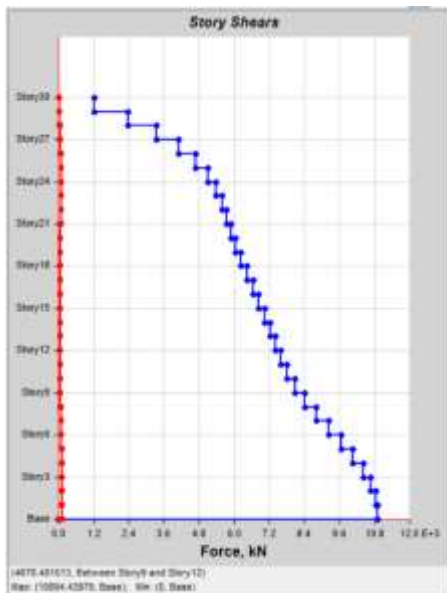


Fig 1.49: Indian Model Twisted G+30 Story Shears

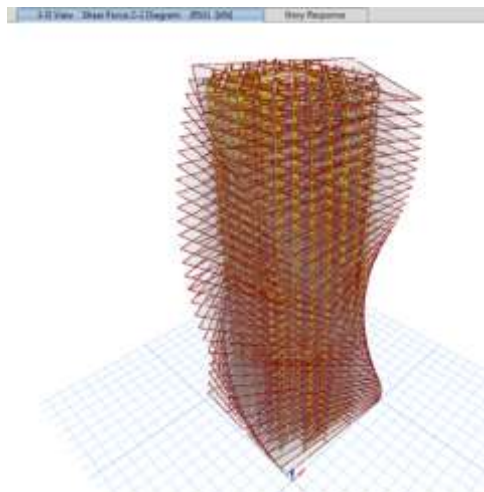


Figure1.50 Indian Model Twisted G+30 3-D View Shear Force 2-2 Diagram (Dead) [Kn]

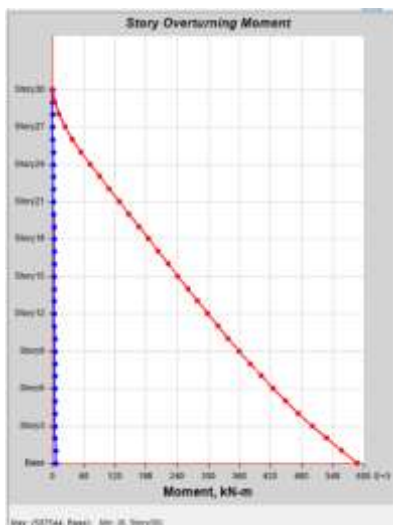


Fig 1.51 Indian Model Twisted G+30 Story Overturning Moment

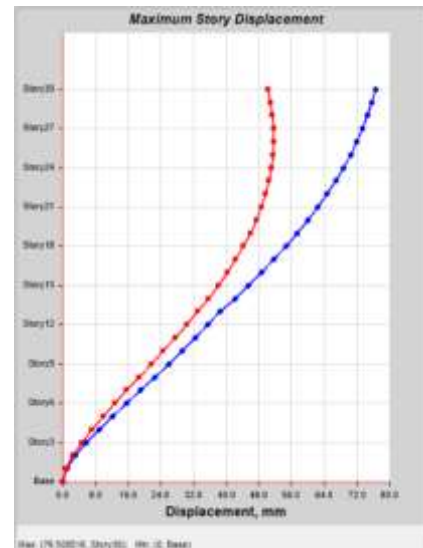


Fig 1.52 Indian Model Twisted G+30 Maximum Story Displacement

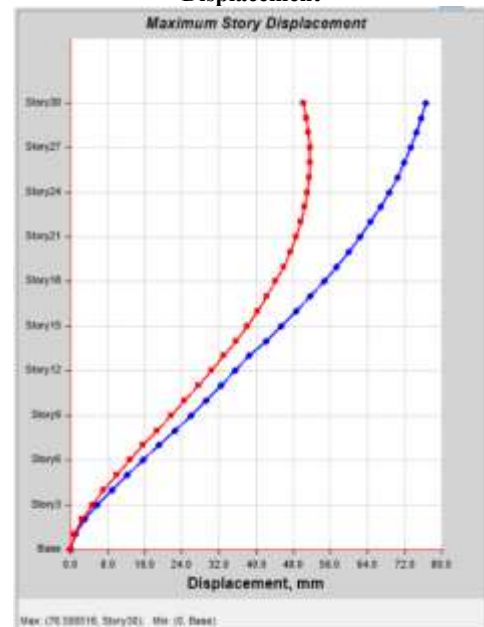


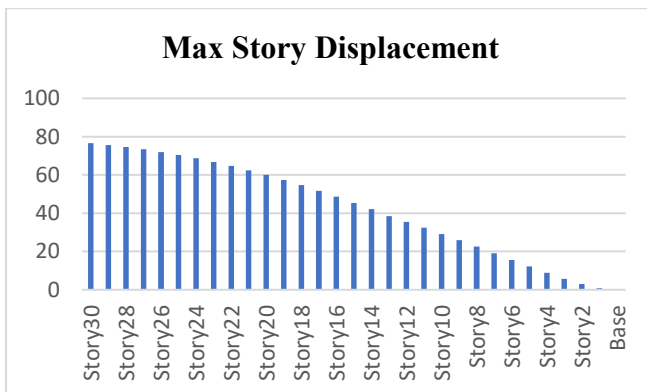
Fig 1.53 Indian Model Twisted G+30 Maximum Story Displacement

Table 1.53 Indian Model Twisted G+30 Maximum Story Displacement

Max Story Displacement	
Story	2.5
	mm
Story30	76.509
Story29	75.642
Story28	74.583
Story27	73.359
Story26	71.967
Story25	70.403
Story24	68.668
Story23	66.761
Story22	64.683
Story21	62.432
Story20	60.007
Story19	57.408
Story18	54.637

Story17	51.699
Story16	48.603
Story15	45.362
Story14	42.063
Story13	38.52
Story12	35.472
Story11	32.38
Story10	29.174
Story9	25.873
Story8	22.498
Story7	19.072
Story6	15.626
Story5	12.206
Story4	8.88
Story3	5.754
Story2	3.003
Story1	0.913
Base	0

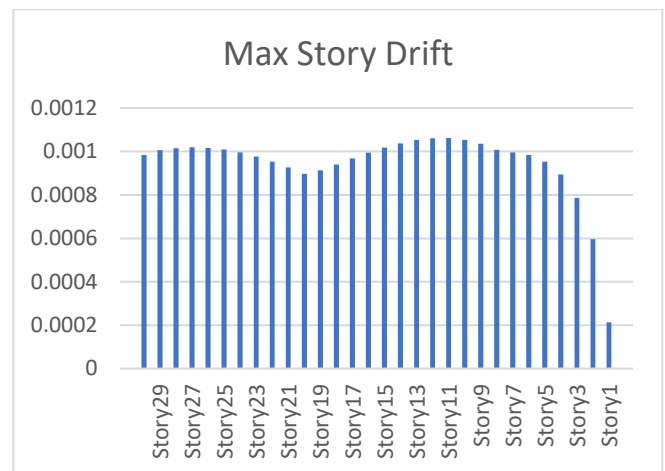
Story13	0.001053
Story12	0.001061
Story11	0.001062
Story10	0.001054
Story9	0.001036
Story8	0.001008
Story7	0.000996
Story6	0.000984
Story5	0.000953
Story4	0.000894
Story3	0.000786
Story2	0.000597
Story1	0.000213
Base	0



Graph 1.53: Indian Model Twisted G+30 Maximum Story Displacement

Table1.54 Indian Model Twisted G+30 Max Story Drift

Story	Max Story Drift
Story30	0.000985
Story29	0.001006
Story28	0.001015
Story27	0.001019
Story26	0.001017
Story25	0.001009
Story24	0.000996
Story23	0.000977
Story22	0.000954
Story21	0.000927
Story20	0.000897
Story19	0.000913
Story18	0.00094
Story17	0.000968
Story16	0.000994
Story15	0.001018
Story14	0.001038

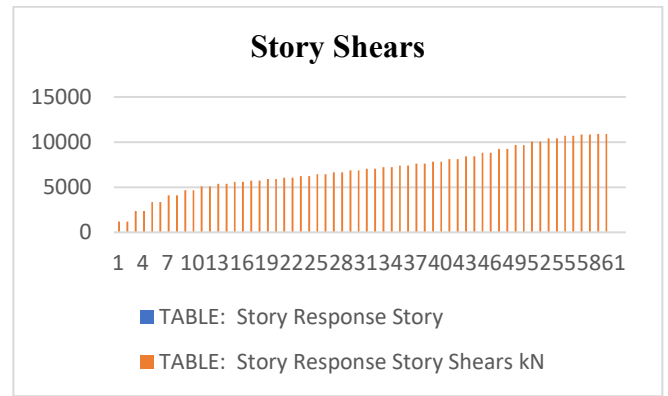


Graph 1.54: Indian Model Twisted G+30 Max Story Drift

Table 1.55: Indian Model Twisted G+30 Max Story Shears

Story	Story Shears
	kN
Story30	1201.9126
	1201.9126
Story29	2373.6977
	2373.6977
Story28	3342.3184
	3342.3184
Story27	4107.8045
	4107.8045
Story26	4683.279
	4683.279
Story25	5095.0333
	5095.0333
Story24	5380.082
	5380.082
Story23	5581.2674
	5581.2674
Story22	5740.5533
	5740.5533
Story21	5891.6302

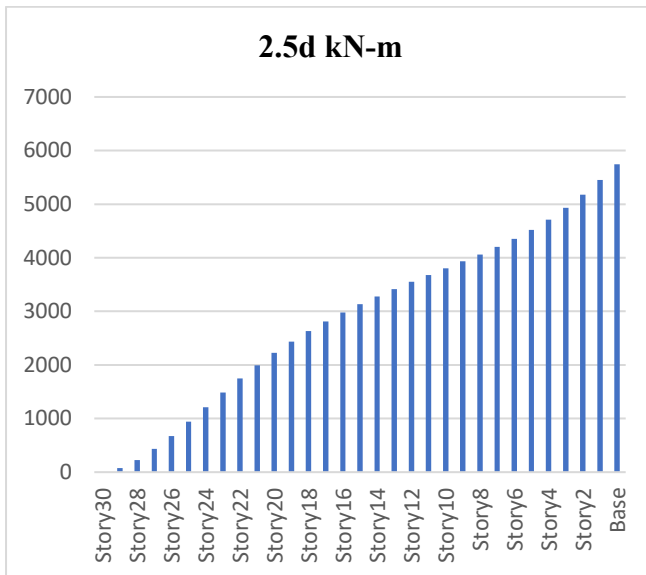
	5891.6302
Story20	6055.6509
	6055.6509
Story19	6239.7397
	6239.7397
Story18	6439.9205
	6439.9205
Story17	6646.3556
	6646.3556
Story16	6848.8313
	6848.8313
Story15	7041.0937
	7041.0937
Story14	7223.5615
	7223.5615
Story13	7403.611
	7403.611
Story12	7595.7826
	7595.7826
Story11	7818.4461
	7818.4461
Story10	8088.8563
	8088.8563
Story9	8417.1528
	8417.1528
Story8	8801.2569
	8801.2569
Story7	9224.8272
	9224.8272
Story6	9659.2987
	9659.2987
Story5	10069.0618
	10069.0618
Story4	10417.9574
	10417.9574
Story3	10678.3177
	10678.3177
Story2	10835.9367
	10835.9367
Story1	10894.4398
	10894.4398
Base	0
	0



Graph 1.55: Indian Model Twisted G+30 Max Story Shears

Table 1.56 Indian Model Twisted G+30 Max Story 2.5d

Story	2.5d
	kN-m
Story30	0
Story29	78.2242
Story28	228.1641
Story27	432.6229
Story26	674.8773
Story25	939.4756
Story24	1213.009
Story23	1484.674
Story22	1746.554
Story21	1993.583
Story20	2223.274
Story19	2435.131
Story18	2630.02
Story17	2809.616
Story16	2975.962
Story15	3131.179
Story14	3277.292
Story13	3416.131
Story12	3549.382
Story11	3678.624
Story10	3805.583
Story9	3932.5
Story8	4062.537
Story7	4200.01
Story6	4350.26
Story5	4519.032
Story4	4711.43
Story3	4930.731
Story2	5177.552
Story1	5449.79
Base	5743.46



Graph 1.56: Indian Model Twisted G+30 Max Story 2.5d

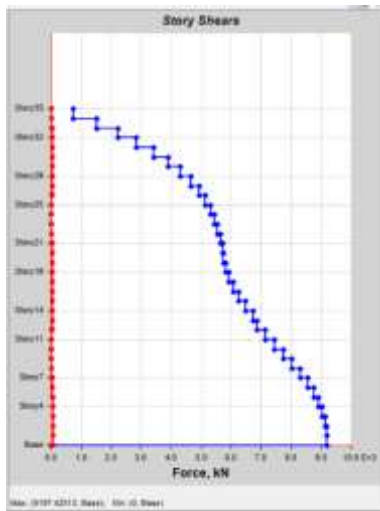


Fig 1.54: Indian Model Twisted G+35 Max Story Shears

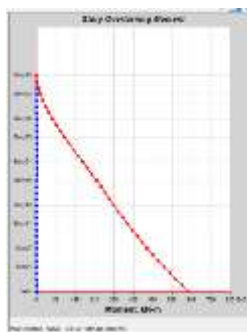


Fig 1.55: Indian Model Twisted G+35 Max Story Overturning Moment



Figure1.56: Indian Model Twisted G+35 3-D View Shear Force 2-2 Diagram (Dead) [Kn]

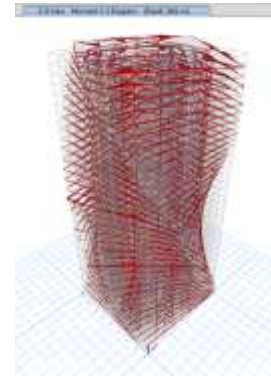


Figure 1.57: Indian Model Twisted G+35 3-D View Shear Force 3-3 Diagram (Dead) [Kn]

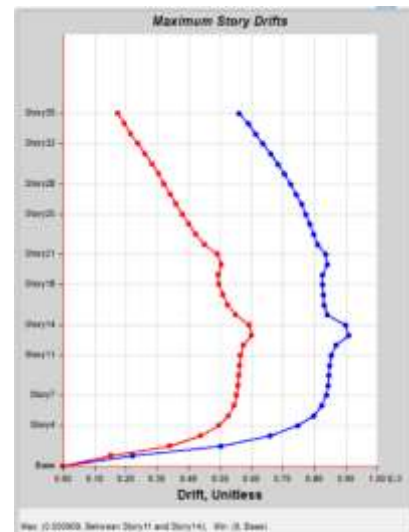


Fig 1.58: Indian Model Twisted G+35 Maximum Story Drifts

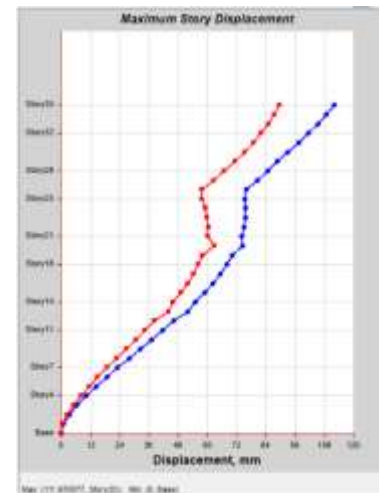
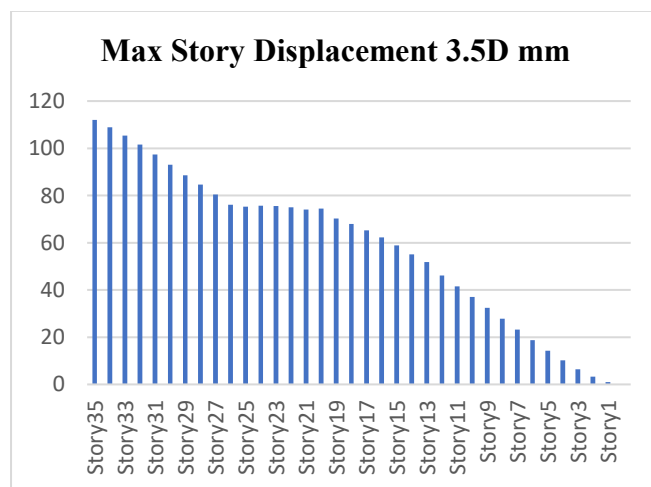


Fig 1.59: Indian Model Twisted G+35 Maximum Story Displacement

Table 1.57: Indian Model Twisted G+35 Story 3.5D

Story	3.5D
	mm
Story35	111.97
Story34	108.844
Story33	105.355
Story32	101.545
Story31	97.434

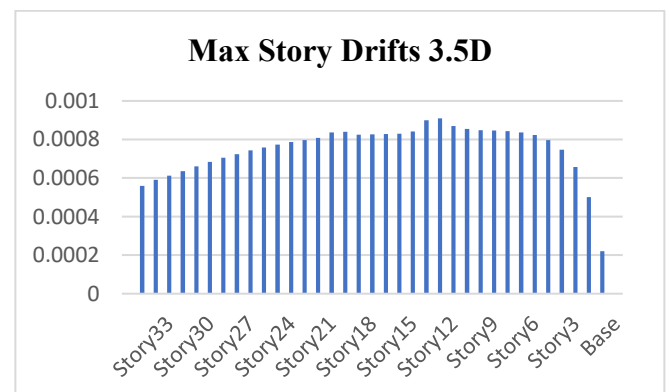
Story30	93.047
Story29	88.603
Story28	84.681
Story27	80.498
Story26	76.096
Story25	75.292
Story24	75.65
Story23	75.588
Story22	75.06
Story21	74.013
Story20	74.512
Story19	70.263
Story18	67.941
Story17	65.296
Story16	62.285
Story15	58.879
Story14	55.036
Story13	51.838
Story12	46.076
Story11	41.559
Story10	37.022
Story9	32.441
Story8	27.832
Story7	23.236
Story6	18.709
Story5	14.326
Story4	10.187
Story3	6.432
Story2	3.259
Story1	0.957
Base	0



