# INVESTIGATE THE EFFECT OF CFT AND RCC COLUMN ON BUILDINGS IN SEISMIC ZONE-2 AS PER BNBC-2020

**A Project and Thesis submitted in partial fulfillment of the requirements for the award of Degree of Bachelor of Science in Civil Engineering**

by

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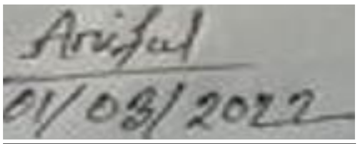
# Certification

This is to certify that the following students worked on the show and thesis "Investigation of the concrete-filled tube (CFT) and RCC column effect on building in seismic zones-2 in ETABS" (*ETABS*, n.d.) under my direct supervision and in the laboratories of the department of Civil engineering under the faculty of engineering of Daffodil International University in fulfillment of the requirements for the degree of bachelor of science in civil engineering. The work was presented on the 1st of March, 2022.

**Signature of the candidates**

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# List of Abbreviations

# ACKNOWLEDGEMENT

| | |
|---|---|
| $f_c'$ | Compressive strength of concrete |
| $f_y$ | Yield strength of steel |
| $E_s$ | Modulus of Elasticity |
| $\varepsilon_y$ | strain |
| PW | Partition wall |
| F | Floor Finish |
| A1 | Dead Load |
| A2 | Live Load |
| BM1 | Wind load X Direction |
| BM2 | Wind Load Y Direction |
| BR1 | Earthquake load in X Direction |
| BR2 | Earthquake load in Y Direction |

First and foremost, I express gratitude to Allah or God. Then I'd want to take this occasion to thank Md. Mehedi Hassan Bhuiyan, Lecturer in the Department of Civil Engineering, for his dedication to supporting, motivating, and guiding us through the project. Without his invaluable advice and assistance, my thesis would be impossible to complete. Thank you also for helping us to pick this thesis topic.

I likewise need to convey our appreciation to **Dr. Mohammad Hannan Mahmud khan, Assistant Professor and Head** of the **Department of Civil Engineering** for his help, support, and constant encouragement.

Apart from that, I'd want to express our sincere gratitude to all of our friends for sharing their knowledge and information with us, as well as for accompanying us to complete this project. Thanks also for letting us borrow some tools and equipment.

To our cherished family, I need to give them our most unfathomable love and appreciation for being extremely steady and for their motivation and support during our investigations at this University.

# ABSTRACT

In today's environment, CFT columns are a common feature in modern multi-story construction all over the world. These RCC and CFT columns are added to the structure to allow it to be used for both commercial and residential purposes, and they begin at the story level where the building is intended to be used as a dwelling. The influence of wind and seismic displacement at different column sizes in the considered plan, as well as the effect of wind and earthquake speed maximum story displacement on concrete-filled tube (CFT) column and RCC column frame structure for G+8 story in zones 2 in Bangladesh, were investigated in this study. That after the success of past researchers on bond cement-filled cylinders (CFT) with the round segments, this study discusses the trial findings on the square CFT column and RCC column. In today's era of growth, multi-story structures using concrete-filled tube (CFT) columns play a major role in commercial construction. Several cases were created and analyzed using the FE package ETABS in this study. After analysis, the results were consolidated and compared with

the code's specified limit, and it showed a better result in the CC12 case specifically. This study also discovered that reinforced columns perform worse under seismic and wind forces than CFT columns. Finally, the CFT column requires less area than conventional reinforced columns and also shows better behavior in horizontal force conditions. For buildings with more than six stories, CFT columns are recommended for better performance.

