Comparison of Multi-Storied Building in Seismic Zone 1 & Seismic Zone 4

A project and thesis that are not fully in compliance with the requirements for the privilege of receiving a degree in
Bachelor of Science in Civil Engineering

Submitted by

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Certification

This is to certify that this project and thesis entitled "Comparison of Multi-Storied Building in Seismic Zone 1 & Seismic Zone 4" is done by the following student under my direct supervision of Lecture **Engr. Md. Imran Hasan Bappy** and this work has been carried out by him in the laboratories of the Department of Civil Engineering under the Faculty of Engineering of Daffodil International University in partial fulfillment of the requirements for the degree of Bachelor of Science in Civil Engineering. The presentation of the work was held on 27 March 2024.

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The task and theory named "Comparison of Multi-Storied Building in Seismic Zone 1 & Seismic Zone 4" using ETABS" was put together by Nafiz Anam, ID No: 182-47-714. Meeting: Summer 2018 has been acknowledged as good in halfway satisfaction of the necessities for the level of Bachelor of Science in Civil Engineering on June 2024.

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DECLARATION

With deepest gratitude and admiration, this work is dedicated to the unwavering support & invaluable guidance of my revered parents.

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ABSTRACT

Among the most destructive and erratic acts of nature, earthquakes wreak havoc on human life and infrastructure with an intensity never seen before. Structural components suffer significant damage from the seismic forces released during an earthquake, often with disastrous results. Buildings must therefore be carefully investigated and designed, taking into account potential lateral forces. A thorough analysis of the response range of a six-story building was conducted in a recent case study utilizing two different computer programs, one of which being ETABS 2016. We compared two seismic zone there. There we found that Seismic Zone 4 is more risky than Seismic Zone 1 according to an analysis of all the data. All of the column and beam values for the specific elevation in X axis and Y axis indicates that the values for seismic zone 4 (Sylhet) are higher than those for seismic zone 1 (Jessore). Additionally, it can be found that Sylhet, Zone 4, has larger displacement than Jessore, Zone 1, by examining the story response of the maximum story displacement for EQx and EQy in seismic zones 1 and 4. Additionally, seismic zone 4 generally has higher maximum story drifts than seismic zone 1.

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CHAPTER I

Introduction

1.1 GENERAL

Earthquakes represent unforeseen catastrophes that profoundly impact both human lives and infrastructure, disrupting communities, displacing individuals, and inflicting severe economic setbacks. The aftermath of an earthquake often entails years of recovery efforts to mitigate losses and rebuild affected areas. Remarkably, seismic tremors can reverberate across vast distances from the epicenter, underscoring the widespread reach of these events.

At their core, earthquakes result from the abrupt release of seismic energy along fault lines, causing the earth's surface to convulse. The destructive potential of earthquakes is starkly evident in the damage they inflict on buildings and structures. Seismic monitoring tools such as seismographs and the Richter scale serve to gauge the intensity of seismic waves generated within the earth's crust and their impact on the surface.

In the face of seismic threats, the resilience of buildings is paramount. Structural analysis, particularly seismic analysis, plays a pivotal role in understanding how buildings respond to earthquake-induced stresses. With the proliferation of multi-story buildings for commercial and residential purposes, ensuring their earthquake resistance is imperative. Unfortunately, many high-rise structures are not adequately fortified against lateral forces, rendering them susceptible to catastrophic collapse.

Designing earthquake-resistant structures entails a comprehensive consideration of various factors, including the inherent frequency of the structure, damping characteristics, foundation type, structural importance, and ductility. By integrating these elements into the design process, engineers strive to create buildings that can withstand the rigors of seismic activity, thereby safeguarding lives and property against the ravages of earthquakes.

1.2 OBJECTIVES OF THIS RESEARCH

The principle purpose of this research is to :

1. Comparison of Maximum Shear and Maximum Moment in Seismic Zone 1 & Seismic Zone 4.

2. Comparison of Maximum Story Displacement and Maximum Story Drifts in Seismic Zone 1 & Seismic Zone 4.

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CHAPTER II

LITERATURE EVALUATE

2.1 GENERAL

The epicenter of an earthquake triggers ground vibrations that propagate in all directions, inducing structural vibrations and inertia forces. Adherence to the Indian earthquake syntax IS 1893 (Part 1) 2002 is imperative for ensuring structural resilience during seismic events. Past significant earthquakes have underscored the importance of addressing construction flaws to prevent structural damage or collapse.

Structures anchored to the ground experience motion as the earth vibrates during earthquakes. Consequently, seismic loading on a structure is a result of the ground's movement rather than external forces. While structures may be engineered to endure earthquakes with limited damage and without catastrophic failure, achieving this balance is critical for preserving human safety and well-being.

Furthermore, seismic analysis of structures cannot rely solely on peak ground acceleration rates. Instead, it must account for the frequency content of ground motion and the dynamic characteristics of the structure itself to accurately predict structural response during earthquakes.

2.2 LITERATURE EVALUATE

The publications below were disseminated by a variety of various authors throughout the course of the last several years.

Interdependence of Column Moment Values in a Structures with Various Structural Difficulties and Earthquake Area" In this study, two earthquake zones are examined for a multi-story building with varying architectural difficulties using the Etabs programme. And with such outcomes, the following conclusion is drawn. (318 Building Code Topic, February 14,2022)

In this study, the software ETABS is used to analyze a multi-story building with varying architectural complexities for several seismic zones. And with such outcomes, the following conclusion is drawn. It is established that, in comparison to lower seismic zones, higher seismic zones exhibit significantly larger moment values in the situations modeled and analyzed.

As a result, the study looks at the cost-effectiveness of column constructions as well as their safety or unreliability in seismically active places. This research examines the behavior of a standard multi-story building with all of its columns when it is subjected to lateral stresses. Through comparison, it was determined that column buildings are unsafe in seismic zones because their lateral displacement is greater than that of another seismic zone.

Dynamic evaluation done utilizing the models generated in ETABS and the design spectra of a chosen zone. The performance metrics of conventional and ductile building models are analyzed and contrasted for various design adjustments, including story displacements, drift, shear, and moments. Moreover, pushover assessments are performed on the tallest and lowest building models. The prices of traditional and ductile partitions are contrasted and analyzed based on the weight of reinforcing bars. Additionally, because ductile shear wall installations are challenging, sensitivity analysis is done. Conventional design dramatically increases induced seismic reactivity and costs in comparison to ductile construction.

The objectives of this study are as stated in the title, and the analysis is performed using the ETABS programme. The experiment of cut through, bent instant, and twisting is observed, as are the results. This study examines how alternative shear wall shapes are placed in high-rise buildings in response to seismic loads, taking into account both a frame and a dual system. (ETABS- Documentation- Computers and Structures Inc, 2022)

2.3 OVERVIEW

During this section, we explored the fundamentals of designing and analyzing structures by ETABS. We also discussed the design and analysis software used, ensuring adherence to building codes. We covered topics such as structural modeling, describing different types of loads on buildings and the construction process.

CHAPTER III

Methodology

3.1 OVERALL STRUCTURAL COVERAGE

Four structures that stand in for RCC concrete structures, ranging in height from low to medium buildings are examined in this research. Specifically, six-story buildings have been selected for analysis in the present study.

3.2 CODE FOLLOWED

In the design process utilizing ETABS software, adherence to relevant building codes is essential. The ASCE/SEI 7-05 (American Society of Civil Engineers/Structural Engineering Institute) codes are applied. ASCE/SEI 7-05 is an integral part of building codes in the United States. The earthquake load provisions in ASCE 7-05 are substantially adopted by reference in the 2006 International Building Code and the 2006 NFPA 5000 Building Construction and Safety Code. Compliance with these codes is imperative to ensure structural integrity and safety in accordance with ETABS software requirements Specifically, for structural design, the ACI 318-08 (American Concrete Institute) or ACI 318-19 (American Concrete Institute) codes are utilized. ACI 318-08, “Building Code Requirements for Structural Concrete and Commentary,” is the document that presents the code requirements for design and construction of structural concrete that are necessary to ensure public safety. ACI 318–19 raises limits on the specified strength of reinforcement in earthquake-resistant shear wall and moment frame systems. The new standard allows Grade 80 reinforcement for some seismic systems and no longer allows Grade 40 rebar to be used in seismic applications. Additionally, for considerations regarding wind loads and earthquake resistance.