Graph 1.57: Indian Model Twisted G+35 Max Story Displacement 3.5D mm

Table 1.58: Indian Model Twisted G+35 Story 3.5D

Story	3.5D
Story35	0.000559
Story34	0.00059
Story33	0.000613
Story32	0.000636
Story31	0.00066
Story30	0.000683
Story29	0.000705
Story28	0.000724
Story27	0.000743
Story26	0.000759
Story25	0.000773
Story24	0.000786
Story23	0.000797
Story22	0.000809
Story21	0.000836
Story20	0.00084
Story19	0.000825
Story18	0.000826
Story17	0.000828
Story16	0.00083
Story15	0.000841
Story14	0.0009
Story13	0.000909
Story12	0.00087
Story11	0.000854
Story10	0.000848
Story9	0.000846
Story8	0.000843
Story7	0.000837
Story6	0.000824
Story5	0.000797
Story4	0.000747
Story3	0.000657
Story2	0.000501
Story1	0.00022
Base	0

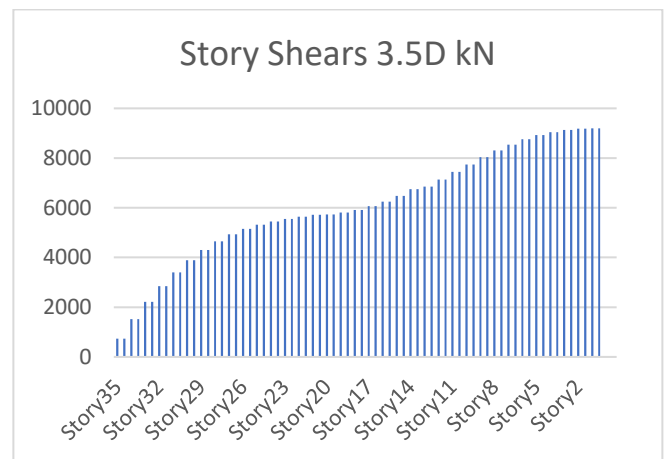


Graph1.58: Indian Model Twisted G+35 Story 3.5D

Table 1.59 Indian Model Twisted G+35 Story Drifts 3.5D

Story	3.5D
	kN
Story35	740.3072
	740.3072
Story34	1513.386
	1513.386
Story33	2216.816
	2216.816
Story32	2848.014
	2848.014
Story31	3405.721
	3405.721
Story30	3889.921
	3889.921
Story29	4302.92
	4302.92
Story28	4647.39
	4647.39
Story27	4927.869
	4927.869
Story26	5150.454
	5150.454
Story25	5322.907
	5322.907
Story24	5454.526
	5454.526
Story23	5556.109
	5556.109
Story22	5639.684
	5639.684
Story21	5718.017
	5718.017
Story20	5735.106
	5735.106
Story19	5811.354
	5811.354
Story18	5918.139
	5918.139
Story17	6063.469
	6063.469
Story16	6251.107
	6251.107
Story15	6479.932
	6479.932
Story14	6744.831
	6744.831
Story13	6851.925
	6851.925
Story12	7140.112

	7140.112
Story11	7440.134
	7440.134
Story10	7741.102
	7741.102
Story9	8031.867
	8031.867
Story8	8302.744
	8302.744
Story7	8545.499
	8545.499
Story6	8753.136
	8753.136
Story5	8921.245
	8921.245
Story4	9047.511
	9047.511
Story3	9132.99
	9132.99
Story2	9180.773
	9180.773
Story1	9197.425
	9197.425
Base	0
	0


Graph 1.59: Indian Model Twisted G+35 Story Shears 3.5D kN
Table 1.60: Indian Model Twisted G+35 Story 3.5D

Story	3.5D
	kN-m
Story35	0
Story34	56.7595
Story33	166.8546
Story32	318.4759
Story31	499.1415
Story30	695.989
Story29	896.1719
Story28	1087.313
Story27	1257.986

Story26	1398.194
Story25	1499.781
Story24	1556.888
Story23	1566.166
Story22	1527.009
Story21	1441.681
Story20	1315.447
Story19	1163.379
Story18	990.7505
Story17	809.0474
Story16	633.0235
Story15	482.2753
Story14	381.8784
Story13	348.9131
Story12	379.1004
Story11	420.7415
Story10	439.7356
Story9	420.962
Story8	360.6417
Story7	266.3759
Story6	182.2517
Story5	241.4146
Story4	433.467
Story3	675.7145
Story2	941.5637
Story1	1218.918
Base	1500.326

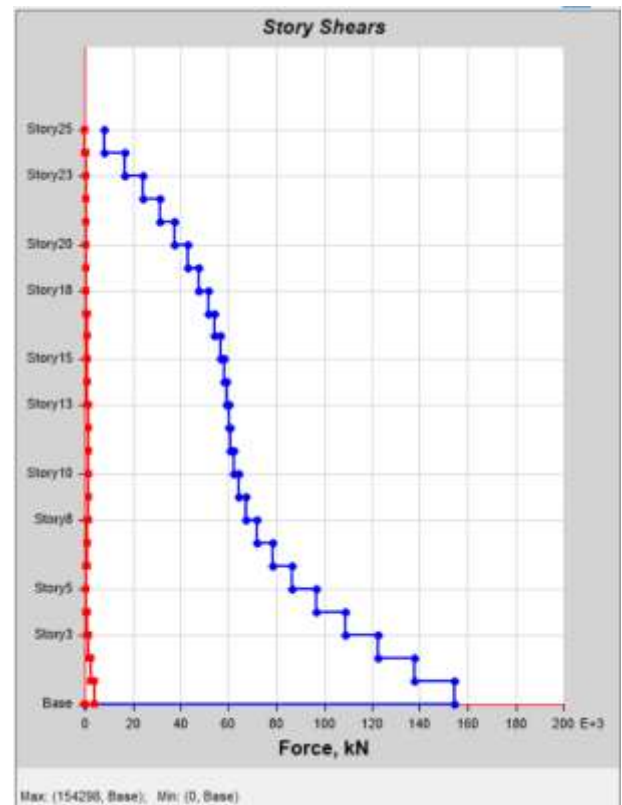


Fig 1.60: American Model Twisted G+25 Story Shears

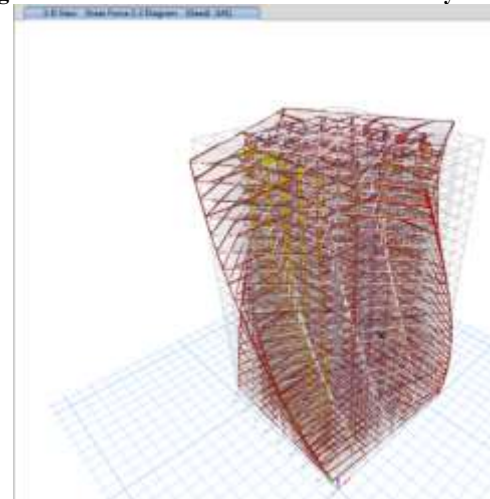
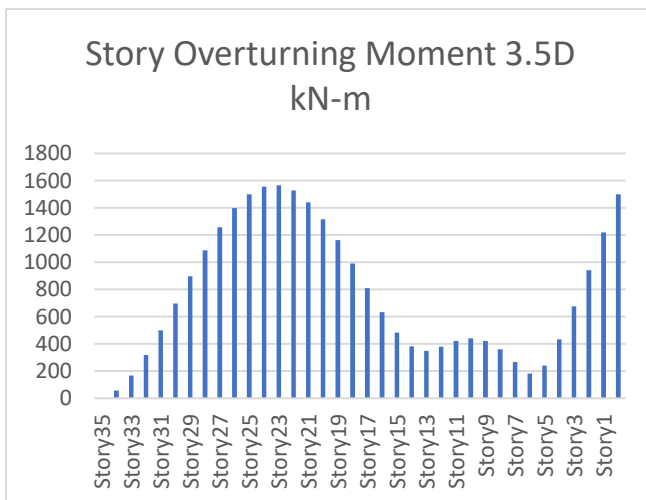


Figure1.61: American Model Twisted G+25 3-D View Shear Force 2-2 Diagram (Dead) [Kn]



Graph 1.60 Indian Model Twisted G+35 Story Overturning Moment 3.5D kN-m

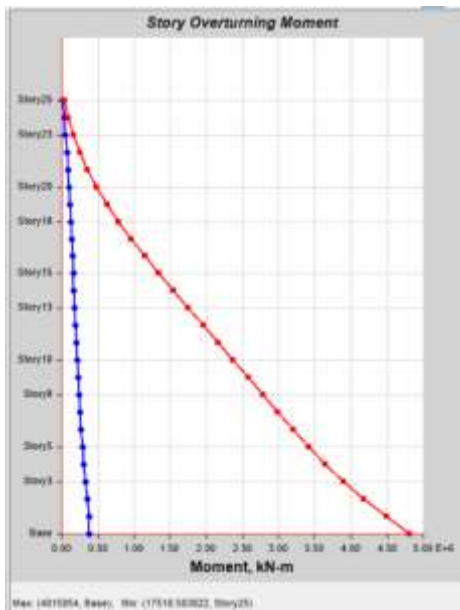


Fig 1.62: American Model Twisted G+25 Story Overturning Moment

3-D View: Moment 3-3 (Pages: 3) of 100-m

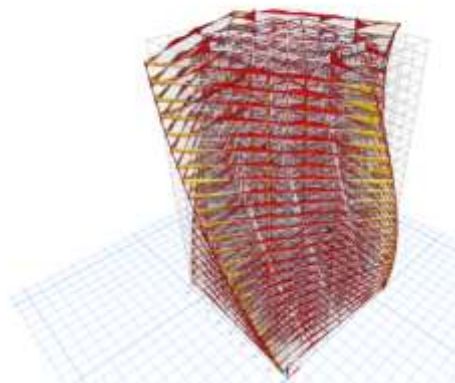


Figure1.63: American Model Twisted G+25 3-D View Shear Force 3-3 Diagram (Dead) [Kn]

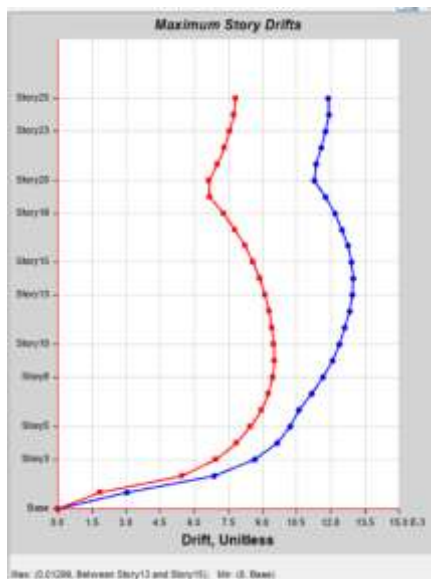


Fig 1.64: American Model Twisted G+25 Maximum Story Drifts

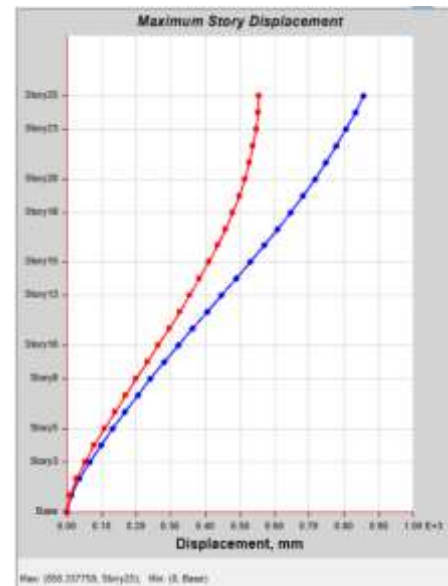
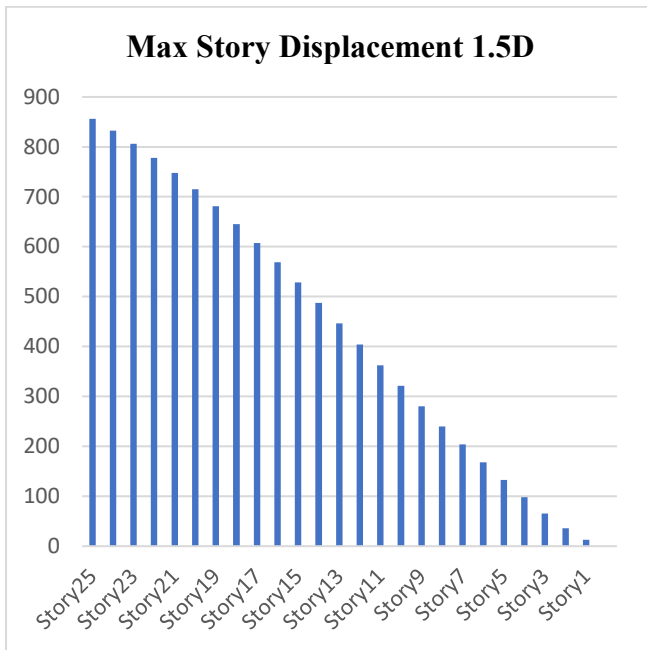


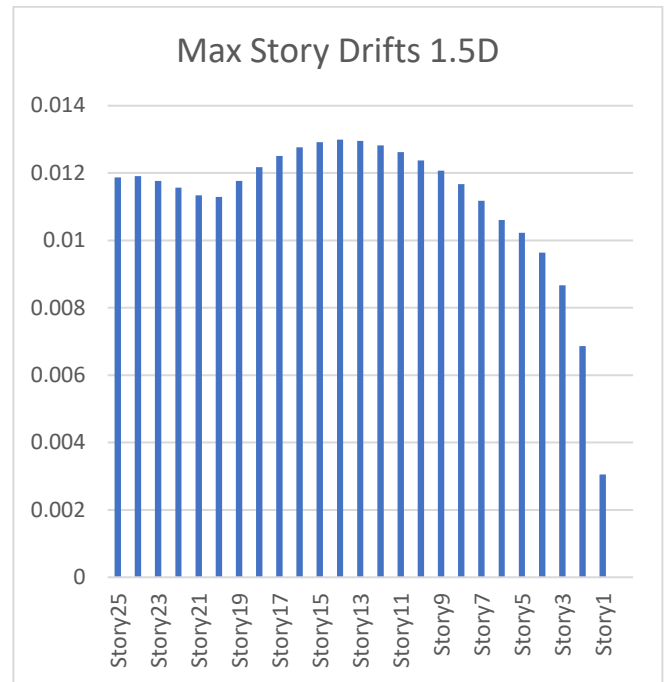
Fig 1.65: American Model Twisted G+25 Maximum Story Displacement

Table1.61: American Model Twisted G+25 Max Story Displacement

Max Story Displacement	
Storey	1.5D
Story25	856.34
Story24	832.61
Story23	806.33
Story22	778.04
Story21	747.73
Story20	715.39
Story19	681.17
Story18	645.19
Story17	607.64
Story16	568.72
Story15	528.64
Story14	487.69
Story13	446.13
Story12	404.31
Story11	362.58
Story10	321.17
Story9	280.26
Story8	240.12
Story7	203.85
Story6	168.12
Story5	132.78
Story4	98.284
Story3	65.317
Story2	35.741
Story1	13.024
Base	0



Graph 1.61: American Model Twisted G+25 Max Story Displacement 1.5D



Graph 1.62 American Model Twisted G+25 Max Story Drifts 1.5D

Table 1.62: American Model Twisted G+25 Max Story Drifts

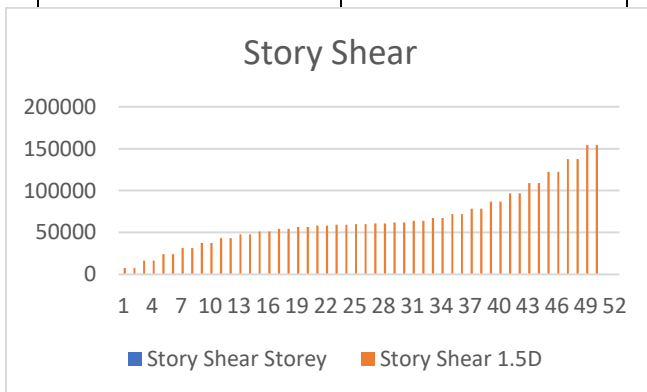
Max Story Drifts	
Storey	1.5D
Story25	0.011869
Story24	0.01191
Story23	0.01177
Story22	0.011568
Story21	0.011336
Story20	0.011291
Story19	0.011766
Story18	0.012175
Story17	0.012509
Story16	0.012761
Story15	0.012919
Story14	0.01299
Story13	0.012955
Story12	0.012822
Story11	0.012622
Story10	0.01238
Story9	0.012067
Story8	0.01167
Story7	0.011175
Story6	0.010611
Story5	0.010231
Story4	0.009642
Story3	0.008665
Story2	0.006862
Story1	0.003056
Base	0

Table 1.63: American Model Twisted G+25 Story Shears

Story Shear	
Story	1.5D
Story25	7888.335
Story24	7888.335
Story23	16477.85
Story22	16477.85
Story21	24315.15
Story20	24315.15
Story19	31401.22
Story18	31401.22
Story17	37663.04
Story16	37663.04
Story15	43063.46
Story14	43063.46
Story13	47677.53
Story12	47677.53
Story11	51448.87
Story10	51448.87
Story9	54422.05
Story8	54422.05
Story7	56639.97
Story6	56639.97
Story5	58220.33
Story4	58220.33
Story3	59307.95
Story2	59307.95
Story1	60110.67
Base	60110.67