# CHAPTER 1

# INTRODUCTION

## 1.1 General

A concrete-filled tube (CFT) column is made up of a concrete-filled steel tube. The CFT columns have outstanding seismic event resistance structural qualities such as high tensile strength, high ductility, and large energy dissipation capacity significant advantages in terms of the structural system of the two materials. Tall building structures are increasingly using filled with concrete tubular (CFT) structures. Rectangular or square CFT columns, in particular, are preferred in construction structures. However, the following issues remain unsolved, preventing CFT structures from being used. For starters, short columns can be found in a variety of structures, such as basement columns. Even though the columns have sufficient bearing capacity, ductility may not be sufficient to fulfill the actual earthquake requirement. Second, local buckling at the end of the piece occurs under repeated loads, reducing the containment effectiveness to the core concrete. This effect is especially noticeable in square CFT columns. Finally, particularly when employing steel tubes with a substantial thickness, rectangular CFT columns cannot display strong seismic performance in terms of axial load ratios. The concept was proposed and validated However, axial stresses caused by axial lateral pressure are not carried out directly. A constrained CFT (CCFT) column was created by Xiao and verified for columns by research teams based on an earlier study of standard CFT columns and tubed columns. To protect or delay lateral stiffness of steel tubes and also more efficiently confining concrete, confinement is given in the potentially flexural regions of the CFT column. Structural steel, pipe strip, angles, steel hollow tube, FRP, reinforced or cement mortar, and other materials can be used to create the confinements. Local plastic bending of metal structure can be postponed or prevented by adding additional confinements in CCFT columns; steel tube works in such a tri-compression region. which is advantageous to create new structures.

## 1.2 Advantages and Disadvantages

**The advantages of concrete-filled tube (CFT) column:**

i) The steel tube serves as structural concrete.

ii) The concrete prevents the steel tube wall from buckling.

iii) Composite segments broaden the solidness of an edge contrasted with more old steel outline development.

iv) Contrasted steel structures, the expense can be diminished by utilizing composite or crossover frameworks since the diminished utilization of steel and the expanded solidness as well as further developed imperviousness to fire. due to the fact longer spans with minimum helps execute be constructed.

v) The steel cylinders can be utilized as the formwork for projecting concrete and the shoring framework in development, in this manner CFT structures have much preferable constructability over substantial designs.

**The disadvantages of concrete-filled tube (CFT) column:**

i) CFT frame constructions include intricate beam-to-column connections.

ii) When using CFT columns, steel designed connectors are usually used, which raises the building cost

iii Because the steel tube is utilized as a reinforcement ratio to withstand axial force or the moment when it yields under high longitudinal stress, its transverse constriction (significantly in relation of stiffening) to the external concrete is drastically diminished. Steel's fate as a transversely isotropic may be viewed in this light.

iv) As exhibited in the cyclic stacking This kind of disappointment is truly challenging to fix on the off chance that certainly feasible. Such disappointment mode additionally results in an unsound hysteretic stacking limit, especially for segments with higher hub load. Classification of CFT column in below the figure 1.1.

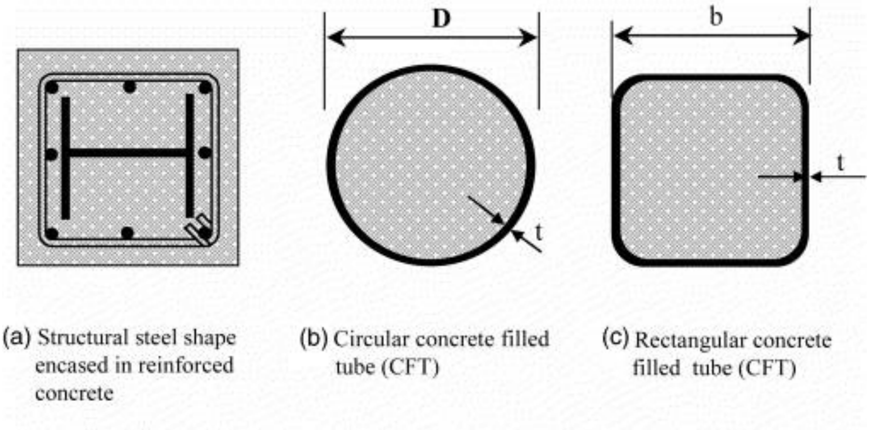



Figure1.1: Classification of Composite Column

## 1.3 Scope of the study

The major purpose of this study is to determine a concrete-filled tube (CFT) and RCC column's seismic load capacity. To offer all precise instructions and material qualities at the start of the study, a control CFT column is constructed with the use of the ETABS-2016 (*ETABS*, n.d.) (Documentation - Computers and Structures, Inc. - Technical Knowledge Base, n.d.) packages software. To create a CFT column model and examine its performance, I utilize the ETABS (*ETABS*, n.d.) packages.

## 1.4 Objective of this study

The fundamental goal of my project is to Select suitable RCC columns and CFT sections for a 5512 square foot building in zone 2 as per BNBC 2020 (BNBC, 2020). And to compare the result

## 1.5 Outline of Thesis

In chapter 1 The RCC and CFT columns are the basic concepts explored in this study.