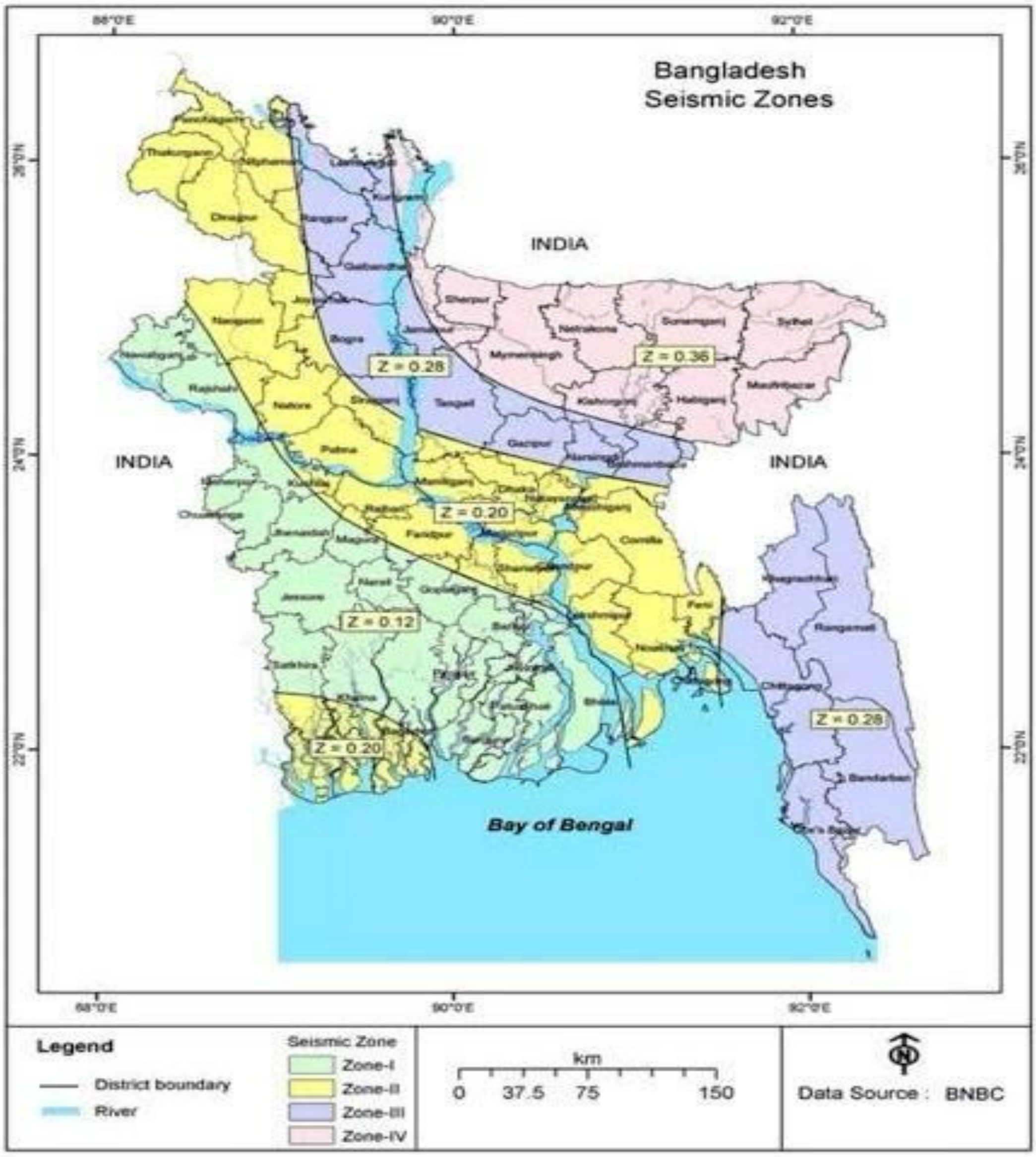
3.3 SEISMIC ZONE

As per the Bangladesh National Building Code (BNBC), There are four distinct earthquake zones in Bangladesh. Here is a table that displays Bangladesh's zone coefficients.

Table 3.1: Earthquake Area Element, Z

Zone	1	2	3	4
Zone Factor, Z	0.12	0.20	0.28	0.36

Fig 3.1: Seismic Zone Map of Bangladesh



3. 4 RESOURCES DESCRIPTIONS

Materials include requirements, durability, usage duration, information, suppliers, and security information. All of these are described in the material specifications. Table 3.2 provides an overview of the material requirements.

Table 3.2 Resources Descriptions

Material	**Specifications**
Grade of Concrete	Fc = 4 ksi
SW thickness	SW= 250 mm
Grade of Steel	Fey= 415 N/mm^2
Density of Concrete	Dc= 25 kN/m^3

3.5 THE STRUCTURE'S DEXTERITY DEADLIGHTS

Gravity loads are made up of two types: "live" loads, which are transient or temporary loads like the weight of the building's occupants and contents, and "dead" loads, which are permanent or long-lasting loads like the mass of a building's walls, ground tiled, finishes, and technical frame works. The three primary design factors that affect a structure are dead load, living load, and seismic load, based on BNBC specifications. The parameters and loads are shown in the following Table 3-3:

Table 3.3 Deadlights Regarding Construction

Parameters	**Loads**
LL	4.8 KN/m^2
FF	1.2 KN/m^2
PW	33% LL

Tabular 3-3 demonstrates the specifications for an advanced design, where a live load (LL) of 4.8 KN/m is applied on each floor except for the rooftop, where a live load of 2.9 KN/m is used. Additionally, a floor finish (FF) of 1.2 KN/m^2 and partition wall weight (PW) of 20-25 psf are employed in our construction. As per BNBC 2020, either 33 percent of the live load or a minimum of 1.2 KN/m can be utilized for partition. Nevertheless, we chose the lowest possible worth of 1.2 KN/m2, that was following investigation, was altered to 3.584 KN/m2.

3.6 AIR DEADLIGHTS

Air deadlights refers to the force exerted on a framework by the speed and heft of air. Vacuum strain is generated in areas of low pressure during high winds, sometimes strong enough to lift the corner of a roof. Table 3.4 presents the wind data for analysis:

Table 3.4 Wind information for investigation

Boundary	**Esteem**
Air speed (m/hr.)	147
Transparency type	B
Importance factor	1
Floor range	GB to Top floor

According to Table 3-4, wind loads are difficult to forecast since they depend on wind speed as well as the structure's form and surface. The construction might accentuate any consequences of protrusion or under-tension. We used the average wind speed of 147 mph for Dhaka city for our rectangle structure. The significant factor for our exposure type, B, is 1.

3.7 SEISMIC TREMOR DEADLIGHTS

Among the fundamental concepts of seismic engineering is earthquake load, which is the transmission of seismic stirring up a framework. This load may show up at the ground contact surfaces of a structure, at the structures next to it, or as a result of tsunami gravity waves. I made use of the seismic data from Zones 1 and 4, which are shown in Tables 3-5 and 3-6 beneath :

:

Table 3.5 Seismic data for seismic zone 1

Boundary	Esteem
Seismic zone	Zone 1
Zone factor	0.12
Type of soil	SD
Site coefficients, Sc	1.5
Site Coefficient Sa	1.35
Signification factor	1
Mathematical coefficient factor, RE	8
Ct	0.03

Table 3.6 Seismic data for seismic zone 4

Boundary	Esteem
Seismic zone	Zone 4
Zone factor	0.36
Type of soil	SD
Site coefficients, Sc	1.2
Site Coefficient Sa	1.15
Signification factor	1
Mathematical coefficient factor, RE	8
Ct	0.04

3.8 DESIGN LOAD COMBINATION

In compliance with BNBC 2020 regulations, specifically "statement 2.7.3 assumptions" regarding "Blends of Load impacts for Strength Design Method" and in accordance with condition 2.7.3.1, the heap mixes are accounted for. For example, in accordance with BNBC 2020 statement 2.7.3 presumptions" for "Blends of Load impacts for Strength Design Method" are followed.

3.9 LOAD COMBINATION

Table 3.7 Load Combination

0.9DL – 1.6Wx	1.2DL – 0.8Wx	1.29DL + LL +Ex + 0.3Ey
0.9DL + 1.6Wx	1.2DL + 0.8Wx	1.29DL + LL +Ey – 0.3Ey
0.9DL – 1.6Wy	1.2DL – 0.8Wy	1.29DL + LL +Ey + 0.3Ey
0.9DL + 1.6Wy	1.2DL + 0.8Wy	1.29DL + LL +Ex – 0.3Ey
0.81DL + Ex - 0.3Ey	1.2DL + 1.6LL	1.29DL + LL +Ex + 0.3Ey
0.81DL + Ex + 0.3Ey	1.2DL + LL	1.29DL + LL +Ey – 0.3Ey
0.81DL - Ex - 0.3Ey	1.4DL	1.29DL + LL +Ey + 0.3Ey
0.81DL - Ex + 0.3Ey	1.2DL + LL – 1.6Wx	DL + 0.5LL – 0.7Wx
0.81DL + Ey - 0.3Ex	1.2DL + LL + 1.6Wx	DL + 0.5LL + 0.7Wx
0.81DL + Ey + 0.3Ex	1.2DL + LL – 1.6Wy	DL + 0.5LL – 0.7Wy
0.81DL - Ey - 0.3Ex	1.2DL + LL + 1.6Wy	DL + 0.5LL + 0.7Wy
0.81DL - Ey + 0.3Ex	1.29DL + LL +Ex – 0.3Ey	

3.10 MATERIAL PROPERTY

Modulus of Elasticity of Concrete, Ec = 3600ksi

Poisson's Ratio of Concrete = 0.2

Minimum Yield Strength of Steel, Fy = 60ksi

Concrete Compressive Strength, f'c = 4ksi

3.11 MODEL GEOMETRY

The analyzed structures consist of six-story buildings with identical geometries.