	60909.63
Story11	62090.9
	62090.9
Story10	64061.39
	64061.39
Story9	67191.35
	67191.35
Story8	71865.05
	71865.05
Story7	78315.1
	78315.1
Story6	86625.75
	86625.75
Story5	96820.76
	96820.76
Story4	108816.2
	108816.2
Story3	122479.9
	122479.9
Story2	137705.9
	137705.9
Story1	154297.8
	154297.8
Base	0
	0

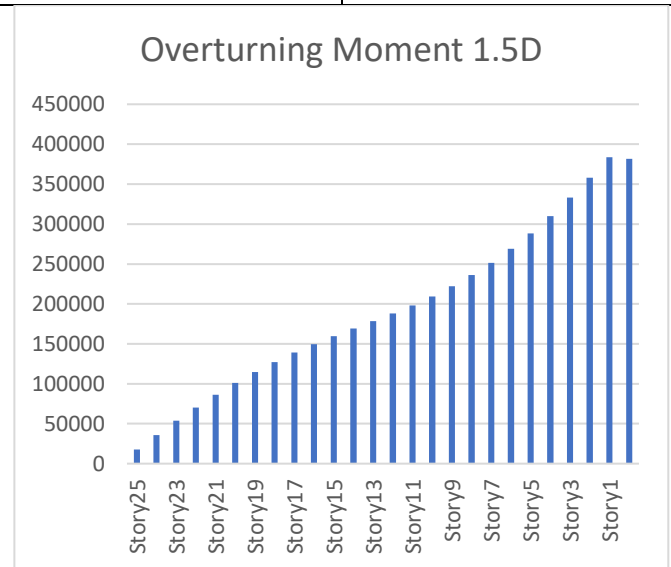
Story18	127324.9
Story17	139028.3
Story16	149752.6
Story15	159548.2
Story14	169139.4
Story13	178495.5
Story12	188064.2
Story11	198206.1
Story10	209393.3
Story9	222146.2
Story8	236001.1
Story7	251412.4
Story6	268843.3
Story5	288239.1
Story4	309818.4
Story3	333097.9
Story2	357997.3
Story1	383534.4
Base	381595.7



Graph 1.63: American Model Twisted G+25 Story Shears

Table 1.64: American Model Twisted G+25 Overturning Moment

Overturning Moment	
Story	1.5D
Story25	17518.58
Story24	35854.7
Story23	53764.31
Story22	70359.63
Story21	86071.08
Story20	100910.2
Story19	114640.4



Graph 1.64: American Model Twisted G+25 Overturning Moment 1.5D

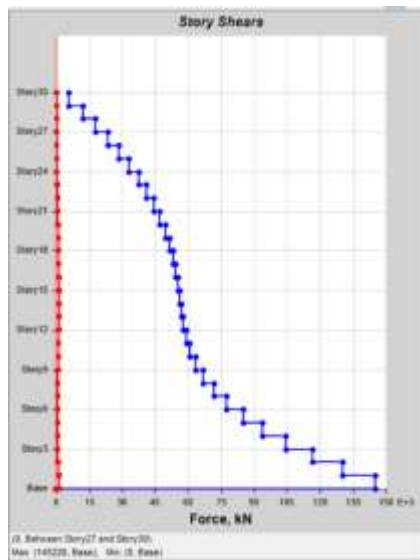


Fig 1.66: American Model Twisted G+30 Story Shears

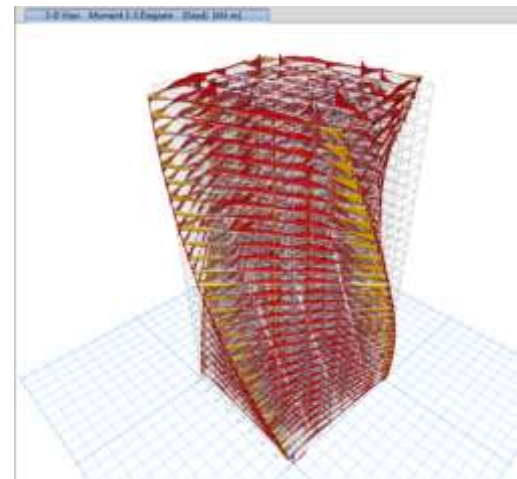


Fig1.69: American Model Twisted G+30 3-D View Shear Force 3-3 Diagram (Dead) [Kn]

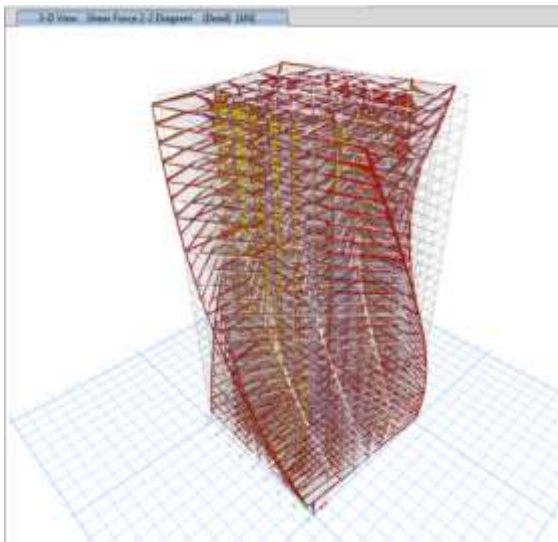


Figure1.67: American Model Twisted G+30 3-D View Shear Force 2-2 Diagram (Dead) [Kn]

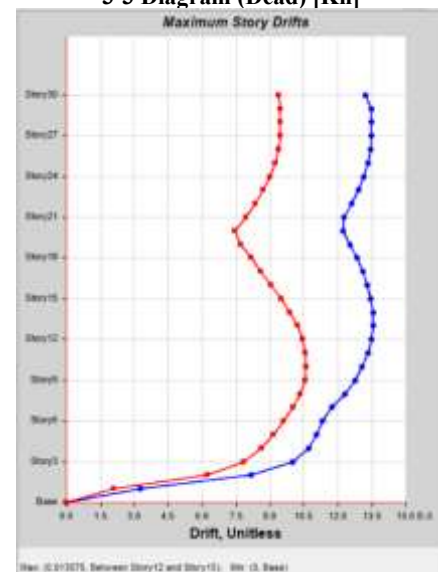


Fig1.70: American Model Twisted G+30 Maximum Story Drifts

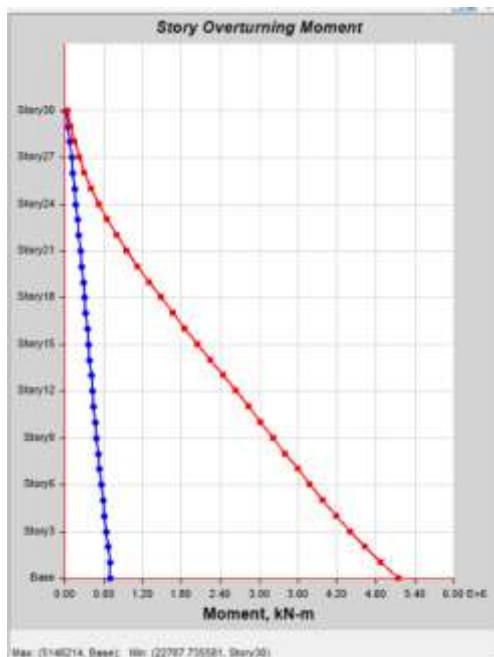


Fig 1.68: American Model Twisted G+30 Story Overturning Moment

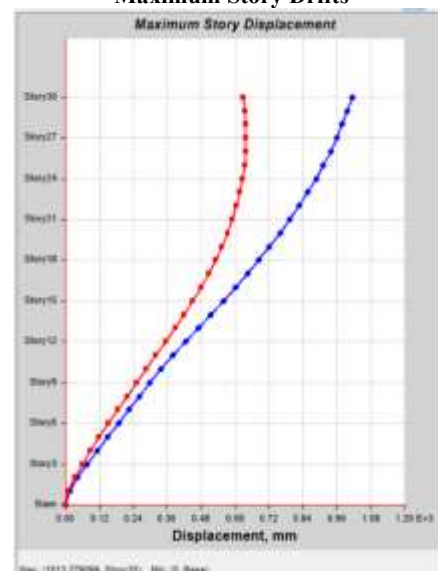
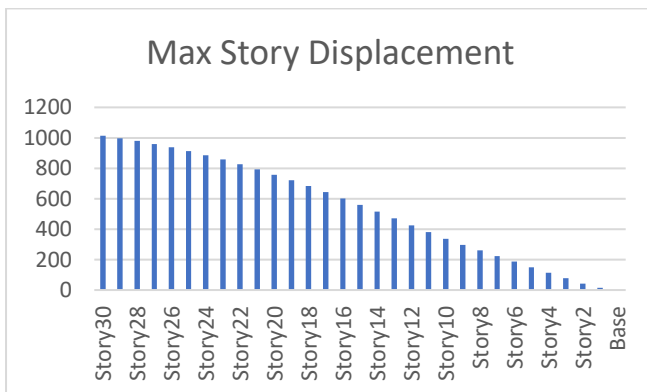


Fig 1.71: American Model Twisted G+30 Maximum Story Displacement

Table1.65: American Model Twisted G+30 Max Story Displacement

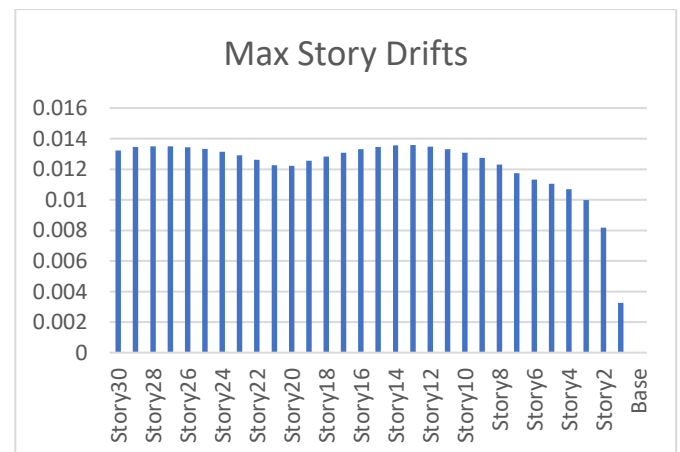
Max Story Displacement	
Story	2.5
Story30	1013.279
Story29	997.731
Story28	979.669
Story27	959.549
Story26	937.271
Story25	912.744
Story24	886.016
Story23	857.119
Story22	826.114
Story21	793.091
Story20	758.094
Story19	721.3
Story18	682.802
Story17	642.739
Story16	601.243
Story15	558.48
Story14	514.692
Story13	470.16
Story12	425.283
Story11	380.479
Story10	336.068
Story9	297.221
Story8	260.287
Story7	223.543
Story6	186.924
Story5	150.272
Story4	113.504
Story3	77.031
Story2	42.514
Story1	14.029
Base	0



Graph1.66: American Model Twisted G+30 Max Story Displacement

Table1.67: American Model Twisted G+30 Max Story Drifts

Max Story Drifts	
Story	2.5
Story30	0.013224
Story29	0.013465
Story28	0.013499
Story27	0.013499
Story26	0.013443
Story25	0.013326
Story24	0.013152
Story23	0.012918
Story22	0.012611
Story21	0.012269
Story20	0.012213
Story19	0.012551
Story18	0.012839
Story17	0.01309
Story16	0.013301
Story15	0.013462
Story14	0.013565
Story13	0.013575
Story12	0.013483
Story11	0.013311
Story10	0.01308
Story9	0.012746
Story8	0.012301
Story7	0.011738
Story6	0.011321
Story5	0.011047
Story4	0.010701
Story3	0.009971
Story2	0.008172
Story1	0.003248
Base	0

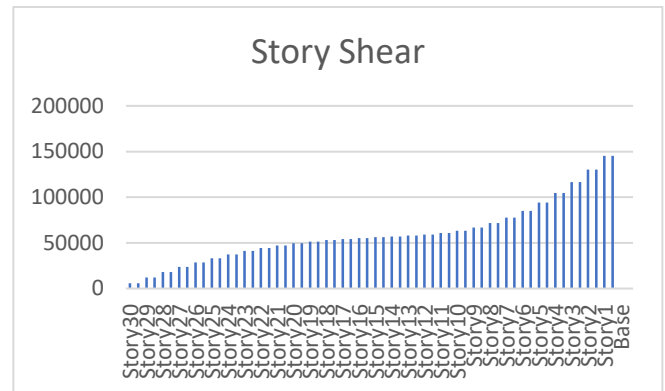


Graph1.67: American Model Twisted G+30 Max Story Drifts

Table1.68: American Model Twisted G+30 Story Shear

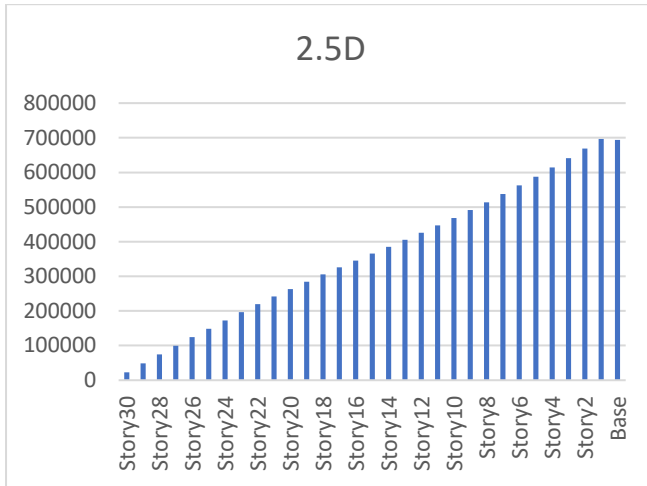
Story Shear	
Story	2.5D
Story30	5775.726
	5775.726
Story29	12111.32
	12111.32
Story28	18007.98
	18007.98
Story27	23501.98
	23501.98
Story26	28580.41
	28580.41
Story25	33196.52
	33196.52
Story24	37405.72
	37405.72
Story23	41145.41
	41145.41
Story22	44426.1
	44426.1
Story21	47231.74
	47231.74
Story20	49571.54
	49571.54
Story19	51509.99
	51509.99
Story18	53062.25
	53062.25
Story17	54292.68
	54292.68
Story16	55270.94
	55270.94
Story15	56103.37
	56103.37
Story14	56911.49
	56911.49
Story13	57841.95
	57841.95
Story12	59077.43
	59077.43
Story11	60874.51
	60874.51
Story10	63439.63
	63439.63
Story9	66940.95
	66940.95
Story8	71613.17
	71613.17
Story7	77607.21

	77607.21
Story6	85022.51
	85022.51
Story5	93965.41
	93965.41
Story4	104474.6
	104474.6
Story3	116544.8
	116544.8
Story2	130169.1
	130169.1
Story1	145219.6
	145219.6
Base	0
	0


Graph1.69: American Model Twisted G+30 Story Shear
Table1.70: American Model Twisted G+30 Story 2.5D

Story	2.5D
Story30	22767.74
Story29	48743.71
Story28	74192.83
Story27	99533.44
Story26	124380.2
Story25	148721.1
Story24	172754.6
Story23	196390
Story22	219256.2
Story21	241533.2
Story20	263295.7
Story19	284555.6
Story18	305268.6
Story17	325710.9
Story16	345756.7
Story15	365623.3
Story14	385554.4
Story13	405487.1
Story12	425780.8
Story11	446841.8
Story10	468541.2

Story9	490960.1
Story8	513930.3
Story7	537597.6
Story6	562176.9
Story5	587636.3
Story4	614025.9
Story3	641066.1
Story2	668669.5
Story1	696315
Base	694208.7



Graph1.70: American Model Twisted G+30 Story 2.5D

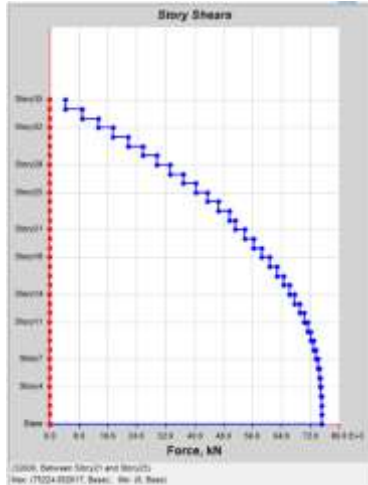


Fig1.72: American Model Twisted G+35 Story Shears

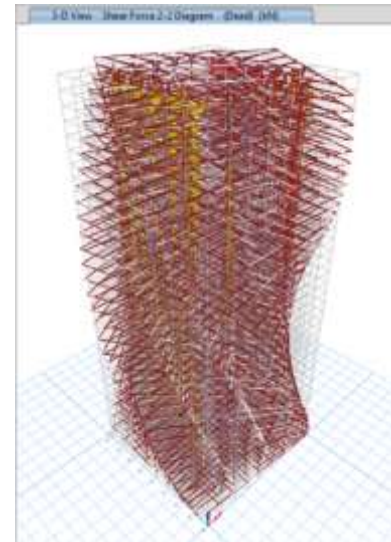


Fig 1.73: American Model Twisted G+35 3-D View Shear Force 2-2 Diagram (Dead) [Kn]