In chapter 2 The following section discusses previous work in the RCC and CFT columns, as well as the types of work that were used.

In chapter 3 What we accomplished and how we did it.

In chapter 4 We confirm the Model and Evaluation/Examination findings.

In Chapter 5 This section covers important findings from the investigation as well as recommendations for future research.

# CHAPTER 2

# LITERATURE REVIEW

## 2.1 Introduction

A writing survey summarizes what has been written about a particular topic by competent academics and specialists. It's common to be approached for follow-up as a separate project, although it's more common for an article, study report, or proposal. The author's purpose in constructing a creative audit is to pass on in the persona of themselves per user whether data and hypotheses have already been put out on a subject, as well as their assets and flaws. As suggested by a specific subject, writing audits assist the students. Written reviews can fill in as a starting point if you only have a limited amount of time, as stated by lead research. Writing questionnaires provides a similar benefit.

## 2.2 Overview

The writer should talk about what they've learned so far from reading books and what they've learned subsequently. After reading this section, the user should be convinced that the creator's planned research will play an important role in the advancement of that discipline.

## 2.3 literature review

This review examines the exploring articles and diaries which have been read to comprehend the task to be done, and these publications are presented in this part according to the review's references.

(Yang Xiao et al., 2003) This research proposes a creative concrete-filled steel cylindrical (CFT) segmented framework for seismic steel and significant composite designs. In light of important mechanical, the design idea is aimed at limiting the significance in the possibility of plastic pivoted zones of CFT sections and managing the neighborhood clutched tightly of the steel tube. To do so, a few proficient crosses over repression nuances were developed and explored by exploratory testing. The CCFT framework, a novel type of CFT segmentation framework, is expected to overcome many of the drawbacks of traditional CFT sections and provide the best choice for the model structure of large structures in seismic zones. The research introduced a new CFT segment framework, dubbed CCFT, in which work on earthquake execution is given extra imprisonment. Regular CFT segments and tubeless tires RC section frameworks are combined in the proposed CCFT sections. The creator's notion was effectively validated by pivotal pressure testing and seismic loading tests depicted in this publication.

(Cheng & Chung, 2003) A nonlinear power twisting model is proposed for recreating shear motion behavior in the boarding zone of CFT (concrete-filled Steel Tube) column segment relationships. The consequence of center load on shear motion conduct is depicted in this model. Five circular CFT shaft segment relationships were developed and tested to validate the stated idea. The welding crack faded all of the samples as they entered the nonlinear stage, according to the test data. The stronger the hub load, the greater the association's flexibility. Based on scientific and exploratory findings, the recommended board shear expectation is reasonable for larger hub load testing, but conservative for lower critical burden tests.

(Conference & Engineering, 2004) Giving the possible plastic pivot district greater incarceration can greatly improve the seismic conduct of CFT sections. The close clasping also resulted in a break of the steel tube, as revealed by the testing of CCFT model sections with CFRP constraint, which was delayed compared to the companion CFT cases. According to the test structure's insightful reenactments, part and association miss occurrences are not large enough to trigger strength corruption at the DBE level. More damage is likely at the MCE level, including local clasping of bars and sections, but the breakdown is not expected. Testing will be conducted using a dislodging controlled semi-static stacking strategy, in which the model edge will be thrust up in the air ahead of time by using a detailed model of the model edge to choose ground movement data.

(Yan Xiao et al., 2005) Giving the possible plastic pivot district greater incarceration can greatly improve the earthquakes conduct of CFT sections. The close clasping also resulted in the breaking of the steel tube, as revealed by the assessment of CFT model components without CFRP constraint, which was delayed compared to the companion CFT cases. That this so elephant foot forms local buckling, as well as improved fatigue fracture near the rebar end and insufficient restriction to the core concrete, hampered the achievement of satisfactory behavior in the past for CFT model sections subjected to cyclic horizontal force and constant axial load, particularly for a CFT concept column with just a thinner steel tube.