Six storied RCC building

Number of bays along X-direction = 6

Number of bays along Y-direction = 7

Base to ground floor height = 6 Feet

Feet Story height =10 feet

Bay width along X-direction = 17 Feet

Bay width along Y-direction = 17 Feet

Fig 3.2: Column Layout Plan

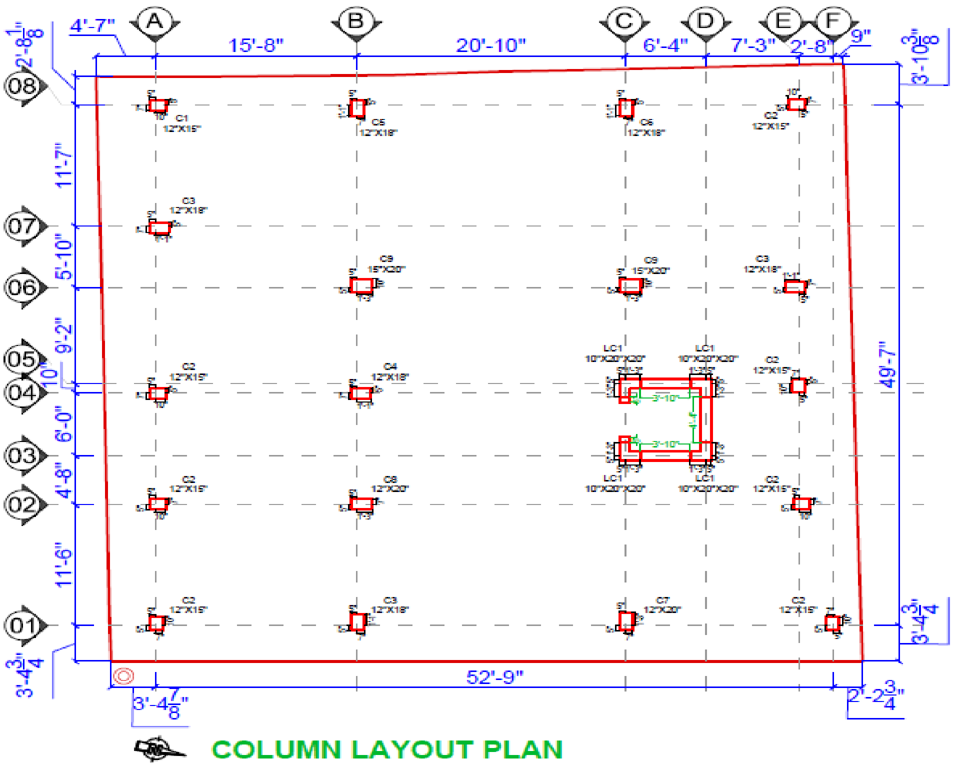


Fig 3.3: Floor Beam Layout Plan

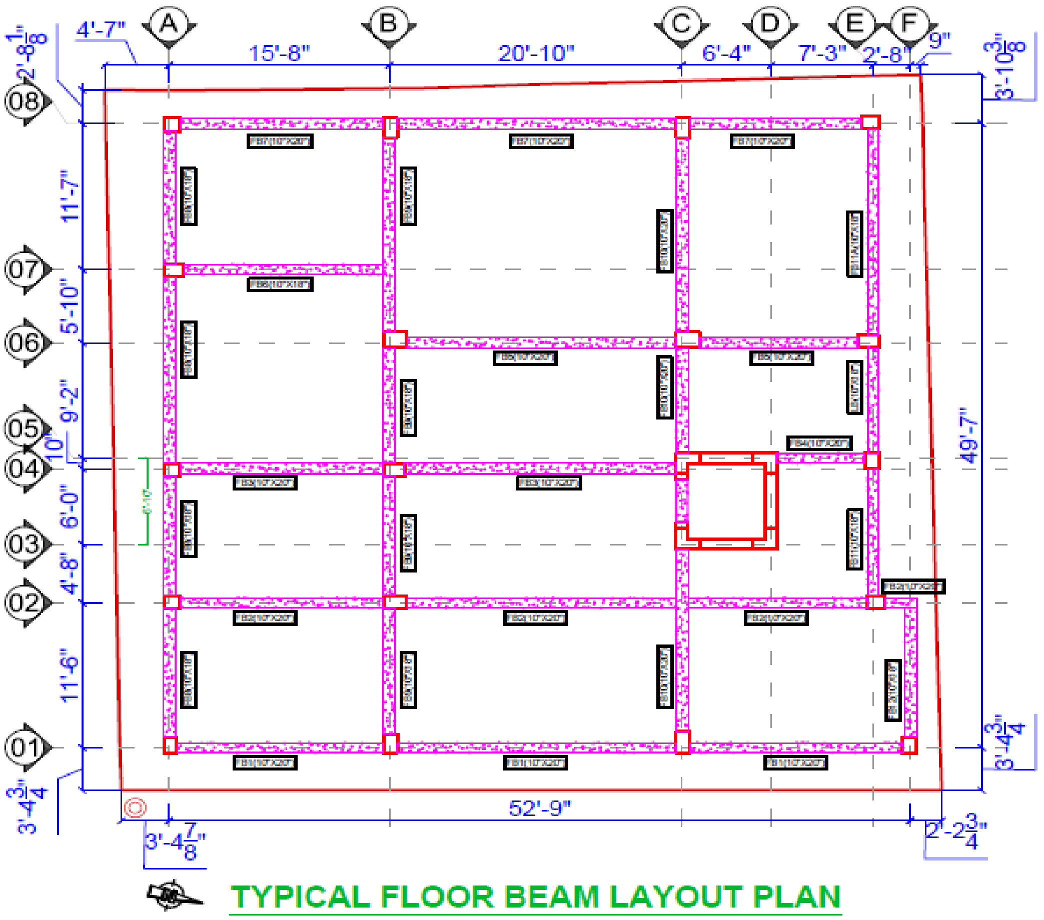


Fig 3.4: Ground Floor Plan

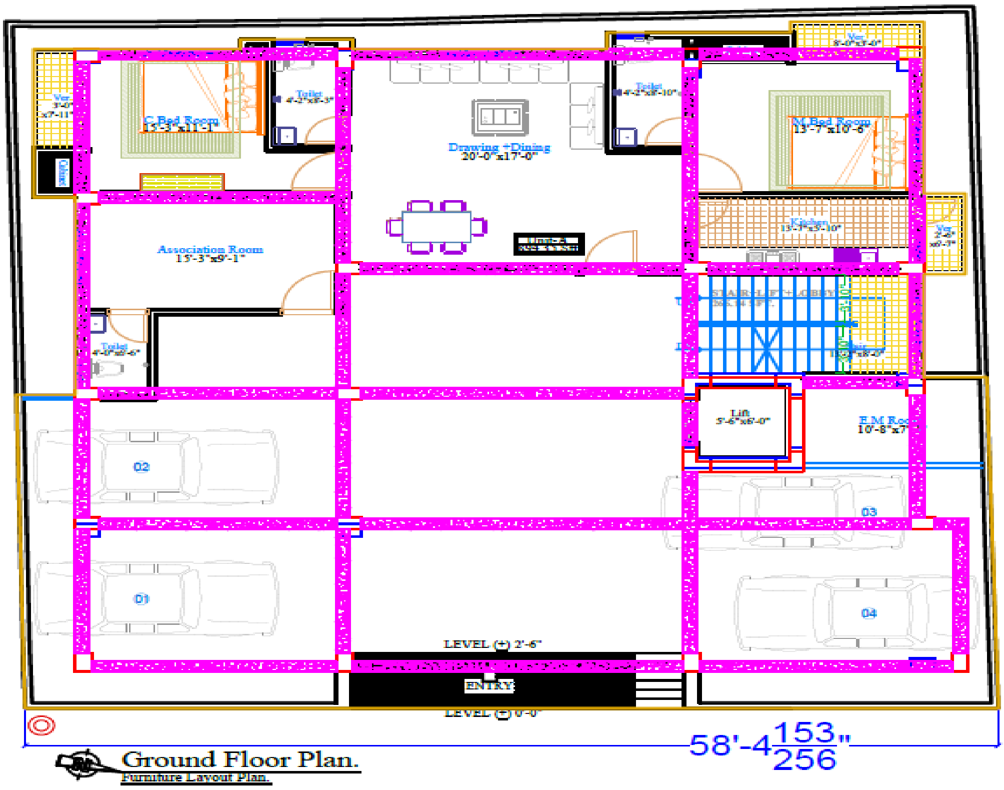


Fig 3.5: View of Zone 1 in Etabs

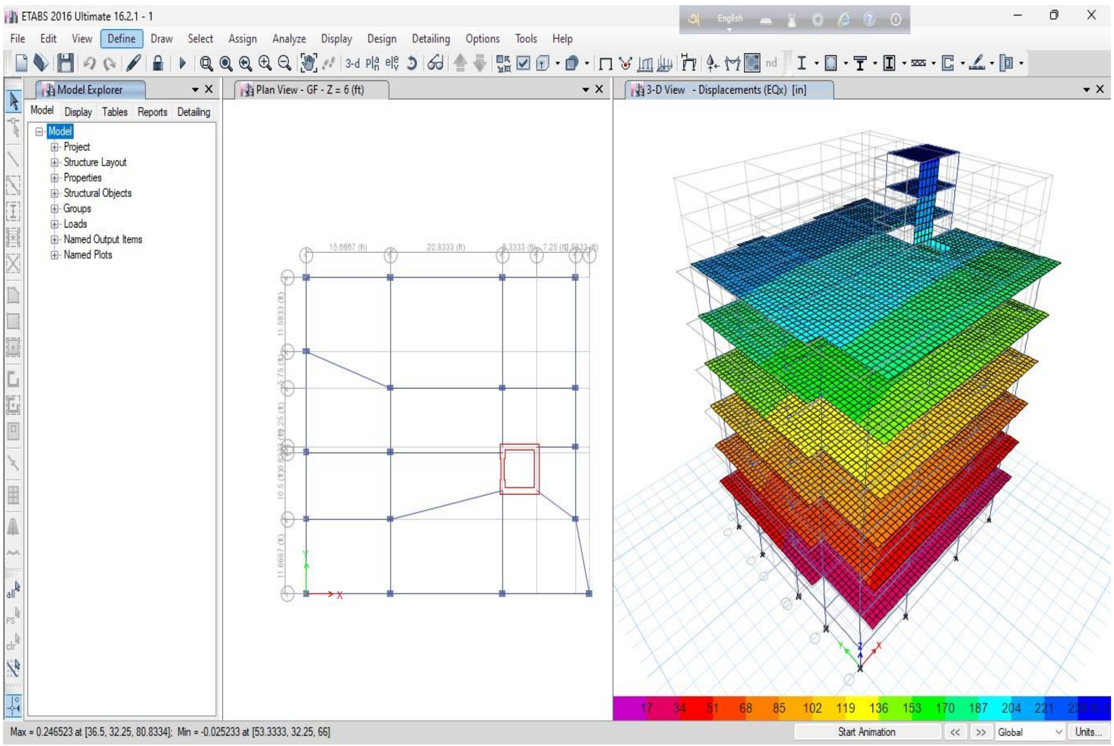
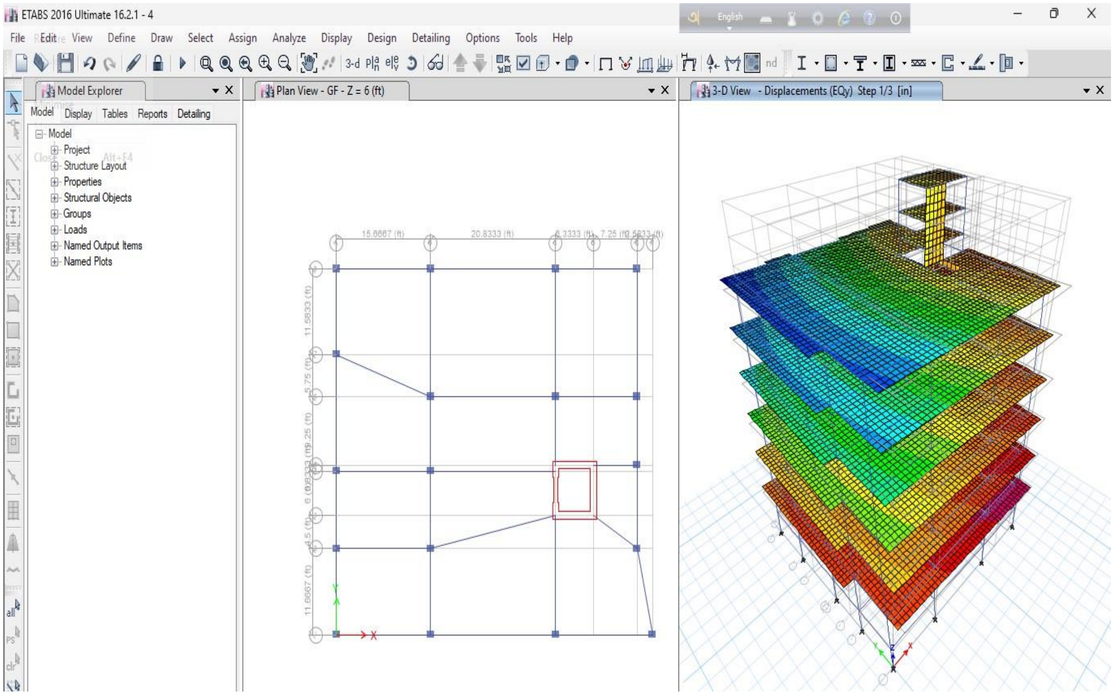


Fig 3.6: View of Zone 4 in Etabs



3.12 LOADING CONDITION

Floor Finish = 0.000174 ksi

Partition Wall = 0.000556 ksi

Dead Load = 0.000834 ksi

Live Load = 0.000347 ksi

Wind load is automatically calculated by program.

As per BNBC :

Site location = Jessore, Zone =1

Basic wind speed = 141 km/hr Exposure = A

Structure importance factor = 1.00

Seismic load is automatically calculated by program.

As per BNBC :

Site location, Jessore , Zone = 1

Seismic zone factor, Z = 0.12

Seismic zone factor, Z=0.075 Site coefficient, S = 1.5

Structure importance factor, I = 1.00

Seismic modification factor for RCC building, R = 8 (IMRF)

Time period for RCC building, Ct (ft.) = 0.030

Loading Condition

Floor Finish = 0.000174 ksi

Partition Wall = 0.000556 ksi

Dead Load = 0.000834 ksi

Live Load = 0.000347 ksi

Wind load is automatically calculated by program.

As per BNBC :

Site location = Sylhet Zone = 4

Basic wind speed = 142 km/hr Exposure = B

Structure importance factor = 1.00