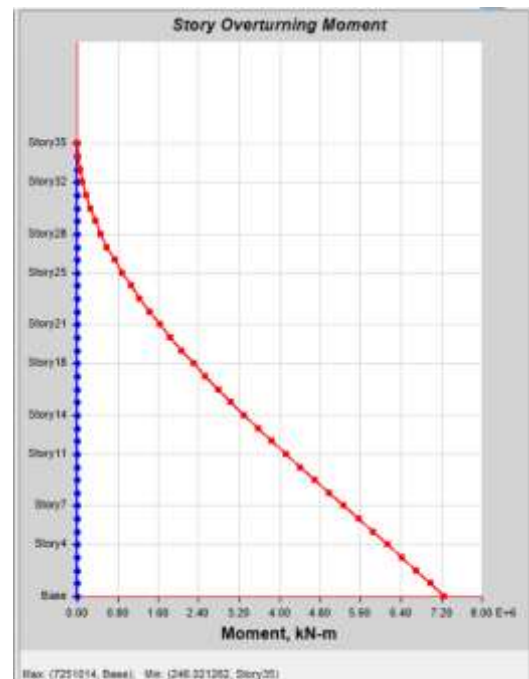


Fig1.74: American Model Twisted G+35 Story Overturning Moment

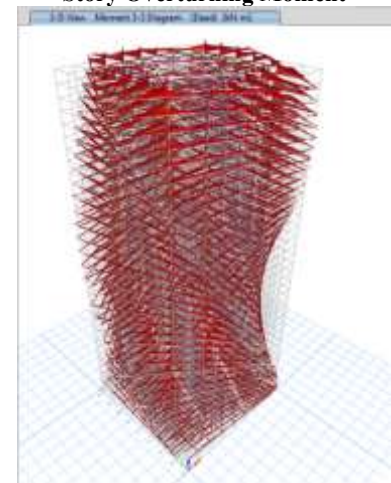


Fig1.75: American Model Twisted G+35 3-D View Shear Force 3-3 Diagram (Dead) [Kn]

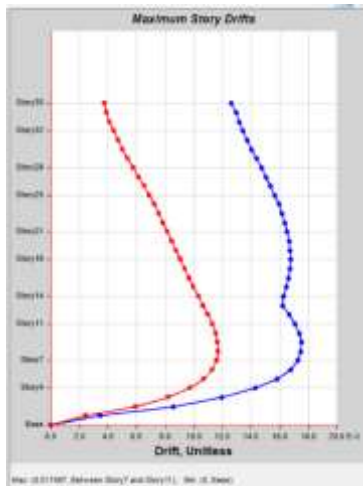


Fig1.76: American Model Twisted G+35 Maximum Story Drifts

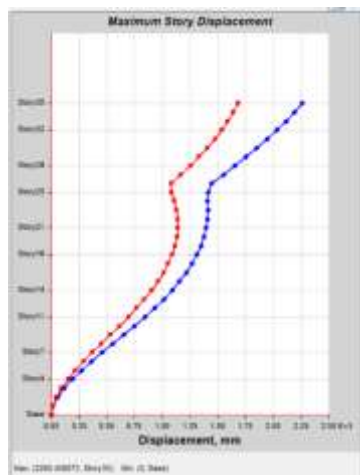
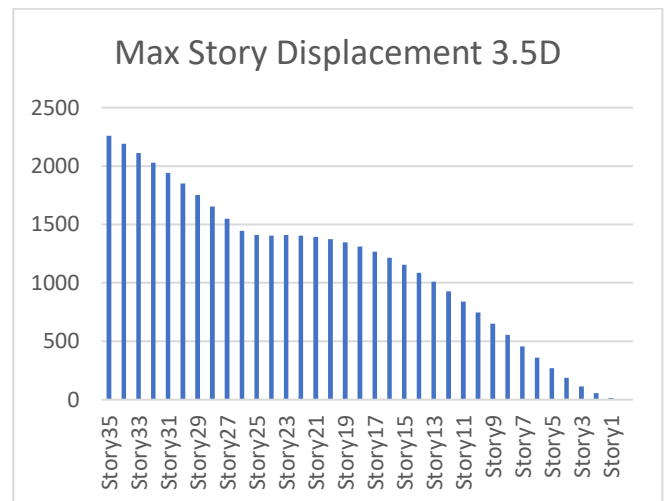


Fig1.77: American Model Twisted G+35 Maximum Story Displacement

Table 1.71: American Model Twisted G+35 Story 3.5D

Story	3.5D
Story35	2260.457
Story34	2189.362
Story33	2112.207
Story32	2029.708
Story31	1942.162
Story30	1849.893
Story29	1753.432
Story28	1653.396
Story27	1550.525
Story26	1445.642
Story25	1408.301
Story24	1405.04
Story23	1408.482
Story22	1404.832
Story21	1393.661
Story20	1374.529
Story19	1347.14
Story18	1311.349
Story17	1267.147
Story16	1214.646

Story15	1154.068
Story14	1085.781
Story13	1010.285
Story12	928.201
Story11	840.279
Story10	747.372
Story9	651.155
Story8	553.528
Story7	456.09
Story6	360.833
Story5	270.127
Story4	186.718
Story3	113.804
Story2	55.15
Story1	15.254
Base	0

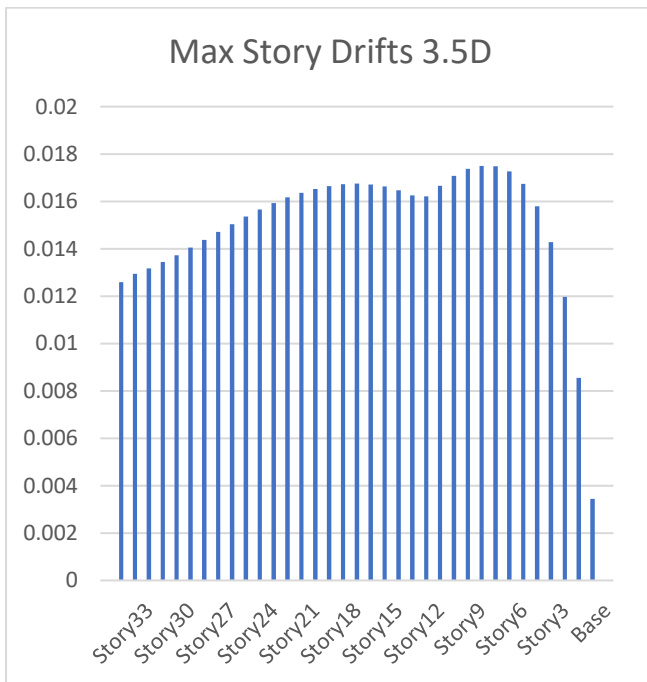


Graph 1.71: American Model Twisted G+35 Max Story Displacement

Table1.72: American Model Twisted G+35 Story 3.5D

Story	3.5D
Story35	0.01259
Story34	0.012942
Story33	0.013171
Story32	0.013437
Story31	0.013732
Story30	0.014048
Story29	0.014377
Story28	0.014709
Story27	0.015039
Story26	0.015358
Story25	0.015657
Story24	0.01593
Story23	0.01617
Story22	0.016358

Story21	0.01652
Story20	0.016647
Story19	0.016725
Story18	0.016749
Story17	0.016716
Story16	0.016625
Story15	0.01647
Story14	0.01625
Story13	0.016218
Story12	0.016656
Story11	0.017083
Story10	0.017376
Story9	0.017497
Story8	0.017487
Story7	0.017265
Story6	0.01674
Story5	0.015798
Story4	0.01428
Story3	0.011967
Story2	0.008545
Story1	0.003447
Base	0

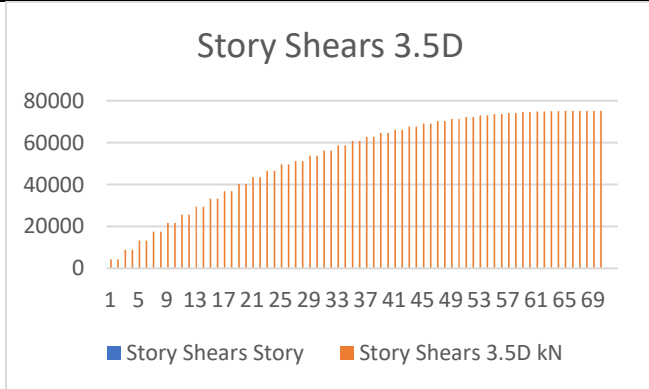


Graph1.72 American Model Twisted G+35 Max Story Drifts 3.5D

Table1.73: American Model Twisted G+35 Story 3.5D

Story	3.5D
	kN
Story35	4326.521
	4326.521
Story34	8862.794
	8862.794
Story33	13274.08
	13274.08
Story32	17513.22
	17513.22
Story31	21659.1
	21659.1
Story30	25661.83
	25661.83
Story29	29537.72
	29537.72
Story28	33264.59
	33264.59
Story27	36841
	36841
Story26	40266.27
	40266.27
Story25	43538.53
	43538.53
Story24	46656.45
	46656.45
Story23	49618.93
	49618.93
Story22	51192.61
	51192.61
Story21	53822.3
	53822.3
Story20	56296.08
	56296.08
Story19	58607.45
	58607.45
Story18	60754.27
	60754.27
Story17	62737.54
	62737.54
Story16	64560.09
	64560.09
Story15	66221.4
	66221.4
Story14	67724.28
	67724.28
Story13	69072.72
	69072.72
Story12	70268.19

	70268.19
Story11	71315.75
	71315.75
Story10	72193.68
	72193.68
Story9	72960.57
	72960.57
Story8	73596.78
	73596.78
Story7	74110.69
	74110.69
Story6	74510.25
	74510.25
Story5	74806.59
	74806.59
Story4	75011.98
	75011.98
Story3	75139.57
	75139.57
Story2	75204.04
	75204.04
Story1	75224.85
	75224.85
Base	0
	0

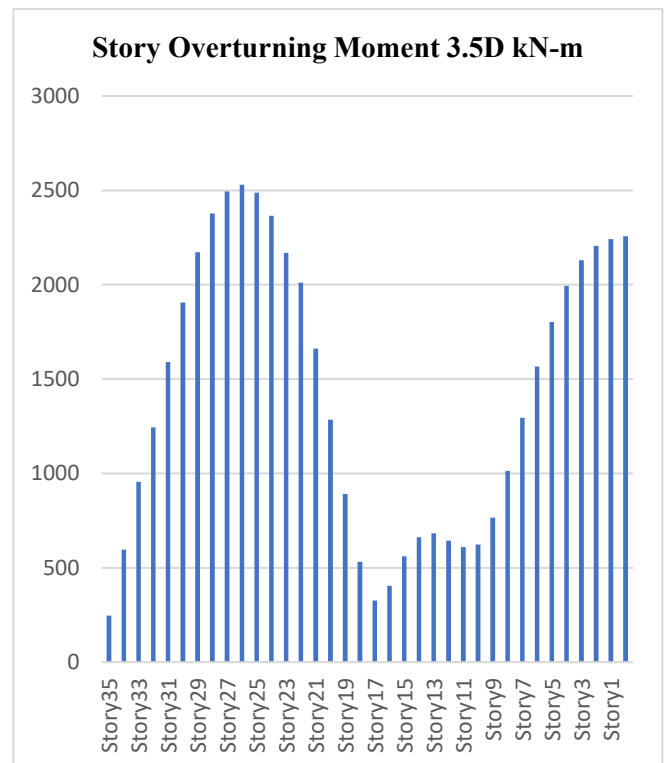


Graph1.73: American Model Twisted G+35 Story Shears 3.5D

Table1.74: American Model Twisted G+35 Story Overturning Moment

Story Overturning Moment	
Story	3.5D kN-m
Story35	246.0213
Story34	595.6736
Story33	955.8864
Story32	1244.186
Story31	1589.541
Story30	1905.746
Story29	2171.254
Story28	2377.139
Story27	2494.542

Story26	2530.517
Story25	2487.251
Story24	2365.627
Story23	2168.372
Story22	2011.602
Story21	1662.087
Story20	1284.121
Story19	891.4143
Story18	531.3332
Story17	325.7731
Story16	404.8018
Story15	560.044
Story14	661.9894
Story13	681.7293
Story12	642.8645
Story11	608.7359
Story10	623.205
Story9	765.1774
Story8	1013.507
Story7	1295.473
Story6	1566.043
Story5	1802.247
Story4	1994.016
Story3	2130.021
Story2	2206.367
Story1	2242.34
Base	2256.658