(Yan Xiao et al., 2005) The elastoplastic information is recorded and low cycle tiredness bursts are frequently used to administrate the disappointment of standard concrete-filled cylinders (CFT) during seismic stacking. The next author proposed that extra confinement be used to restrict or delay the inelastic clutched tightly of the steel section at the prospective plastic pivoting zones of CFT people. This study discusses the exploratory results on square CCFT sections, after the success of previous investigations on bonded concrete-filled cylinders (CCFT) with circular parts. Under constant crucial burden and cyclic lateral powers, one traditional CFT design segment were tested. The hypothesis of CCFT for square sections was validated by the results of the tests. In comparison to the standard CFT segment concept, the CCFT sections on show all worked on seismic performance with a great deal of flexibility. A planning technique for the extra control to the plastic pivot district was additionally evolved and approved.

(Shan et al., 2007) Concrete-filled steel tubes (CFT) and carbon composite reinforced plastics (CFRP) restricted concrete-filled steel tubes were subjected to impact testing using gas gun equipment (CCFT). When exposed to high strain rates, the CFT specimens performed well, exhibiting improved dynamic strength. When compared to traditional CFT model specimens, the dynamic strength of CCFT specimens adopting CFRP confinement can be raised even more. Using generalized dynamic behavior finite-element software, a pretest blind analysis was carried out to estimate seismic wave performance in CFT model specimens. The wave propagation tendencies in the specimen may be anticipated fairly accurately. In the construction of big buildings and bridges, concrete-filled tubular (CFT) columns will become increasingly popular. Xiao recently designed a novel CFT column system called constricted concrete-filled tubes (CCFT), and static and virtual seismic loading tests proved its superior load carrying capacity and ductility. The effect behavior of the CFT and CCFT stub column is described in this study. A high-speed gas cannon was used to study the impact reactions of concrete-filled tubes (CFT) and confined reinforced concrete slabs tubes (CCFT). The restriction details and contact speed were among the experimental parameters. The failure patterns and dynamic strains are discussed. The test findings show that lateral confinement can greatly enhance the dynamic impact response of CFT columns.

(Faizullah z Shariff., 2015) By including various forms of transverse reinforcement and shear walls in the building frames, the fundamental period is reduced. The number of stories increases the period, but the frequency reduces. When compared to bare frame, the time duration for RCC buildings is longer than CFT buildings in many modes and can be lowered by employing bracings and shear walls. Supported significant structures are frequently used because they are the most advantageous and cost-effective framework for low-ascent structures. However, due to increased dead load, less solidity, range limitation, and dangerous formwork, this type of design are now uneconomical for medium to high-rise structures. As a result, the fundamental designers are up against the challenge of designing the most effective and cost-effective plan arrangement. The usage of composite material is particularly appealing because of its essential potential in improving overall execution through relatively minor adjustments in assembly and constructional developments. In today's constructions, steel-substantial composite segments are commonly used. Broad research on composite sections with primary steel segments enclosed in concrete is now complete. Composite with a filler area but have received limited consideration when it comes to stories, which are all being examined for similar research. The examination of periods, tale dislodging, and story float has been completed.

(Wang et al., 2017) The hysteretic behavior of rectangular concrete-filled steel rounded (CFT) terminal section with binding bars is presented in this work. Under stable hub stress and cyclic parallel weights, a total of ten circular CFT stub sections with eight instances with restriction bars and two specimens with limiting bars were tested. The effects of axle load level and restraining bar separation on hysteretic behavior were carefully explored. In comparison to those without restricting bars, the examples with restraining bars have a greater lateral bearing limit, higher solidity, higher extreme deformity limit, and superior energy-dissemination limit. Furthermore, for example with restricting bars, the fundamental nearby clasping is substantially deferred by the limitation bars. Aside from that, there's the laterally bearing limit, which is a definite miss happening limit with the disseminating of restricting bars reducing, the energy-scattering maximum and hardness of the cases with constricting bars are substantially improved. With an increase in hub load levels, the definite twisting limit decreases, but the energy-dissipation limit increases. Finally, all of the fiber component investigations have been completed. The fiber component investigation's determined envelope bends and determined energy absorption bends of the cases are very similar to the exploratory results.