Seismic load is automatically calculated by program.

As per BNBC :

Site location = Sylhet Zone = 4

Seismic zone factor, Z = 0.36

Seismic zone factor, Z= 0.075 Site coefficient, S = 1.2

Structure importance factor, I = 1.00

Seismic modification factor for RCC building, R = 8 (IMRF)

Time period for RCC building, Ct (ft.) = 0.040

3.13 WORK PROCESS STEP

The workflow step encapsulates the activities undertaken throughout the project:

Step 1: Selection of a structure that is rectangular shape as the design blueprint, adhering to the BNBC 2020 design code.

Step 2: Determine the material qualities, such as shear walls, slab sections, columns, and beams, in step two.

Step 3: Applying different kinds of loads, then analyzing and summarizing the results in Chapter 3.

3.14 SUMMARY

We looked at the design and investigation programs that were used, as well as the fundamentals of exhibiting and inspecting buildings with shear dividers, in this part. We adhered to the code. presenting the architecture and representation There are several types of loads placed on structures and the construction process.

CHAPTER IV

Result and Conversation

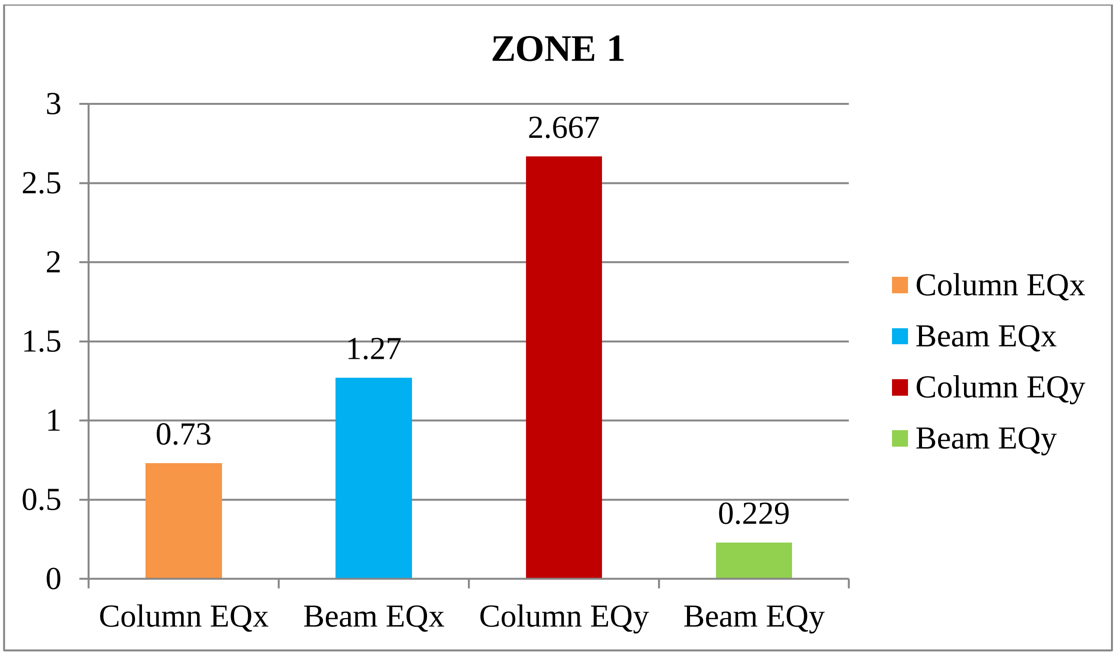
4.1 OVERALL

Results of the "Comparison of Multi-Storied Building in Seismic Zone 1 & Seismic Zone 4" study, which was conducted using ETABS software, are presented in this chapter. Six-story structures located in Seismic Zones 1 and 4 are analyzed with respect to their maximum shear, maximum moment, maximum story displacement, and maximum story drifts.