Graph1.74: American Model Twisted G+35 Story Overturning Moment 3.5D Kn-m

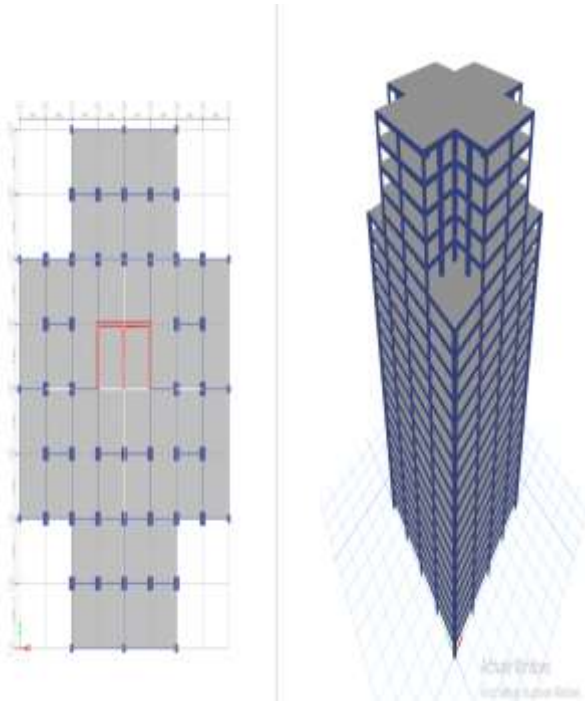


Fig1.78: American Model Normal G+25 Plan & 3D View

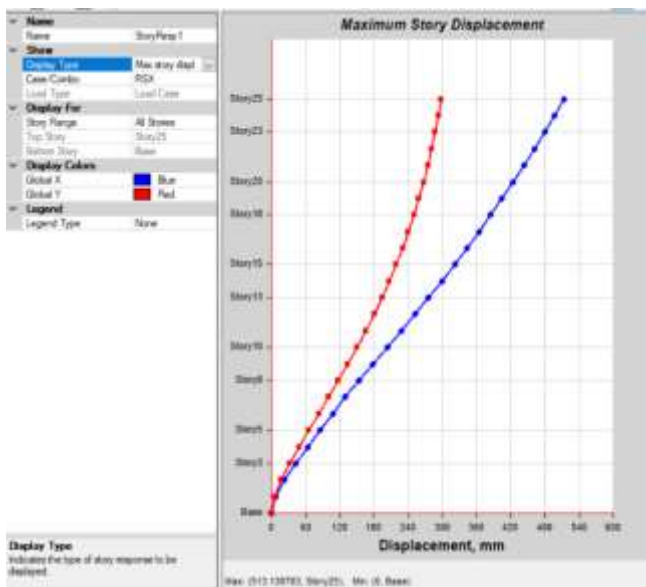


Fig1.79: American Model Normal G+25 Maximum Story Displacement

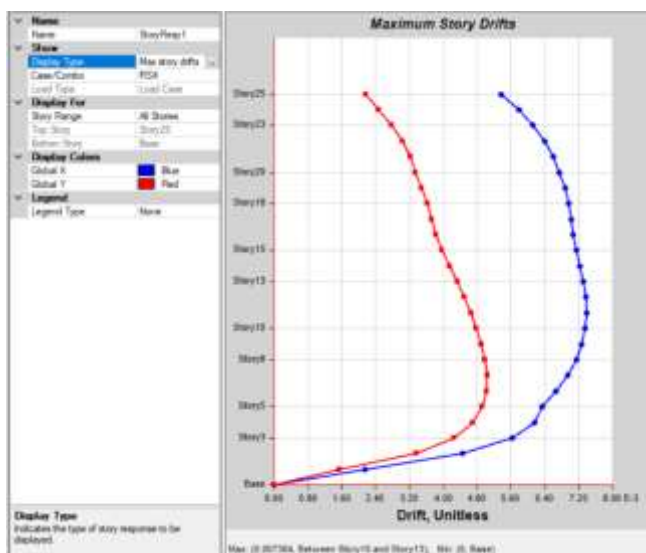


Fig1.80: American Model Normal G+25 Maximum Story Drifts

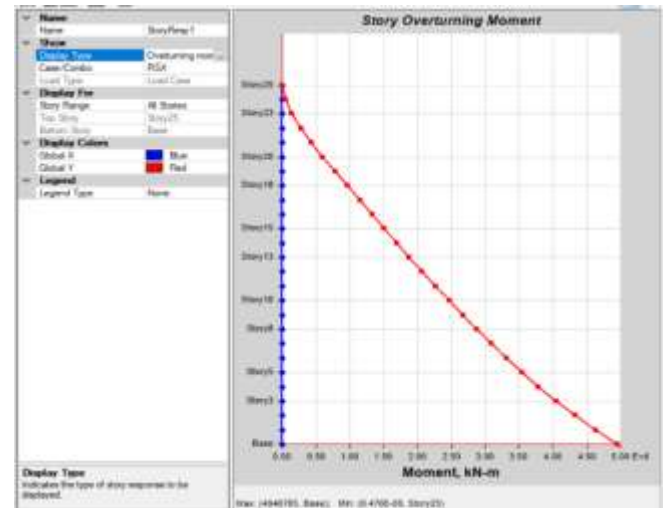


Fig1.81: American Model Normal G+25 Story Overturning Moment

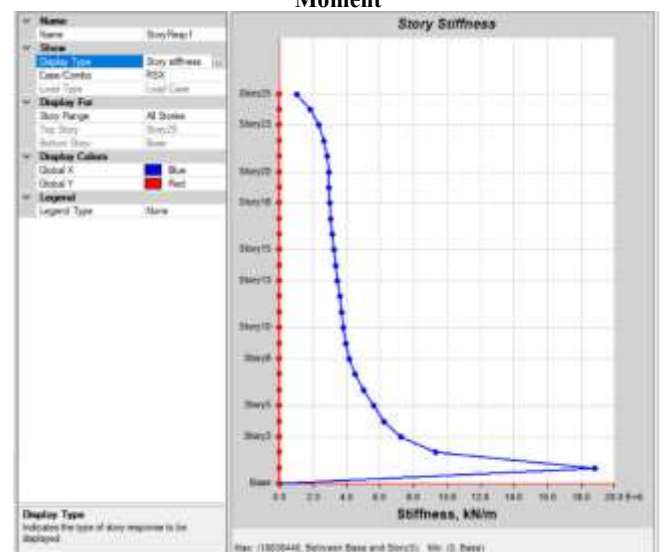


Fig1.82: American Model Normal G+25 Story Stiffness

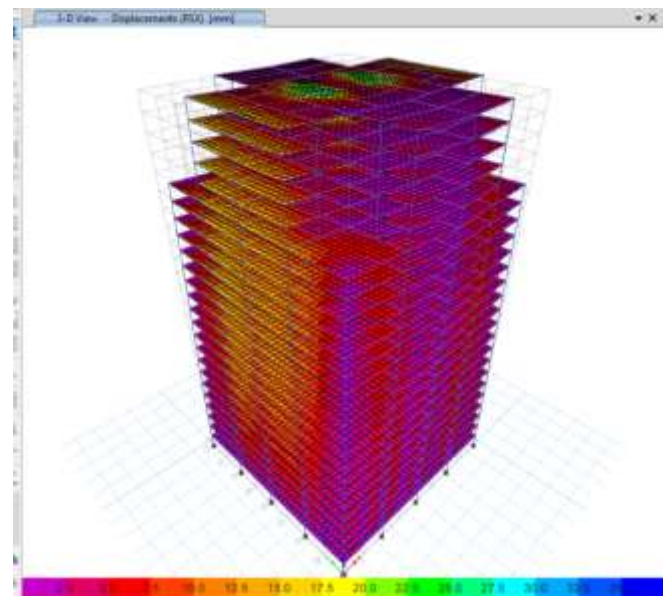


Fig1.83: American Model Normal G+25 Maximum Story Displacement

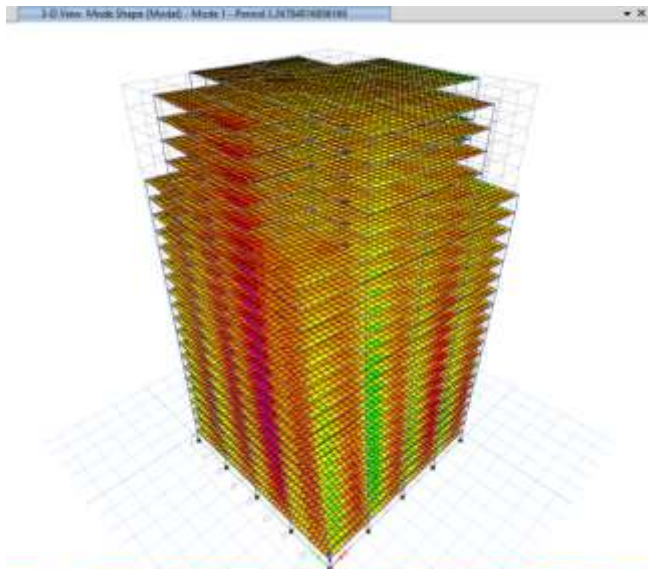


Fig1.84: American Model Normal G+25 Mode Shape Mode 1

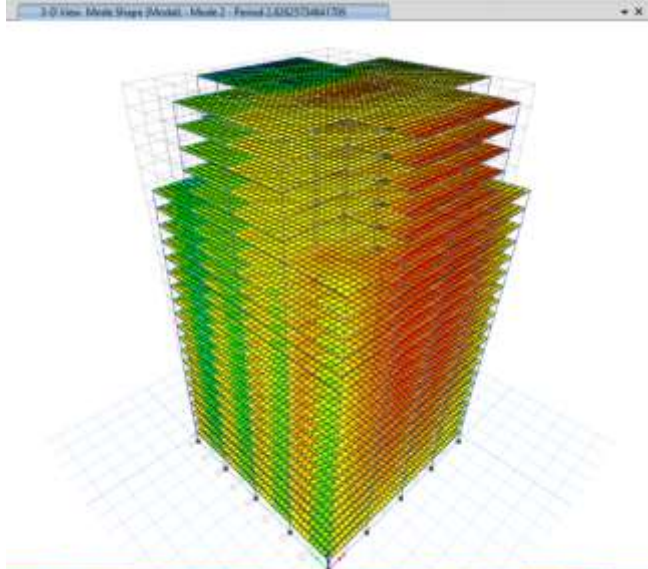


Fig1.85: American Model Normal G+25 Mode Shape Mode 2

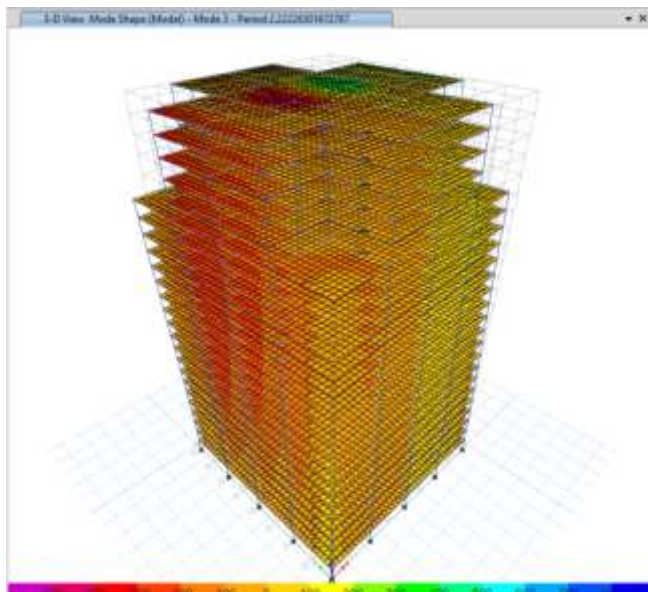


Fig1.86: American Model Normal G+25 Mode Shape Mode 3

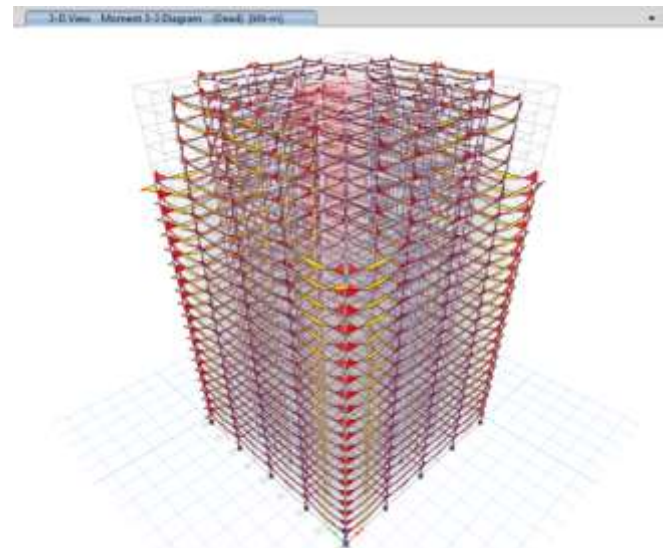


Fig1.87: American Model Normal G+25 Mode BMD

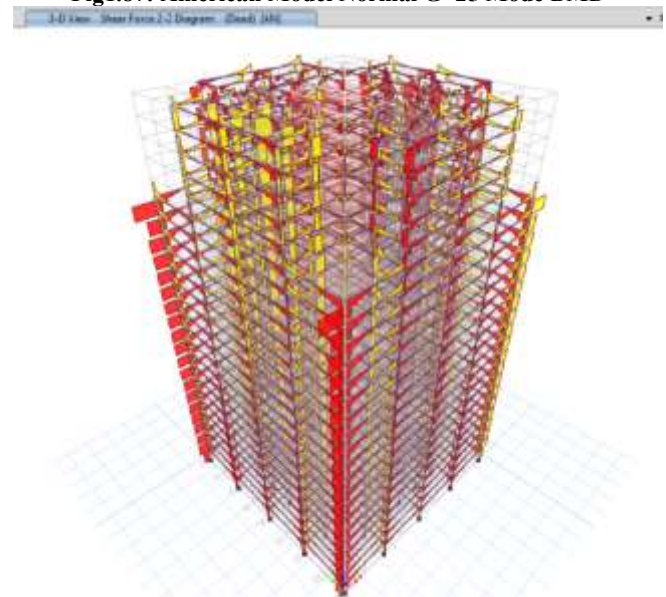


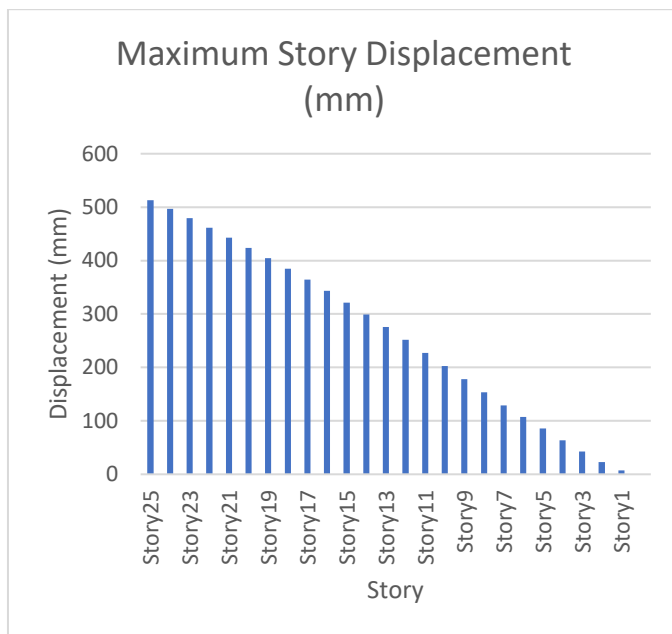
Fig1.88: American Model Normal G+25 Mode SFD

Table1.75: American Model Normal G+25 Maximum Story Displacement

Maximum Story Displacement (mm)	
Story	Displacement (mm)
Story25	513.14
Story24	496.673
Story23	479.274
Story22	461.294
Story21	442.796
Story20	423.916
Story19	404.623
Story18	384.762
Story17	364.283
Story16	343.143
Story15	321.306
Story14	298.761
Story13	275.544
Story12	251.737

Story11	227.458
Story10	202.848
Story9	178.063
Story8	153.285
Story7	128.758
Story6	107.453
Story5	85.692
Story4	63.783
Story3	42.378
Story2	22.738
Story1	7.486
Base	0

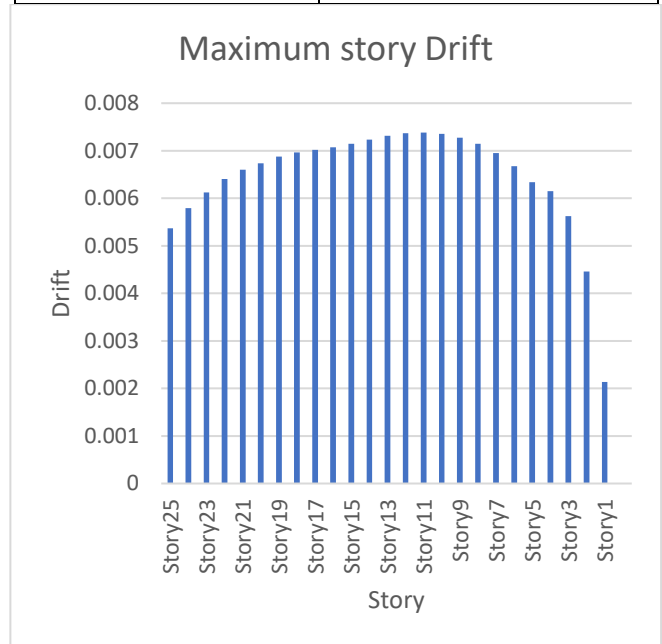
Story9	0.007275
Story8	0.007145
Story7	0.006951
Story6	0.006673
Story5	0.006338
Story4	0.006148
Story3	0.005622
Story2	0.004457
Story1	0.002139
Base	0



Graph 1.75: American Model Normal G+25 Max Story Displacement

Table1.76: American Model Normal G+25 Maximum Story Drift

Maximum Story Drift	
Story	Drift
Story25	0.005368
Story24	0.005793
Story23	0.00612
Story22	0.006407
Story21	0.006602
Story20	0.006737
Story19	0.006876
Story18	0.006964
Story17	0.007021
Story16	0.007075
Story15	0.007146
Story14	0.007232
Story13	0.007314
Story12	0.00737
Story11	0.007384
Story10	0.007353



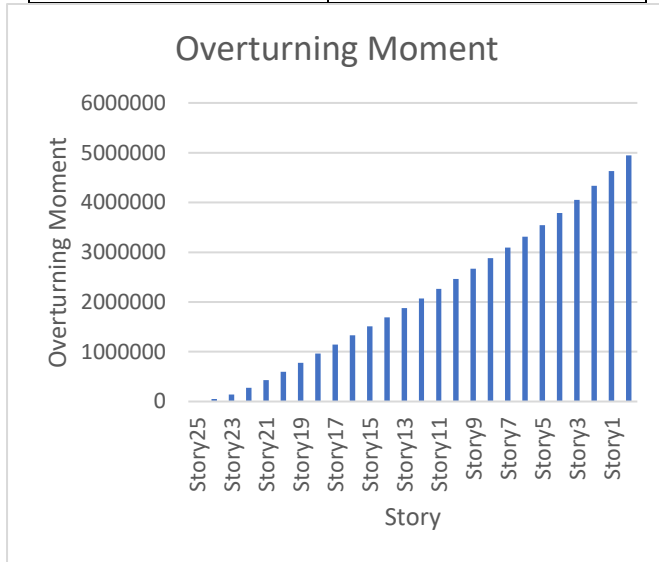
Graph 1.76: American Model Normal G+25 Max Story Drift

Table1.77: American Model Normal G+25 Maximum Story Overturning Moment

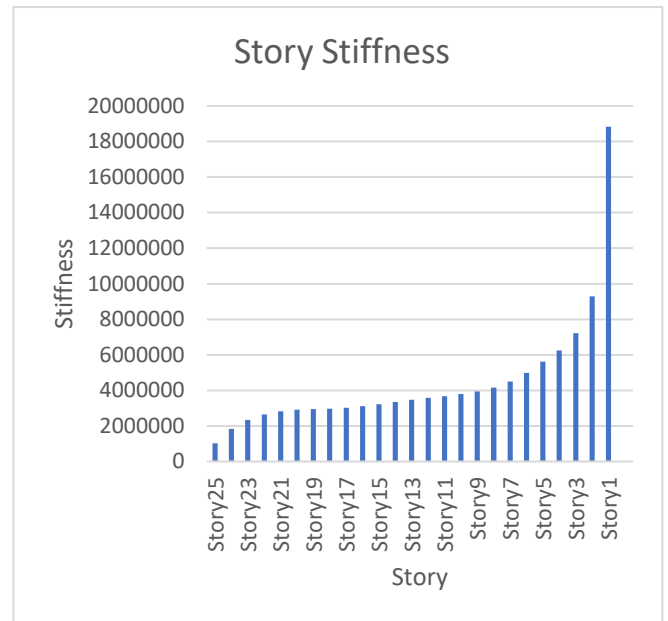
Maximum Story Overturning Moment	
Story	Overturning Moment
Story25	0
Story24	47806.9948
Story23	142097.1121
Story22	272297.754
Story21	427848.5409
Story20	599093.2255
Story19	779789.7922
Story18	963460.0754
Story17	1146598.692
Story16	1328333.136
Story15	1509619.556
Story14	1692291.163
Story13	1878207.878
Story12	2068681.745
Story11	2264248.482
Story10	2464771.429
Story9	2669815.827
Story8	2879196.041
Story7	3093548.251

Story6	3314722.681
Story5	3545772.939
Story4	3790409.79
Story3	4052001.943
Story2	4332466.327
Story1	4631531.049
Base	4946764.899

Story3	7223955.68
Story2	9291329.481
Story1	18836440.24
Base	0



Graph 1.77: American Model Normal G+25 Max Story Overturning Moment



Graph 1.78: American Model Normal G+25 Story Stiffness

Table1.78: American Model Normal G+25 Story Stiffness

Story Stiffness	
Story	Stiffness
Story25	1018340.519
Story24	1830036.58
Story23	2345749.371
Story22	2648804.39
Story21	2816341.909
Story20	2920277.641
Story19	2942689.533
Story18	2971495.986
Story17	3029008.777
Story16	3118880.272
Story15	3228334.616
Story14	3349467.749
Story13	3466383.688
Story12	3573658.434
Story11	3676861.279
Story10	3790691.515
Story9	3940465.603
Story8	4161027.154
Story7	4506241.978
Story6	4989387.274
Story5	5607743.057
Story4	6240467.104