4.2 COMPARISON OF SHEAR IN SEISMIC ZONE 1 & SEISMIC ZONE 4

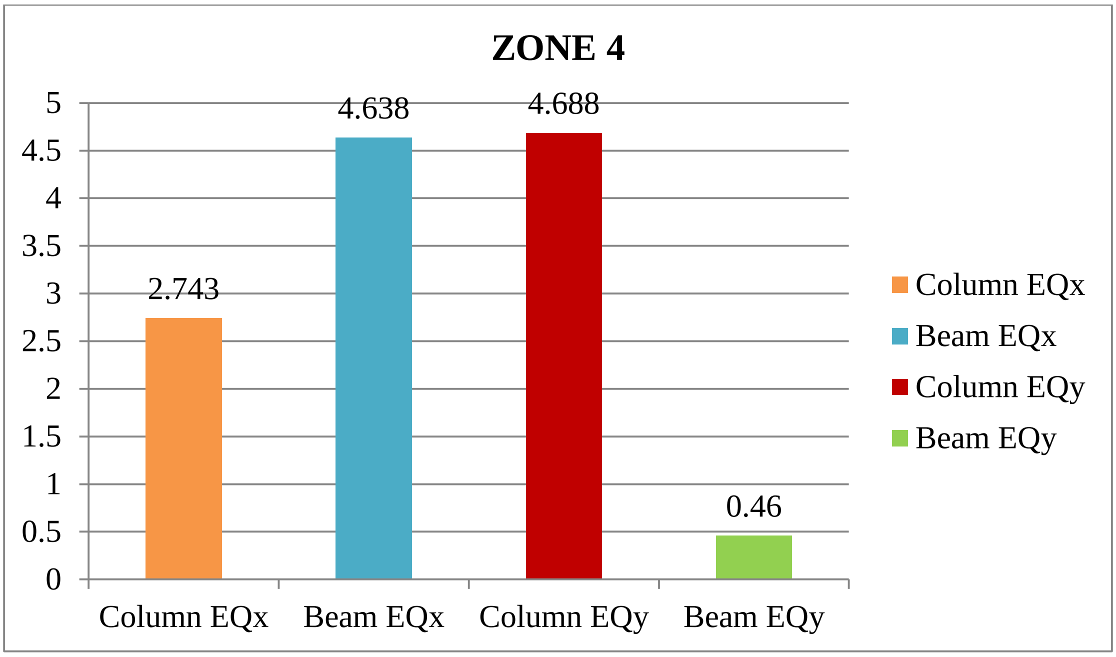
As earlier we took Seismic Zone 1 as Jessore and Seismic Zone 4 as Sylhet. Analysis by ETABS software we took value and put it on excel sheet to make the chart. Using this two we found values for seismic zone 1 and 4. We take all the values from a selected elevation view towards X axis and Y axis.

Figure 4.1 : Maximum Shear Force for Zone 1



As you see from Fig 4.1, Maximum Shear Force for Zone 1, we make a chart for Column EQx, Beam EQx, Column EQy & Beam EQy from a particular elevation to compare between these two axis. From Fig 4.1, for Column EQx, Beam EQx, Column EQy & Beam EQy values are accordingly 0.73 kip, 1.27 kip, 2.667 kip & 0.229 kip.

Figure 4.2 : Maximum Shear Force for Zone 4

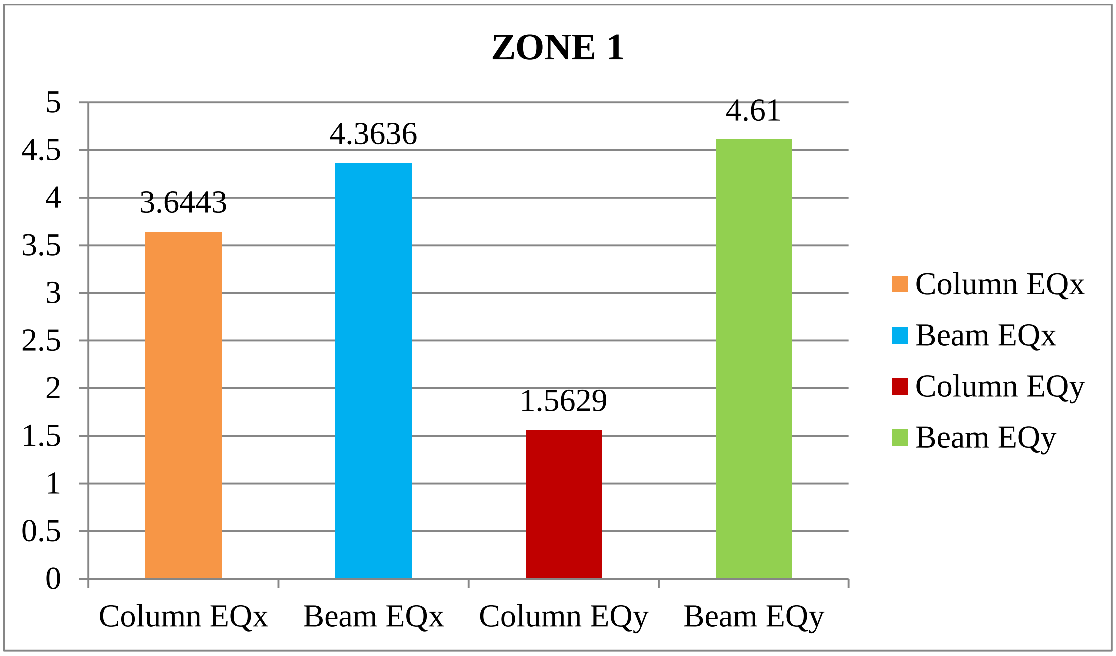


As you see from Fig 4.2, Maximum Moment for Zone 4, we make a chart for Column EQx, Beam EQx, Column EQy & Beam EQy from a particular elevation to compare between these two axis. From Fig 4.2, for Column EQx, Beam EQx, Column EQy & Beam EQy values are accordingly 2.743 kip, 4.638 kip, 4.688 kip & 0.46 kip.

4.3 COMPARISON OF MOMENT IN SEISMIC ZONE 1 & SEISMIC ZONE 4

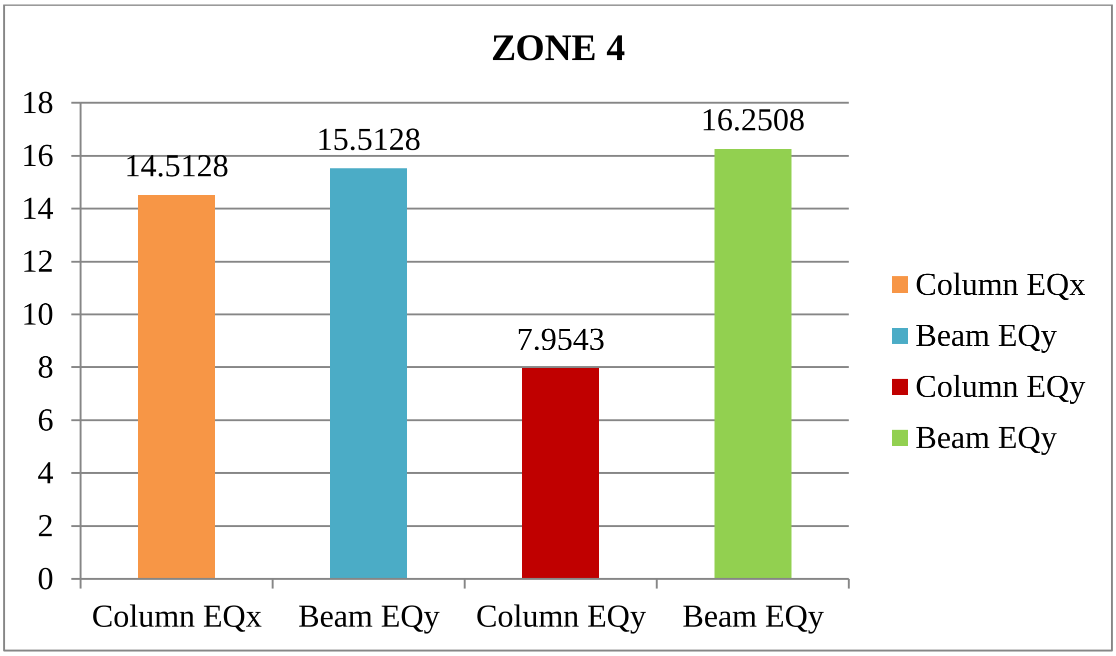
Analysis by Etabs Softwere to create the chart, we took the value and entered it into an Excel file. We determined values for seismic zones 1 and 4 using these two softwere. We extract all the values along the X and Y axis from a particuler elevation view.

Fig 4.3 : Maximum Moment for Zone 1



As you see from Fig 4.3, Maximum Shear Force for Zone 1, we make a chart for Column EQx, Beam EQx, Column EQy & Beam EQy from a particular elevation to compare between these two axis. From Fig 4.3, for Column EQx, Beam EQx, Column EQy & Beam EQy values are accordingly 3.6443 kip, 4.3636 kip, 1.5629 kip & 4.61 kip.

Fig 4.4 : Maximum Moment for Zone 4



As you see from Fig 4.4, Maximum Moment for Zone 4, we make a chart for Column EQx, Beam EQx, Column EQy & Beam EQy from a particular elevation to compare between these two axis. From Fig 4.4, for Column EQx, Beam EQx, Column EQy & Beam EQy values are accordingly 14.5128 kip, 15.5128 kip, 7.9543 kip & 16.2508 kip.

4.4 MAXIMUM DISPLACEMENT IN SEISMIC ZONE 1 & SEISMIC ZONE 4

Fig 4.5 : Maximum Displacement for EQx in Zone 1

ETABS 2016 16.2.1 License #*1YJKTU3Z3HZBURR

Story Response - Maximum Story Displacement

Summary Description

This is story response output for a specified range of stories and a selected load case or load combination.