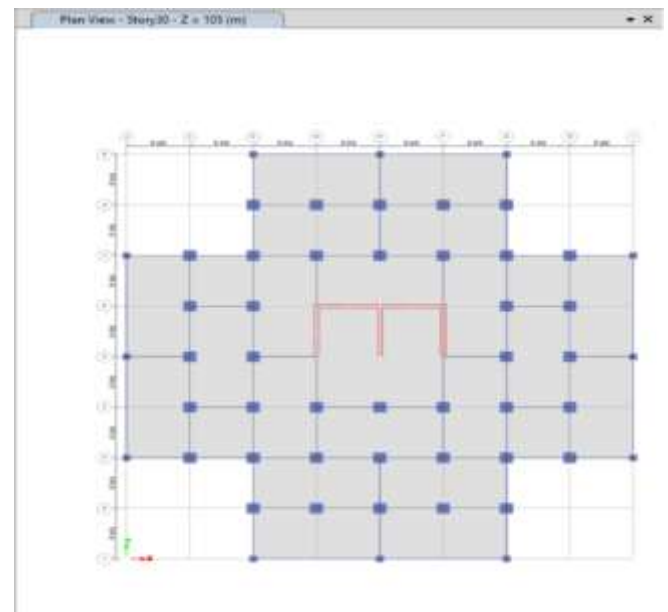


Fig1.89: American Model Normal G+30 Plan

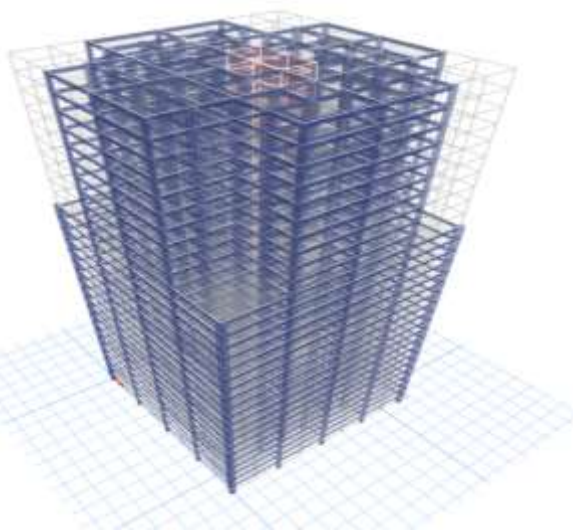


Fig1.90: American Model Normal G+30 3D View

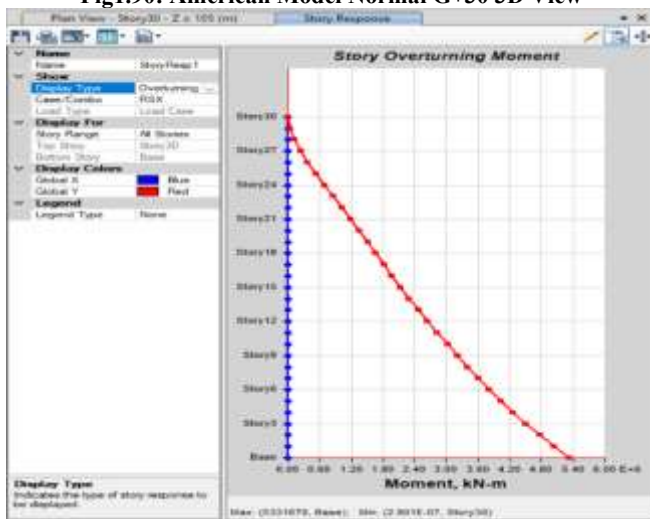


Fig1.91: American Model Normal G+30 Story Overturning Moment

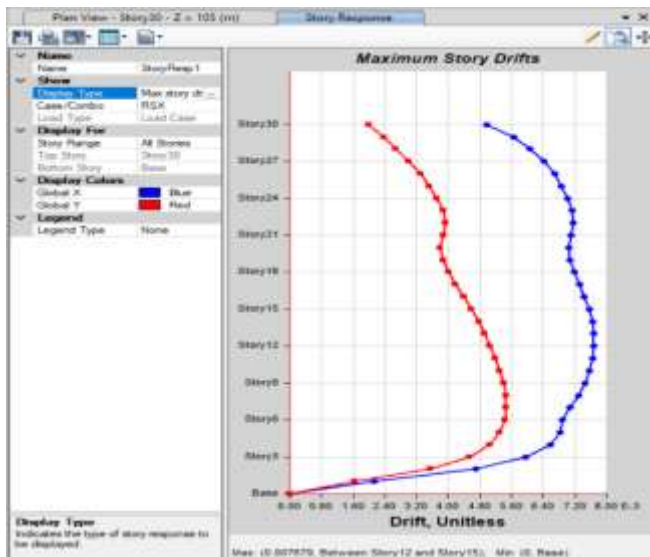


Fig1.92: American Model Normal G+30 Maximum Story Drifts

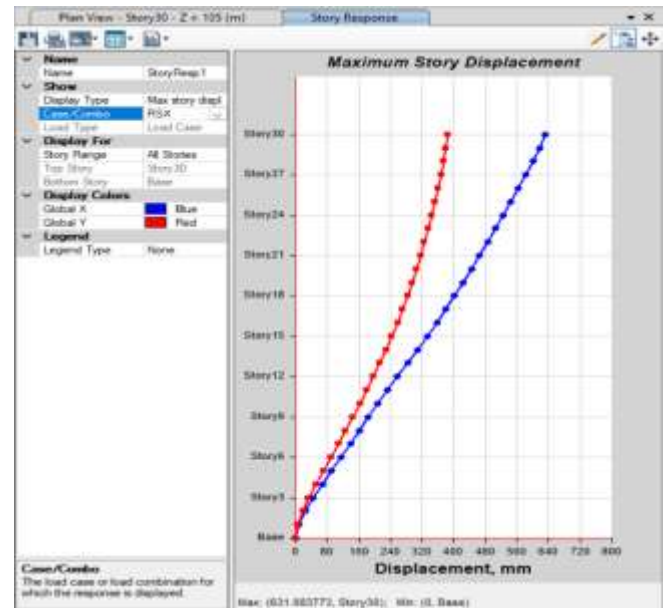


Fig1.93: American Model Normal G+30 Maximum Story Displacement

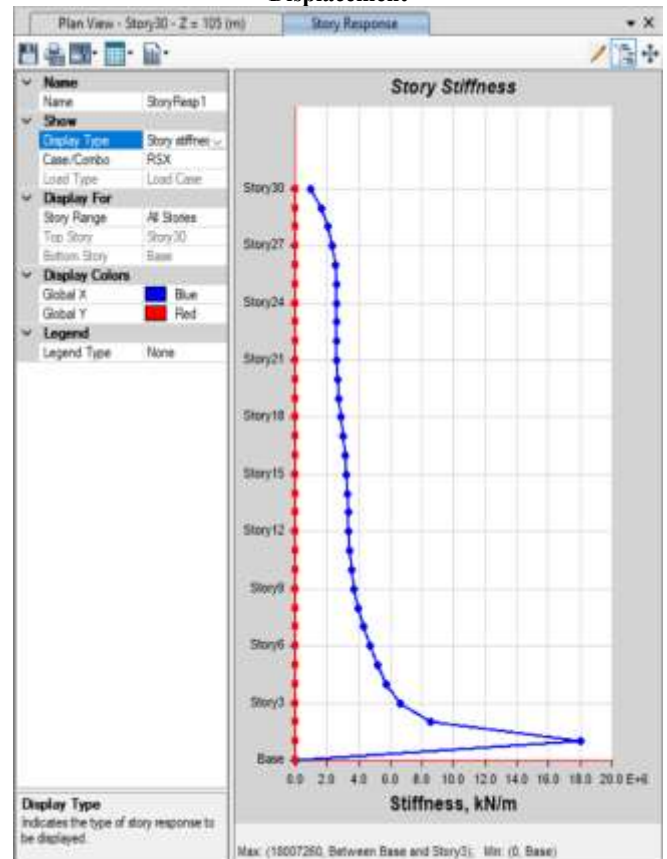


Fig1.94: American Model Normal G+30 Story Stiffness

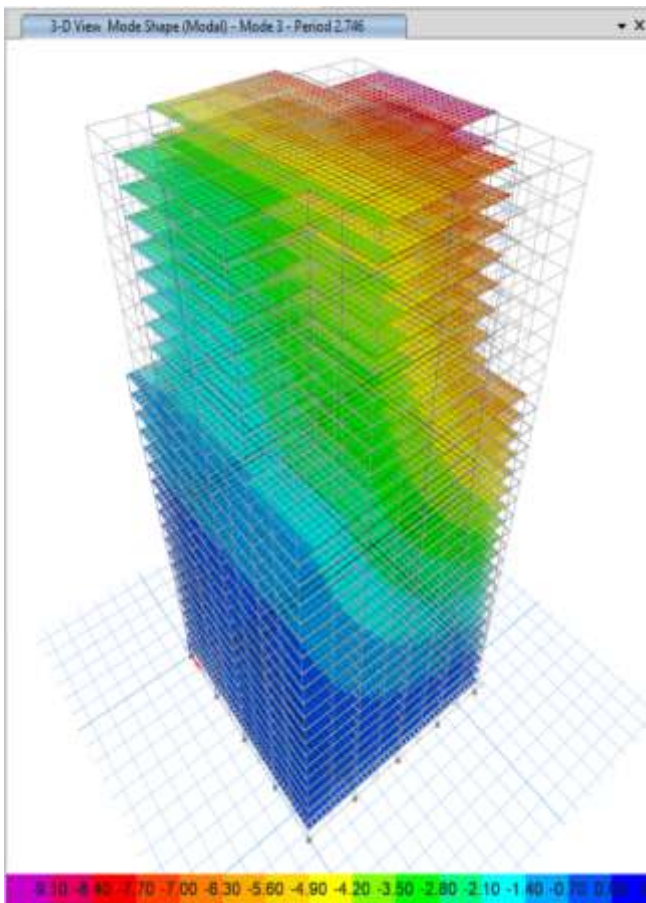


Fig1.95: American Model Normal G+30 Mode Shape Mode 3

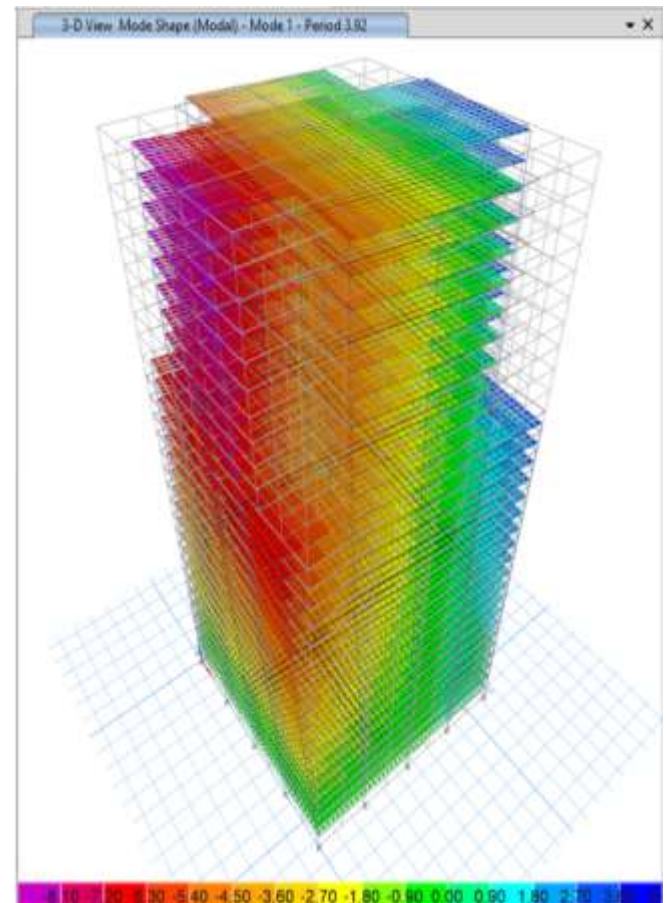


Fig1.97: American Model Normal G+30 Mode Shape Mode 1

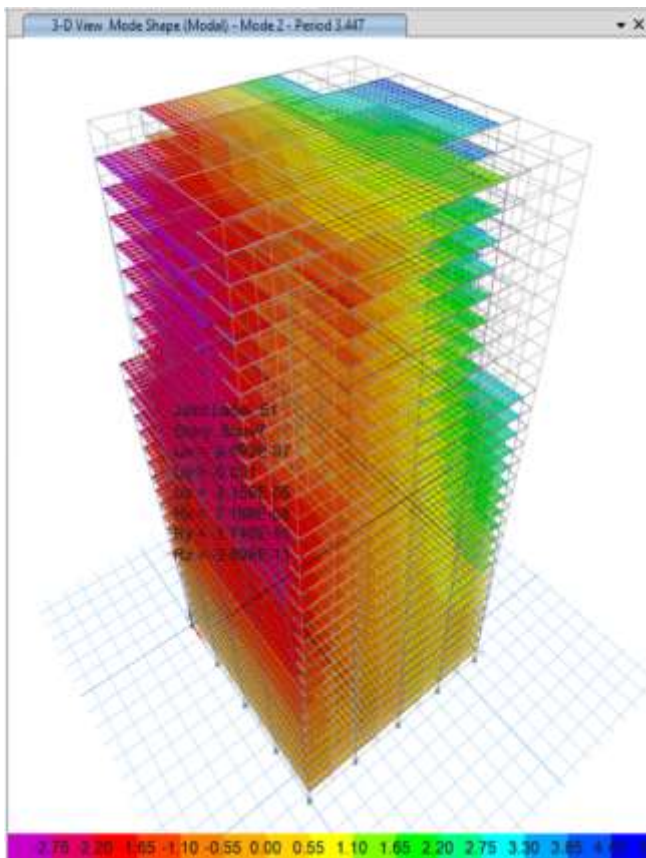


Fig1.96: American Model Normal G+30 Mode Shape Mode 2

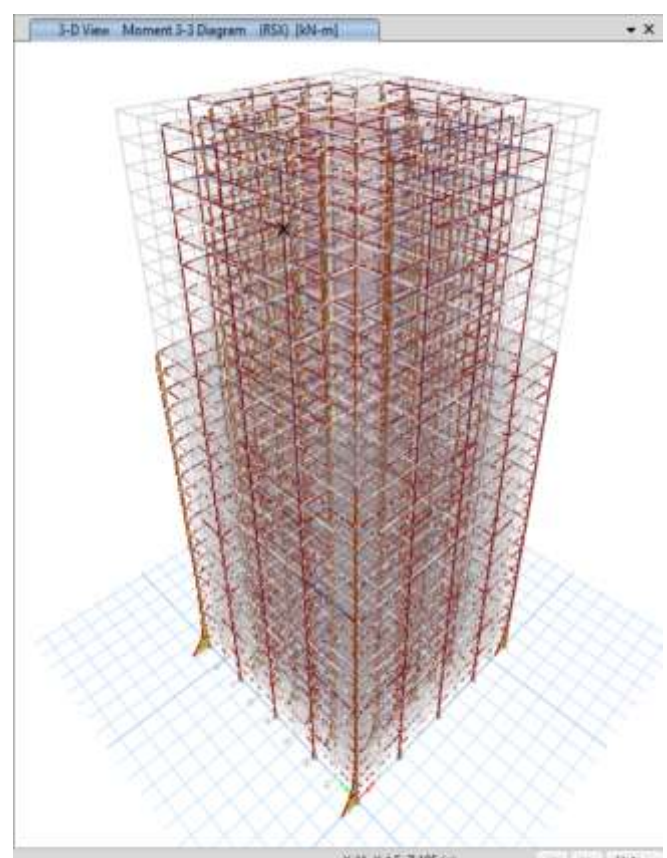


Fig1.98: American Model Normal G+30 Mode BMD

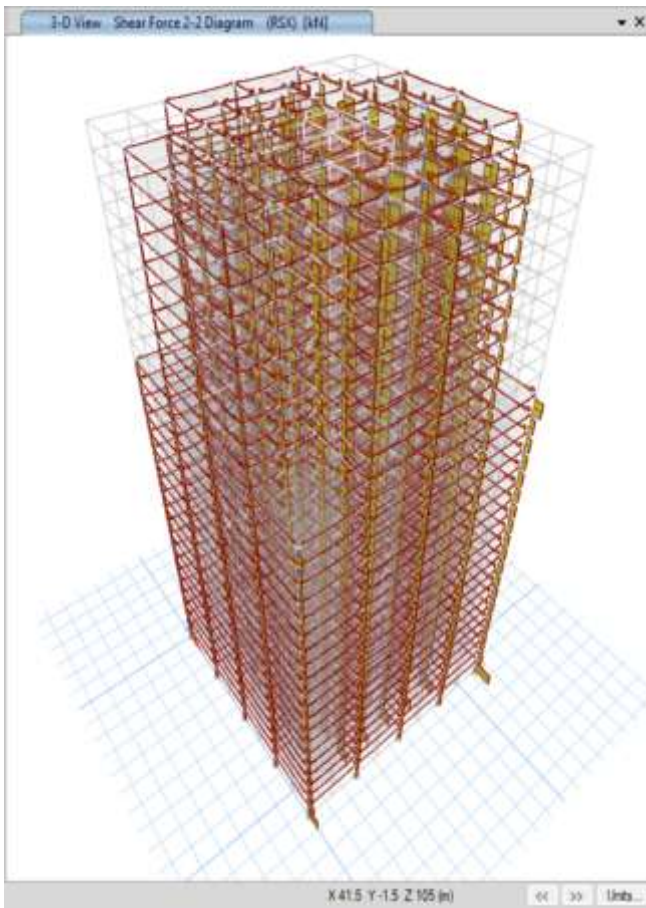
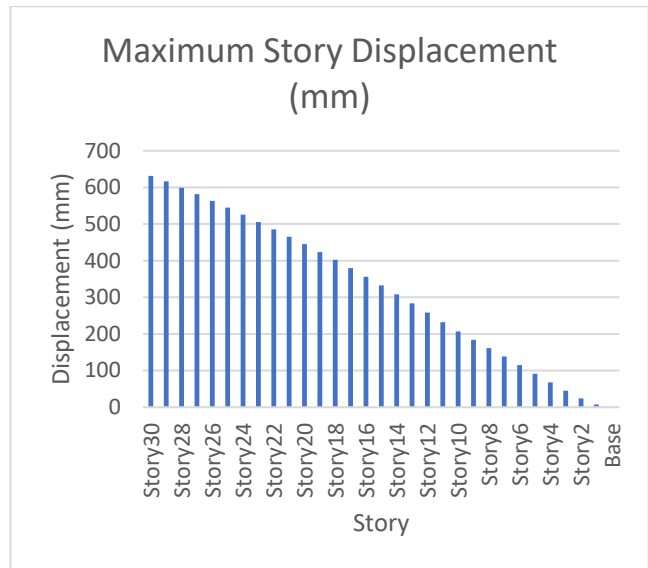


Fig1.99: American Model Normal G+30 Mode SFD

Table1.79: American Model Normal G+30 Maximum Story Displacement

Maximum Story Displacement (mm)	
Story	Displacement (mm)
Story30	631.084
Story29	616.127
Story28	599.414
Story27	581.787
Story26	563.503
Story25	544.625
Story24	525.439
Story23	505.834
Story22	485.828
Story21	465.448
Story20	444.782
Story19	423.732
Story18	402.023
Story17	379.579
Story16	356.396
Story15	332.529
Story14	308.069
Story13	283.123
Story12	257.801
Story11	232.214
Story10	206.478
Story9	183.53
Story8	161.279
Story7	138.431
Story6	115.065
Story5	91.349

Story4	67.657
Story3	44.718
Story2	23.863
Story1	7.454
Base	0

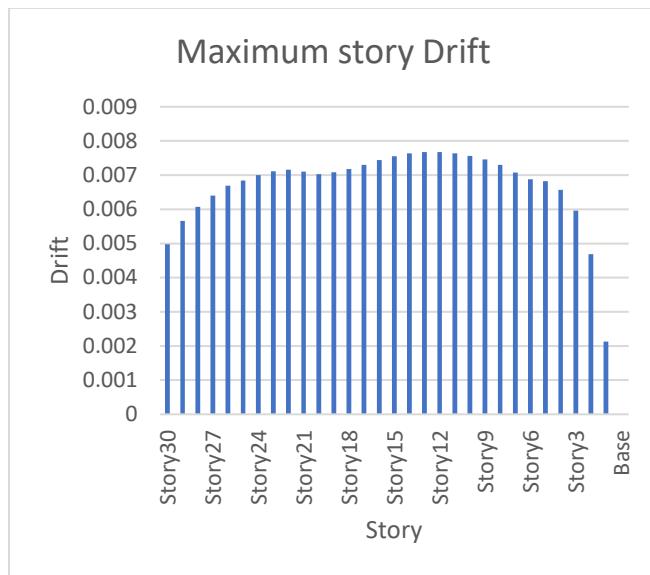


Graph1.79: American Model Normal G+30 Maximum Story Displacement

Table1.80: American Model Normal G+30 Maximum Story Drift

Maximum Story Drift	
Story	Drift
Story30	0.004979
Story29	0.005658
Story28	0.006075
Story27	0.006405
Story26	0.006695
Story25	0.006844
Story24	0.007005
Story23	0.007114
Story22	0.007158
Story21	0.007107
Story20	0.007031
Story19	0.007083
Story18	0.007178
Story17	0.007305
Story16	0.00744
Story15	0.007558
Story14	0.007641
Story13	0.007679
Story12	0.007677
Story11	0.007638
Story10	0.007567
Story9	0.007458
Story8	0.0073
Story7	0.007076
Story6	0.006876
Story5	0.006818
Story4	0.006573
Story3	0.005965
Story2	0.00469

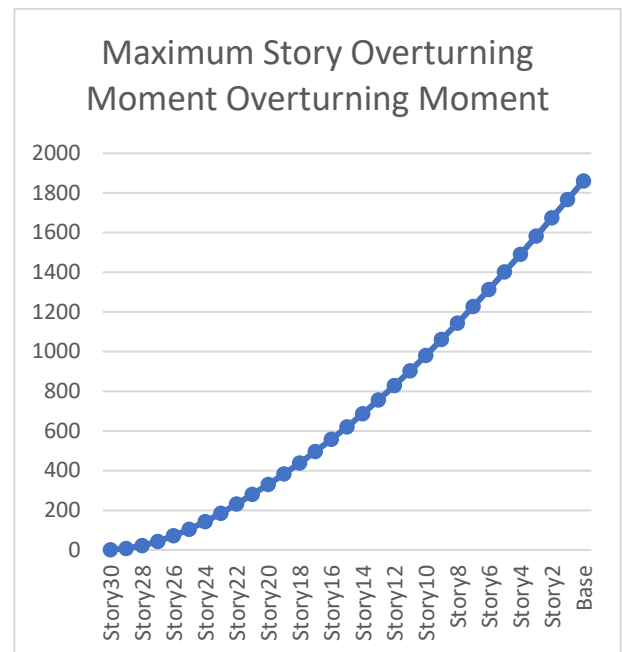
Story1	0.00213
Base	0



Graph1.80: American Model Normal G+30 Maximum Story Drift

Table1.81: American Model Normal G+30 Maximum Story Overturning Moment

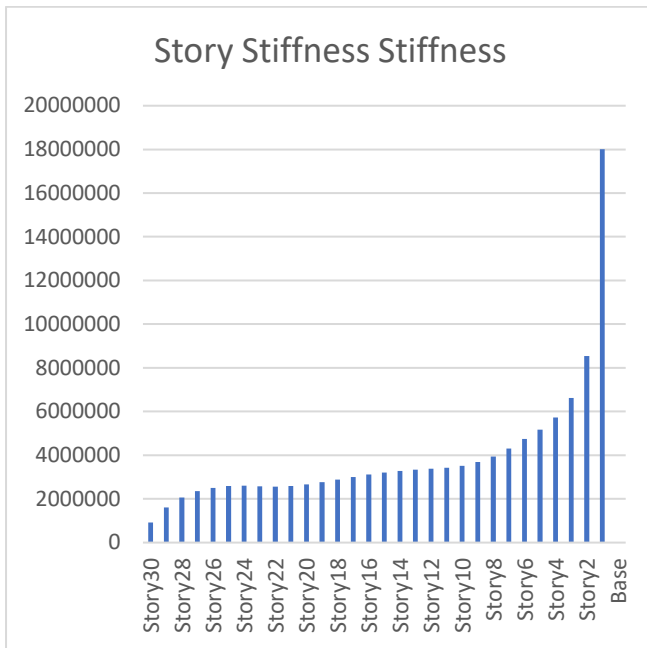
Maximum Story Overturning Moment	
Story	Overturning Moment
Story30	0
Story29	7.2478
Story28	21.8064
Story27	43.2188
Story26	70.9272
Story25	104.2811
Story24	142.5535
Story23	184.9817
Story22	230.8192
Story21	279.4038
Story20	330.231
Story19	383.376
Story18	438.8531
Story17	496.8001
Story16	557.4127
Story15	620.8626
Story14	687.2428
Story13	756.55
Story12	828.7023
Story11	903.5724
Story10	981.0193
Story9	1060.9034
Story8	1143.0859
Story7	1227.4174
Story6	1313.7255
Story5	1401.8087
Story4	1491.4378
Story3	1582.3645
Story2	1674.3339
Story1	1767.1007
Base	1860.4509



Graph1.81: American Model Normal G+30 Maximum Story Overturning Moment

Table1.82: American Model Normal G+30 Story Stiffness

Story Stiffness	
Story	Stiffness
Story30	925748.967
Story29	1610955.854
Story28	2066383.434
Story27	2350762.988
Story26	2507554.402
Story25	2591384.119
Story24	2601059.086
Story23	2581976.553
Story22	2566292.194
Story21	2589431.916
Story20	2669367.251
Story19	2763241.137
Story18	2878288.756
Story17	3002882.565
Story16	3115325.034
Story15	3207860.487
Story14	3278651.744
Story13	3331251.916
Story12	3375634.048
Story11	3429653.285
Story10	3518491.448
Story9	3684733.276
Story8	3942263.349
Story7	4306380.294
Story6	4739443.222
Story5	5165081.723
Story4	5728656.69
Story3	6622260.215
Story2	8545382.395
Story1	18007259.6
Base	0