Input Data

Name	Zone 1		
Display Type	Max story displ	Story Range	All Stories
Load Case	EQx	Top Story	OWHR
Output Type	Not Applicable	Bottom Story	Base

Plot

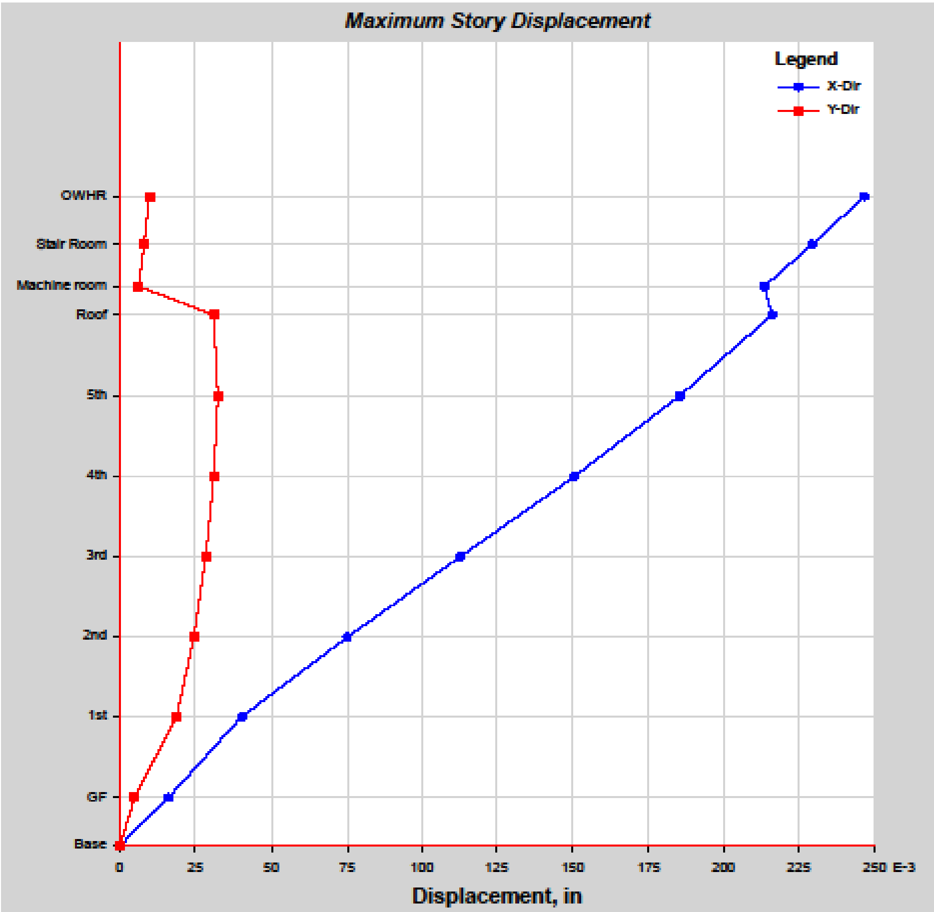


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Fig 4.6 : Maximum Displacement for EQy in Zone 1

ETABS 2016 16.2.1 License #*1YJKTU3Z3HZBURR

Story Response - Maximum Story Displacement

Summary Description

This is story response output for a specified range of stories and a selected load case or load combination.

Input Data

Name	Zone 1		
Display Type	Max story displ	Story Range	All Stories
Load Case	EQy	Top Story	OWHR
Output Type	Not Applicable	Bottom Story	Base

Plot

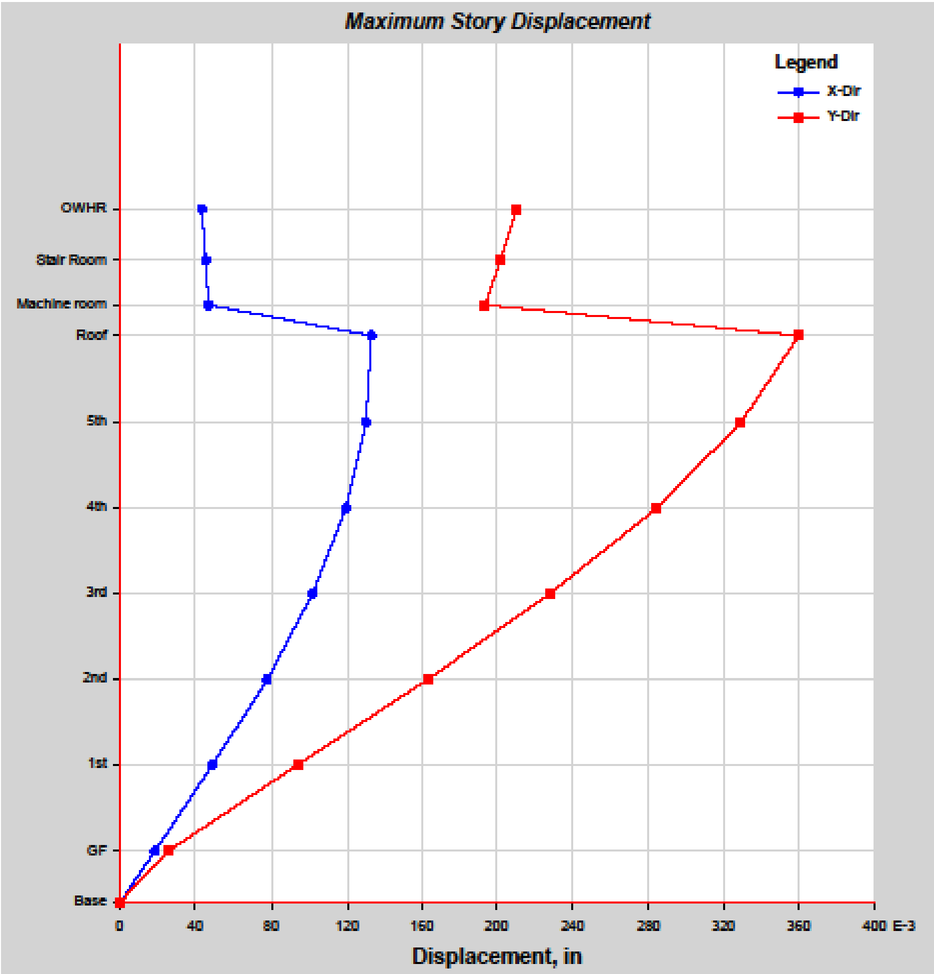

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Fig 4.7 : Maximum Displacement for EQx in Zone 4

ETABS 2016 16.2.1 License #*1YJKTU3Z3HZBURR

Story Response - Maximum Story Displacement

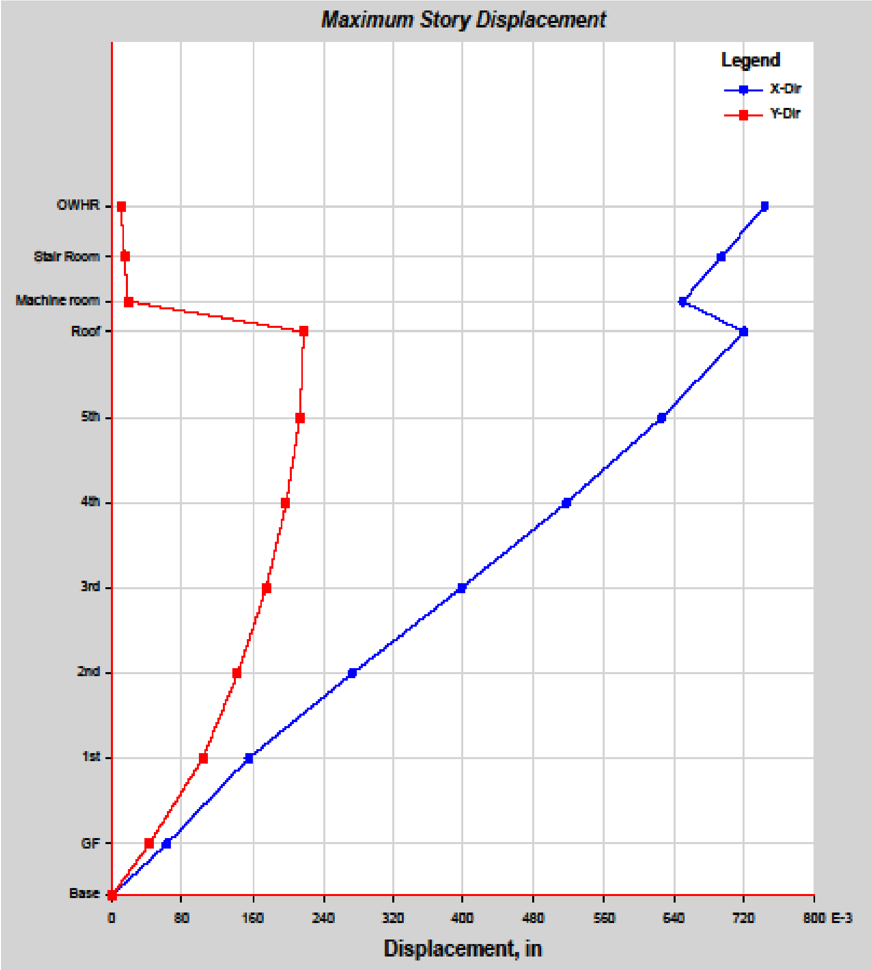
Summary Description

This is story response output for a specified range of stories and a selected load case or load combination.

Input Data

Name	Zone 4		
Display Type	Max story displ	Story Range	All Stories
Load Case	EQx	Top Story	OWHR
Output Type	Max	Bottom Story	Base

Plot



4.EDB Page 1 of 1 6/25/2020

Fig 4.8 : Maximum Displacement for EQy in Zone 4

ETABS 2016 16.2.1 License #*1YJKTU3Z3HZBURR

Story Response - Maximum Story Displacement

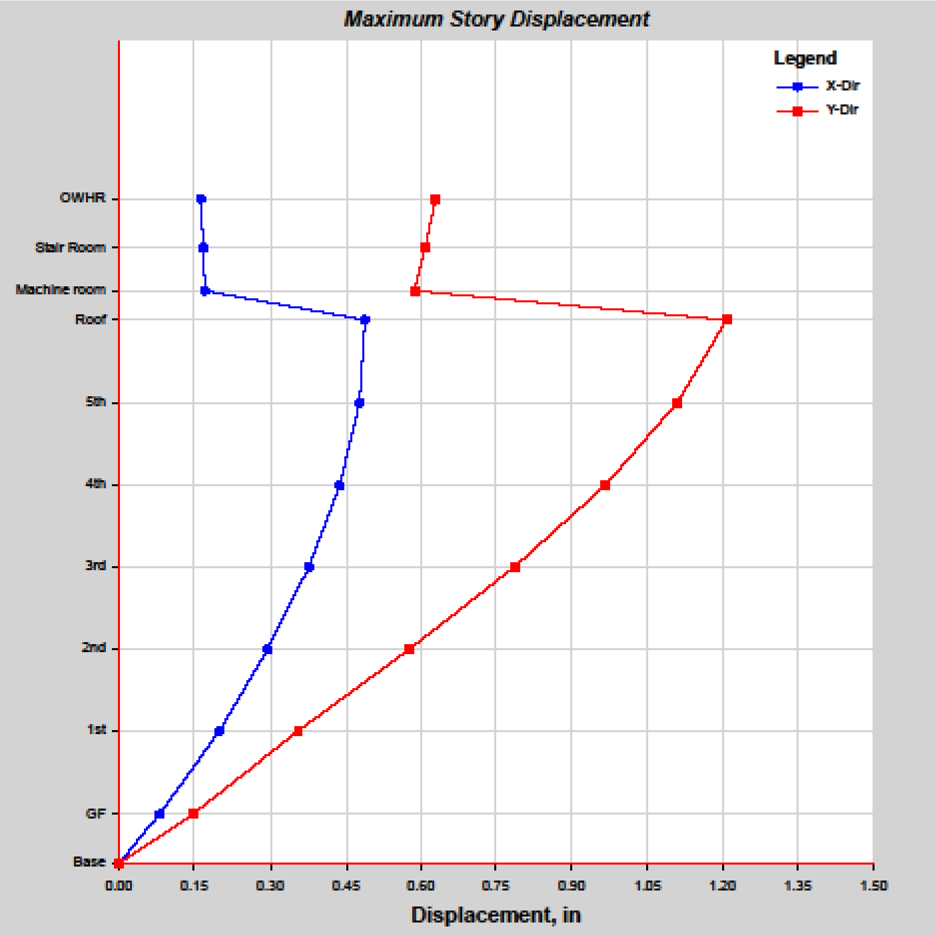
Summary Description

This is story response output for a specified range of stories and a selected load case or load combination.

Input Data

Name	Zone 4		
Display Type	Max story displ	Story Range	All Stories
Load Case	EQy	Top Story	OWHR
Output Type	Max	Bottom Story	Base

Plot



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4.5 MAXIMUM DRIFTS IN SEISMIC ZONE 1 & SEISMIC ZONE 4

Fig 4.9 : Maximum Drifts for EQx in Zone 1

ETABS 2016 16.2.1 License #*1YJKTU3Z3HZBURR

Story Response - Maximum Story Drifts

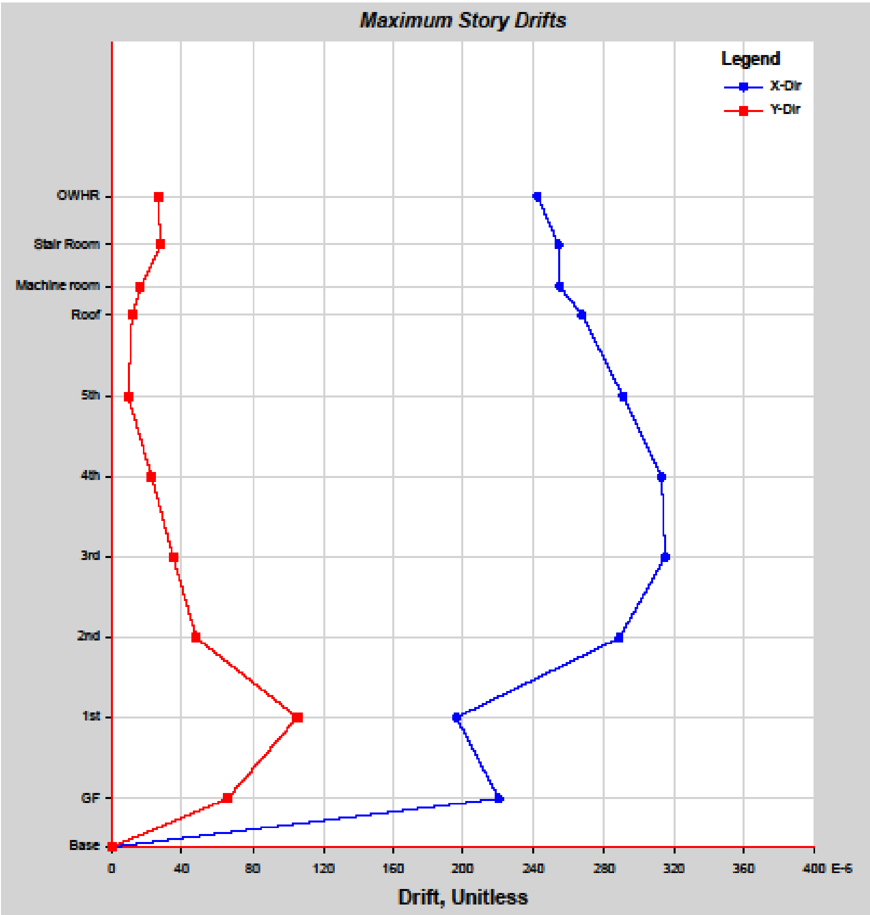
Summary Description

This is story response output for a specified range of stories and a selected load case or load combination.

Input Data

Name	Zone 1		
Display Type	Max story drifts	Story Range	All Stories
Load Case	EQx	Top Story	OWHR
Output Type	Not Applicable	Bottom Story	Base

Plot



1.EDB Page 1 of 1 6/25/2020

Fig 4.10 : Maximum Drifts for EQy in Zone 1

ETABS 2016 16.2.1 License #*1YJKTU3Z3HZBURR

Story Response - Maximum Story Drifts

Summary Description

This is story response output for a specified range of stories and a selected load case or load combination.

Input Data

Name	Zone 1		
Display Type	Max story drifts	Story Range	All Stories
Load Case	EQy	Top Story	OWHR
Output Type	Not Applicable	Bottom Story	Base

Plot

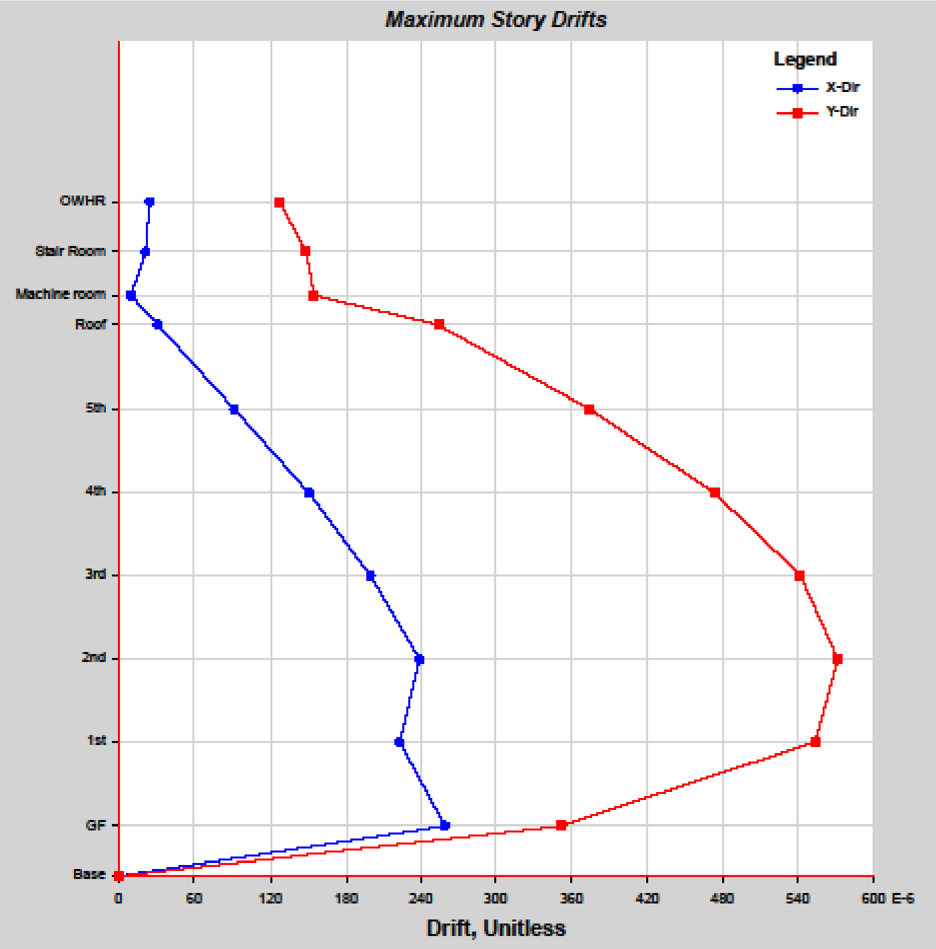


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Fig 4.11 : Maximum Drifts for EQx in Zone 4

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Story Response - Maximum Story Drifts

Summary Description

This is story response output for a specified range of stories and a selected load case or load combination.