Graph1.82: American Model Normal G+30 Story Stiffness

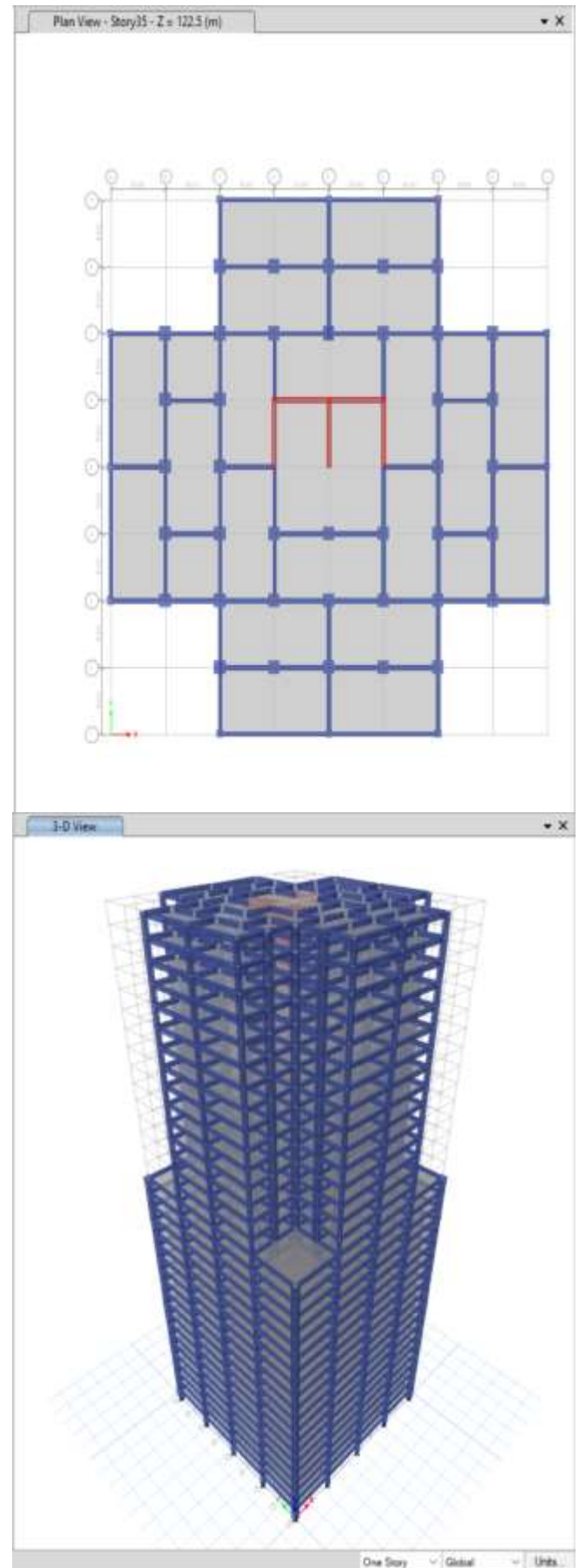


Fig1.100: American Model Normal G+35 Plan & 3D View

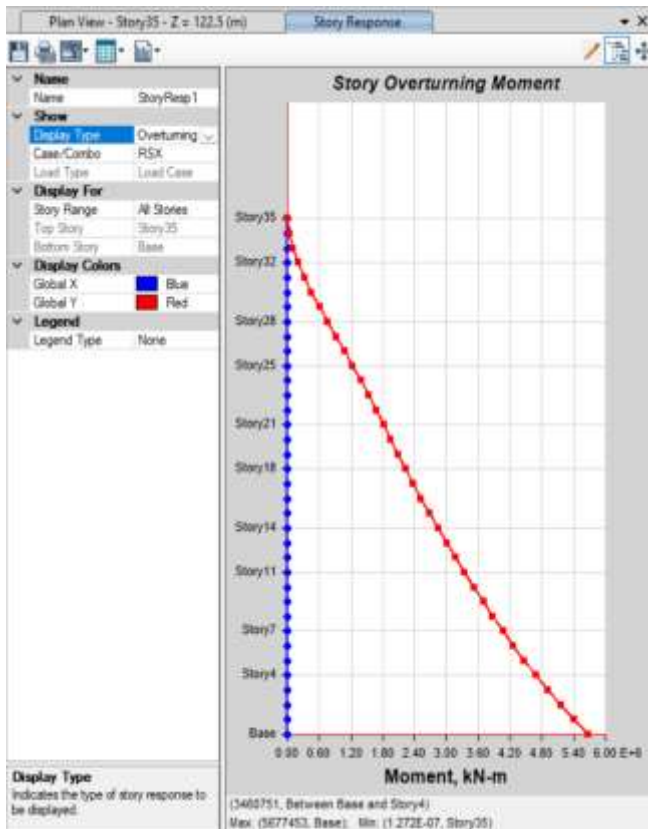


Fig1.101: American Model Normal G+35 Story Overturning Moment

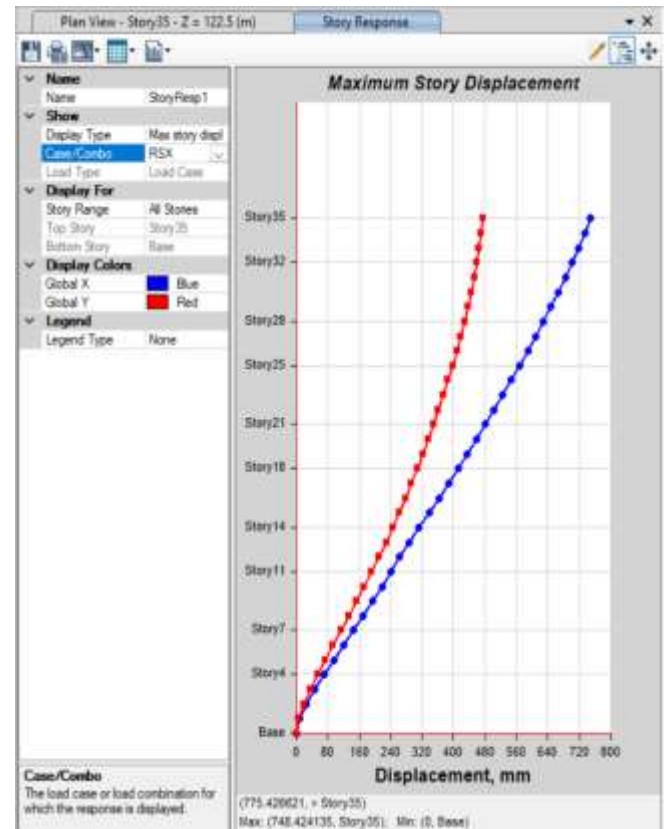


Fig1.103: American Model Normal G+35 Maximum Story Displacement

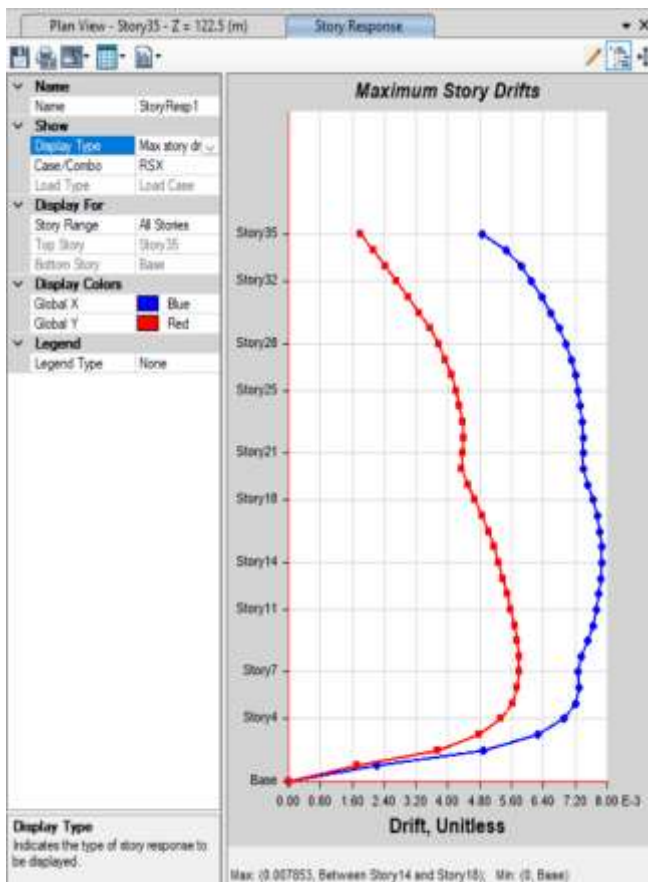


Fig1.102: American Model Normal G+35 Maximum Story Drifts

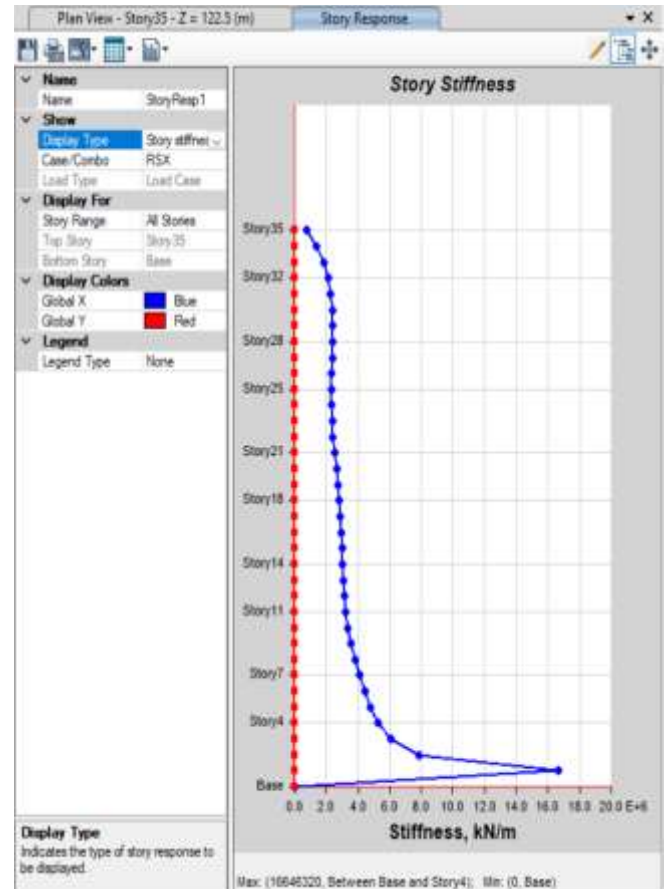


Fig1.103: American Model Normal G+35 Story Stiffness

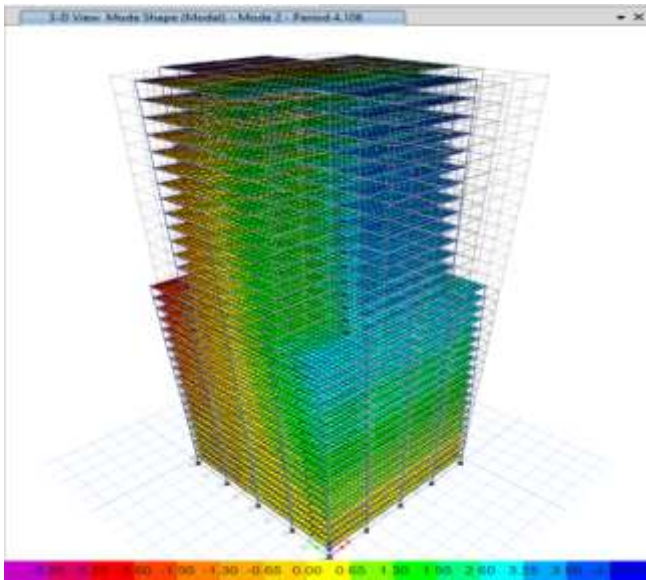


Fig1.104: American Model Normal G+35 Mode Shape Mode 2

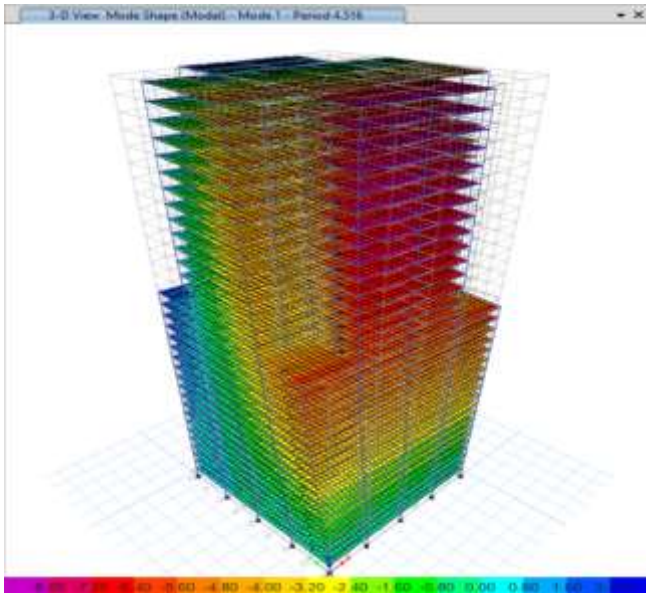


Fig1.105: American Model Normal G+35 Mode Shape Mode 1

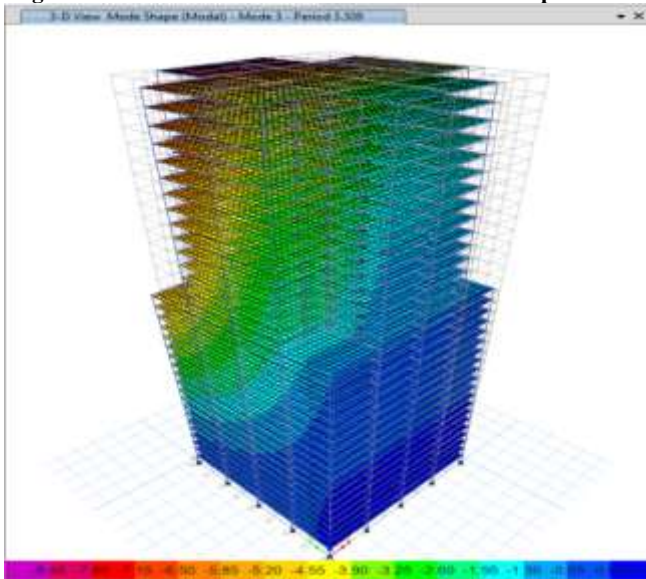


Fig1.106: American Model Normal G+35 Mode Shape Mode 3

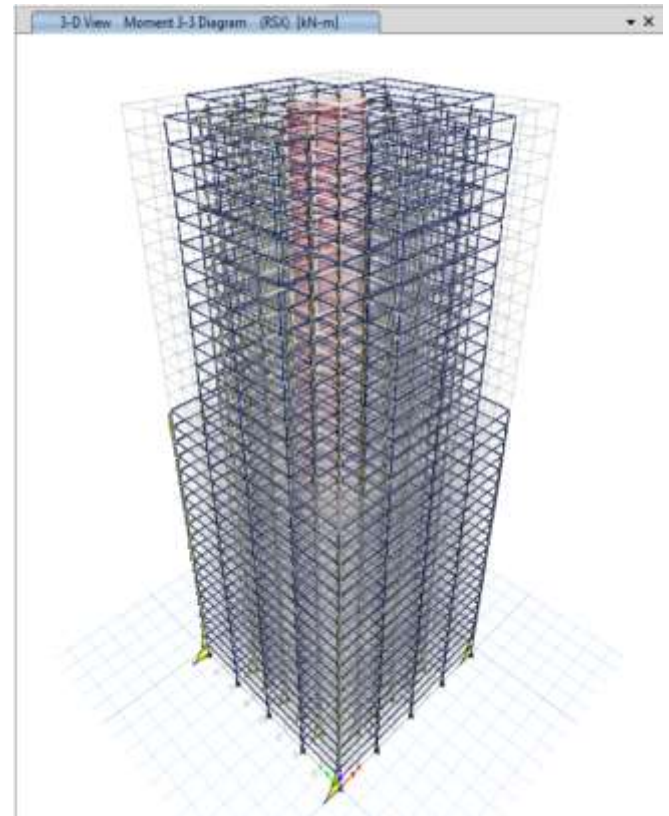


Fig1.107: American Model Normal G+35 BMD

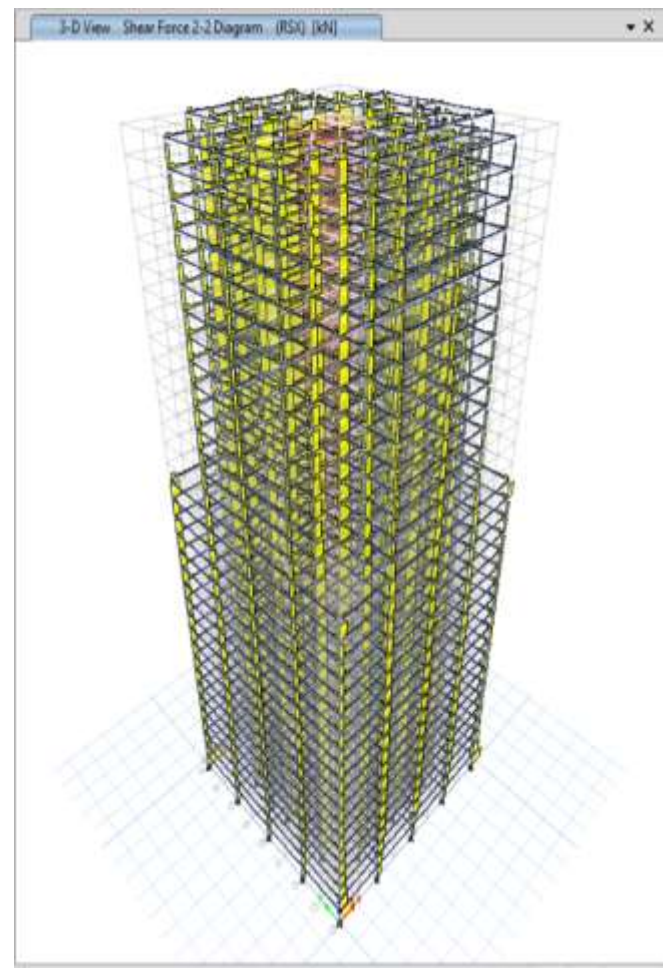


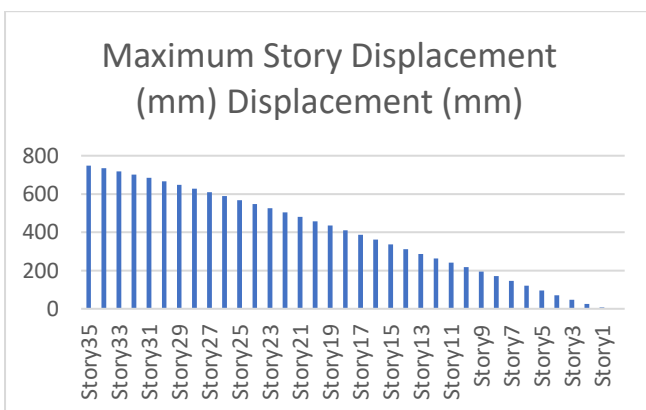
Fig1.109: American Model Normal G+35 SFD

Table1.83: American Model Normal G+35 Maximum Story Displacement

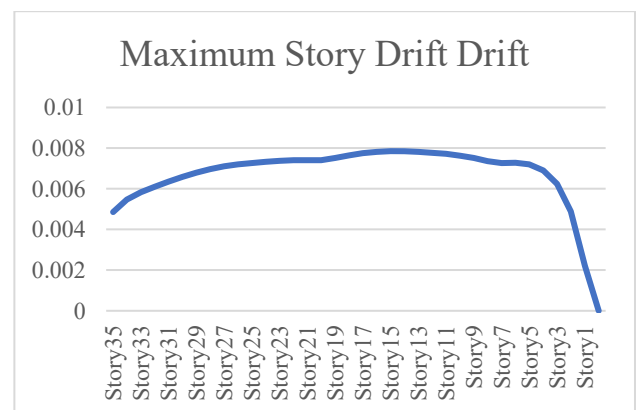
Maximum Story Displacement (mm)	
Story	Displacement (mm)
Story35	748.424
Story34	734.066
Story33	718.123
Story32	701.345
Story31	683.978
Story30	666.052
Story29	647.558
Story28	628.505
Story27	608.902
Story26	588.73
Story25	567.985
Story24	546.848
Story23	525.23
Story22	503.129
Story21	480.58
Story20	457.751
Story19	434.653
Story18	411.031
Story17	386.884
Story16	362.259
Story15	337.225
Story14	311.847
Story13	286.182
Story12	263.319
Story11	241.007
Story10	218.107
Story9	194.638
Story8	170.617
Story7	146.072
Story6	121.085
Story5	95.849
Story4	70.776
Story3	46.637
Story2	24.806
Story1	7.713
Base	0

Table1.84: American Model Normal G+35 Maximum Story Drift

Maximum Story Drift	
Story	Drift
Story35	0.004859
Story34	0.005471
Story33	0.005829
Story32	0.0061
Story31	0.006348
Story30	0.006582
Story29	0.006789
Story28	0.006962
Story27	0.007102
Story26	0.00721
Story25	0.007265
Story24	0.007321
Story23	0.00737
Story22	0.00741
Story21	0.007405
Story20	0.007405
Story19	0.00752
Story18	0.007642
Story17	0.007748
Story16	0.00782
Story15	0.007853
Story14	0.007851
Story13	0.007823
Story12	0.007777
Story11	0.007716
Story10	0.007634
Story9	0.007519
Story8	0.007356
Story7	0.007272
Story6	0.007285
Story5	0.007199
Story4	0.00691
Story3	0.006242
Story2	0.004885
Story1	0.002204
Base	0



Graph1.83: American Model Normal G+35 Maximum Story Displacement



Graph1.84: American Model Normal G+35 Maximum Story Drift

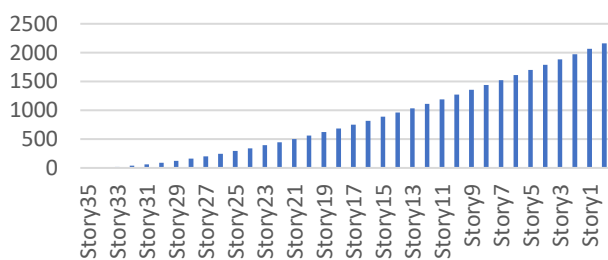
Table1.85: American Model Normal G+35 Maximum Story Overturning Moment

Maximum Story Overturning Moment	
Story	Overturning Moment
Story35	0
Story34	6.1216
Story33	18.4801
Story32	36.7462
Story31	60.5288
Story30	89.386
Story29	122.8367
Story28	160.3778
Story27	201.5073
Story26	245.7536
Story25	292.7039
Story24	342.0321
Story23	393.518
Story22	447.0487
Story21	502.6071
Story20	560.2443
Story19	620.3264
Story18	682.9629
Story17	748.1994
Story16	816.0177
Story15	886.3398
Story14	959.0476
Story13	1034.0071
Story12	1111.0884
Story11	1190.1762
Story10	1271.1692
Story9	1353.9724
Story8	1438.486
Story7	1524.5974
Story6	1612.176
Story5	1701.073
Story4	1791.1244
Story3	1882.1558
Story2	1973.9895
Story1	2066.454
Base	2159.3976

Table1.86: American Model Normal G+35 Story Stiffness

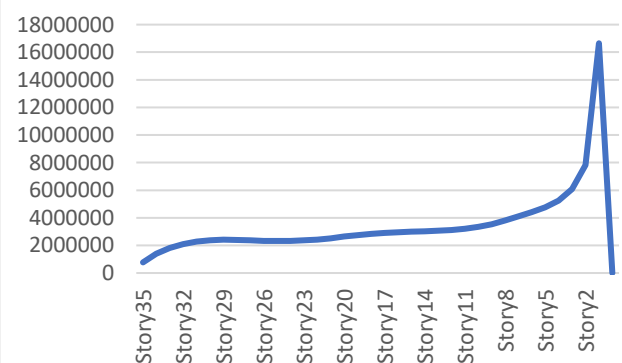
Story Stiffness	
Story	Stiffness
Story35	780074.996
Story34	1388113.173
Story33	1817049.454
Story32	2102551.381
Story31	2285237.729
Story30	2374621.375
Story29	2407751.984
Story28	2398432.478
Story27	2365444.554
Story26	2329409.297
Story25	2315671.519
Story24	2325408.249
Story23	2361350.151
Story22	2423162.554
Story21	2515650.866
Story20	2644415.687
Story19	2744562.538
Story18	2830652.433
Story17	2900377.074
Story16	2954596.775
Story15	2996003.446
Story14	3029618.81
Story13	3063930.75
Story12	3115310.696
Story11	3203391.981
Story10	3339850.064
Story9	3539611.361
Story8	3812414.136
Story7	4111430.46
Story6	4410147.356
Story5	4770550.208
Story4	5256414.44
Story3	6071377.816
Story2	7830264.857
Story1	16646319.91
Base	0

Maximum Story Overturning Moment Overturning Moment



Graph1.85: American Model Normal G+35 Maximum Story Overturning Moment

Story Stiffness Stiffness



Graph1.86: American Model Normal G+35 Story Stiffness

CONCLUSION

- 1) When the rotation of the structure is increases then the base shear is also increasing the total 3.1D structure base is higher than the remaining the structure. The base shear is 1% to 11% increases as compare to the other structure.
- 2) The maximum storey acceleration of the structure is 1.1D is increased by 14 %, 14.01%, 8%, and 16% as compared to the 2D, 2.1D, 3D and 3.1D when we decrease the twisted angle then the acceleration increases.
- 3) The Storey Stiffness 2.1D is increases by 6-7% around but 1.1D is decreasing by 66% around means when we increase the twist angle of floor then the Stiffness also increases.
- 4) The overturning moment effect of the all structure all near about the same the only 1-2% slightly increases 2.1D structure. Means no effect of floor rotation on the moment. It was increased when increases the storey height.
- 5) The maximum storey displacement of the structure 2.1D is increase 6% as compared to other type of structure all around displace nearly same means when we twisted the floor displacement is decreases.
- 6) When we increase the rotation of the floor then the modal time period also decreases
- 7) The maximum storey acceleration of the structure is 1.1D is increased by 2 %, 1.1%, 3%, and 1.8% as compared to the 2D, 2.1D, 3D and 3.1D when we decrease the twisted angle then the acceleration increases.
- 8) storey stiffness is for 1.1D Is increasing by 43 %, 31%, 33.1% and 26.4% as compare to the 2D, 2.1D, 3D and 3.1D model
- 9) The overturning moment is for 1.1D is increasing by 41 %, 33.4%, 31.1% and 24.4% as compare to the 2D, 2.1D, 3D and 3.1D model.
- 10) The maximum storey displacement of the structure 2.0D is increase 6% as compared to other type of structure but only 10% 1.1D type of structure. the displacement is varying for floor to floor.
- 11) When the rotation of the structure is increases then the base shear is also increasing the total 3.1D structure base is higher than the remaining the structure. The base shear is 4% to 12% increases as compare to the other structure.
- 12) When we increase the rotation of the floor then the modal time period also decreases

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