Input Data

Name	Zone 4		
Display Type	Max story drifts	Story Range	All Stories
Load Case	EQx	Top Story	OWHR
Output Type	Max	Bottom Story	Base

Plot

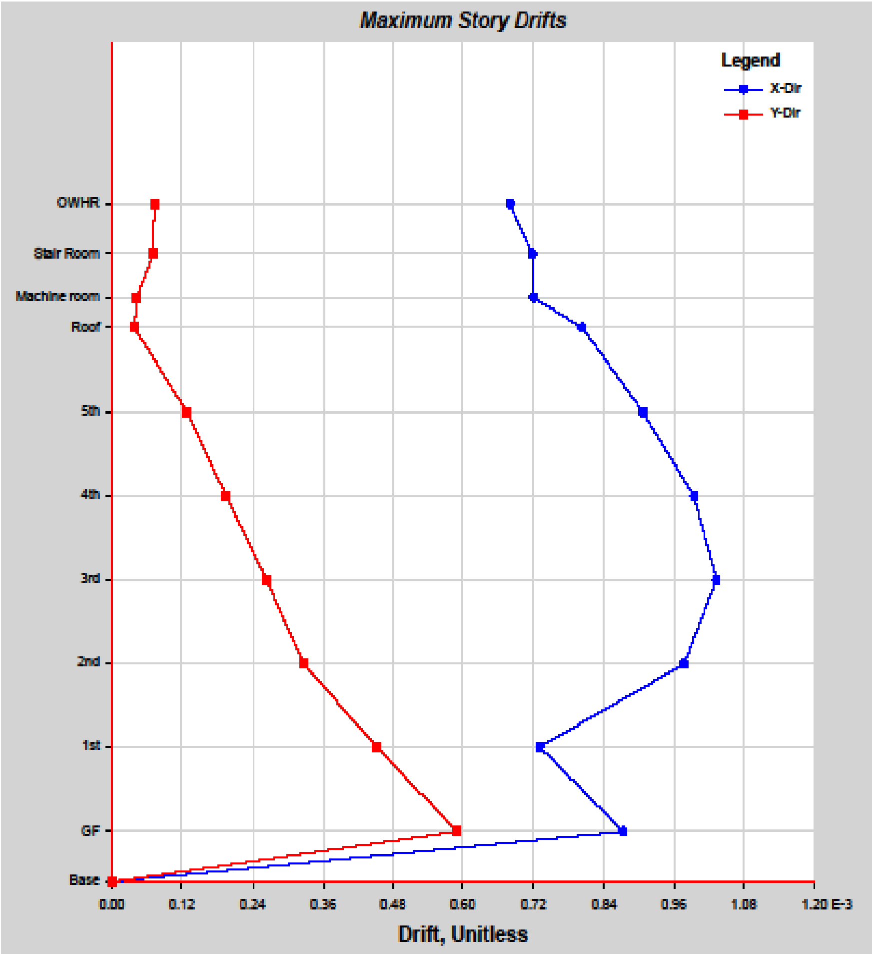

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Fig 4.12 : Maximum Drifts for EQy in Zone 4

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Story Response - Maximum Story Drifts

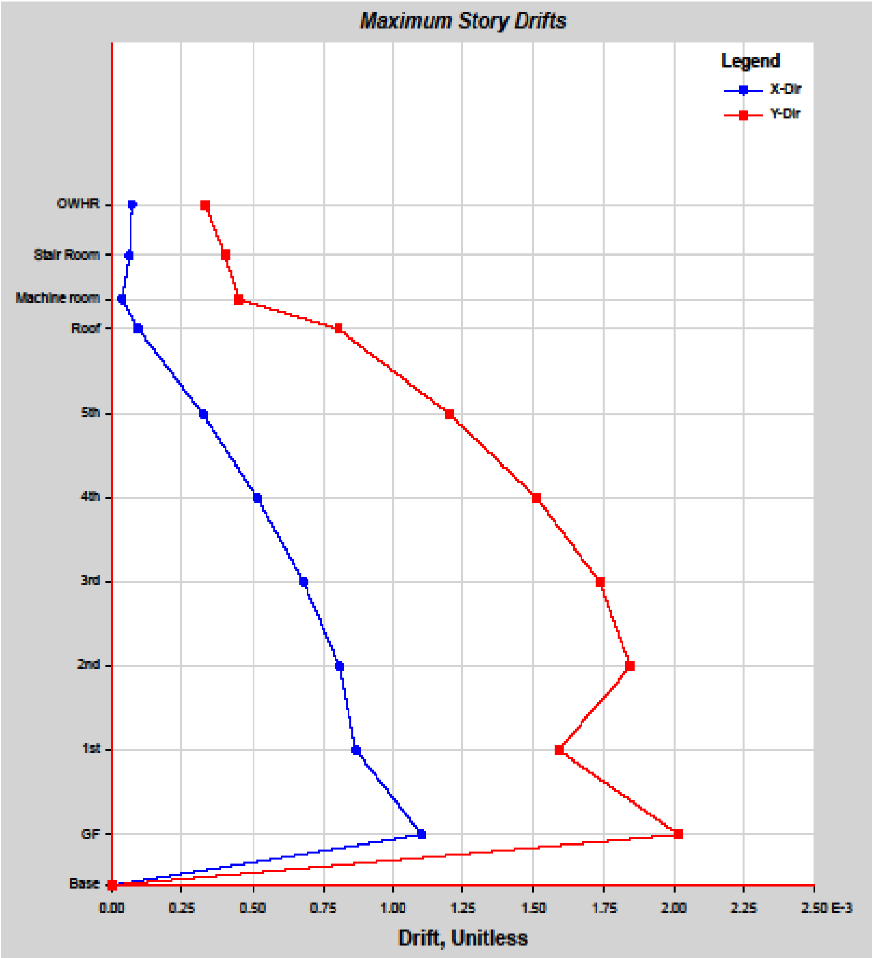
Summary Description

This is story response output for a specified range of stories and a selected load case or load combination.

Input Data

Name	Zone 4		
Display Type	Max story drifts	Story Range	All Stories
Load Case	EQy	Top Story	OWHR
Output Type	Max	Bottom Story	Base

Plot



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4.6 SUMMARY

This research aims to examine a multi-story structure in two distinct seismic zones, Zone 1 for Jessore and Zone 4 for Sylhet using identical construction methods. By analyzing all the values, tables & figures above it is seen that Seismic Zone 4 is more risky than Seismic Zone 1. All the values of column and beam in particular elevation for X-axis & Y-axis shows that seismic zone 4 as Sylhet has more higher values than seismic zone 1 as Jessore. Also by analyzing the story response of the maximum story displacement for EQx and EQy in seismic zone 1 and seismic zone 4 it is seen that there is more displacement in Sylhet - Zone 4 than Jessore - Zone 1. And also the maximum story drifts is mostly higher in seismic zone 4 than seismic zone 1.

CHAPTER V

CONCLUSION & RECOMMENDATION

5.1 GENERAL

It is presently thought that nonlinear pushover analysis is a useful technique for comprehending how a structure performs under various circumstances. There are certain desired levels of seismic performance when the structure is exposed to particular amounts of seismic motion. The degree of framework and non-framework harm anticipated from the seismic shackling serves as a barometer for acceptable performance. This study's primary objective was to give the performance basis analysis of the six-story RCC buildings and to thoroughly assess the buildings' seismic performance.

5.2 CONCLUSION

The experimental results are compiled in this chapter to complete the seismic behavior of seismic zones 1 and 4.

1. Seismic Zone 4 is more dangerous than Seismic Zone 1, as can be shown by carefully examining all of the statistics, tables, and figures above. All of the column and beam values for the specific elevation for the X and Y axis indicate that the values for seismic zone 4 (Sylhet) are higher than those for seismic zone 1 (Jessore). Additionally, it can be found that Sylhet, Zone 4, has larger displacement than Jessore, Zone 1, by examining the story response of the maximum story displacement for EQx and EQy in seismic zones 1 and 4. Additionally, seismic zone 4 generally has higher maximum story drifts than seismic zone 1.

2. Zone 1 usually denotes regions with the least amount of seismic activity. Earthquakes or extremely small tremors are not likely to occur in these areas. Conversely, Zone 4 denotes regions with the highest seismic activity. Strong earthquakes are most likely to occur often in these areas.

3. There is little chance that an earthquake will cause major damage in Zone 1. In these places, structures and infrastructure are often built to withstand very modest

seismic pressures. There is a considerable chance of earthquake damage and devastation in Zone 4. Strict seismic building codes must be followed by infrastructure and buildings in order to reduce possible dangers.

4. Compared to Zone 4, Zone 1's building rules could be less restrictive. It's possible that less seismic reinforcing is needed for structures in Zone 1. Building regulations are more harsher in Zone 4 to make sure that constructions can resist the strong seismic pressures brought on by regular earthquakes. Strong seismic-resistant elements are often included into building designs.

5. Because there are less criteria for earthquake reinforcement in Zone 1, construction costs may be reduced. Buildings in Zone 4 require specialized engineering and materials to guarantee they can survive seismic activity, which drives up construction costs.

5.3 Future Recommendation

I performed modeling and analysis on seismic zone 1 and seismic zone 4. This study is restricted to six-story buildings with shear, moments, deflection used to check for failures.

1) A structure generally costs more if it is meant to endure any harm throughout a significant seismic shakling.

2) The results of this study showed that standard column, beam building is more effective than other models, such floating column design.

3) Drawing from the results, it is possible to make structures with floating columns in Zones 1 and 2 secure by enlarging the ray and section sizes; in Areas 3 and 4, on the other hand, the design must eventually adhere to the recommendations.

4) As a result, suggestions like bracings, infill walls, and shear walls are included in the simulation and evaluation. It is found that may be created to a certain extent to be earthquake resistant, so much so that adding movable sections to RC frames lengthens the period of empty frames because of the decrease in stiffness.

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