(Stephens et al., 2018) For quite some time, exploratory research on concrete-filled steel tube (CFST) spanned elements has revealed that they are a viable alternative to traditional RC segments used in high seismic areas. They allow for faster construction by eliminating the need for internal support and purlins and combining it with the use of self-consolidating concrete. The steel is arranged in the optimal area, reducing the needed width while maintaining flexural and shear characteristics and hardness; these properties reduce cost and material needs. Finally, the initiation of cylinder locking does not result in the corrupting of the mass conveying limit, which is solely influenced by tube ripping, which occurs when rotating at high compressive float requirements. As a result, there are a lot of inelastic seismic displays. This provides common inelastic seismic exhibits in terms of extension utility and post-earthquake repair requirements. The creators and others have previously developed novel plan articulations and building approaches for CFST spans; here, the focus is on new apparatuses for CFST pan execution assessment, such as quadratic examination and probabilistic damage evaluation devices. These devices are predicted to aid in the development of execution-based tremor frameworks.

(Ding et al., 2018) The most typical strain concentration is more than 0.5, indicating that now the steel tube provides enough confinement to the center cement. The center strain can increase the steel cylinder's restrictive impact on the center cement. Furthermore, the trusses can effectively keep the center concrete and reduce the steel tube's largest strain ratio. The reversible stirrups can effectively delay crack initiation of steel tube, work on improving the significant impact on the core concrete, and thus increase the ultimate bearing and ductility index, significantly improving the seismic response of rectangular CFT columns when the compressive ratio is increased. Increasing the height of the terminal stirrup area or the corresponding stirrup ratio at the same ultimate axial ratio can also increase the seismic resistance of the materials.

(Ding et al., 2018) This paper continues the investigation of CFT columns constrained by external rings. The influence of rings on confinement was studied in CFT columns with and without rings at varied spacings. All of the specimens were subjected to uni-axial compression testing. Measurements of axial huge pile capability, flexible stiffness, strength degradability, and Poisson's ratios were used to study the influence of supplying rings on the enhancement of steel-concrete interface bonding. Local bending owing to the "end effect" leads to failure in unrestrained HSTs, particularly whenever the steel tube is thin. Local buckling between steel rings causes failure in constrained HSTs rather than collapse at the end.

(Access & Kumar, 2021) This research looks into why composite structures are becoming more popular in developing countries. Because of increased dead weight, length restrictions, low natural frequency, and hazardous formwork, RCC structures are no longer economically viable for medium and high-rise buildings. Concrete and Steel Composite Structures Are Increasingly Popular These Days, And They Are Safe Over Their Design Life Span. Steel and concrete structures are the best option for modern structures. Iv. An Equivalent Static Method Of Data analysis Is Used For Commercial Buildings Located In Earthquake Zones. Etabs Software (*ETABS*, n.d.) is used to model composite, steel, and R.C.C. structures, and the results can be compared; it is discovered that composite structures are more cost-effective.

## 2.4 Summary

This chapter highlights CFT related study that has been accomplished previously. In addition to analyzing the concrete-filled tube (CFT) and RCC column, I've identified several seismic zones and their advantages and disadvantages. In addition, the CFT column has been used in a variety of practical applications. I discuss some of the criteria that will help us make decisions and determine why CFT columns are used in multi-story buildings.

# CHAPTER 3

# MODELING AND ANALYSIS

## 3.1 Introduction

Configuration is the process of determining the specifics of a structure. By hand, assessing and planning a design would take the majority of the day. With the use of programming, any construction evaluation and setup can be completed rapidly. The main goal of this project is to dismantle and plan a management structure using different seismic zone configurations, such as an average section, a significantly filled tube (CFT), and Rcc column segment with varied seismic zones, and so on. A commercial that uses around half of its floor area for commercial reasons. The effects of seismic and wind stress on structures with varied CFT sections were investigated using ETABS (*ETABS*, n.d.) programming (ETABS – Documentation Computers and Structures, Inc. - Technical Knowledge Base, n.d.). Making use of a standard CFT section is one that is upheld by standard shafts and segments. In a typical cement-filled cylinder segment, the heap travels from the seismic stress to the sectors, the sections towards the bars, and the bars to the establishment (CFT).

## 3.2 The Building Model's Description

The building has such an I-shape 5512 square meters and is 32000mm x 24000mm in the plan, with columns spaced at 8000mm and 4000mm from center to center in this RCC structural building. With a Floor to Floor height of 3000mm, the dimension building is depicted in the accompanying figure. This building uses the column 1000x1000mm,800x800mm,900x900mm column size, flange thickness is 13,25,38,50mm 300x250mm beam and RCC column size 1500x1500mm,1800x1800mm,2000x2000mm,400x350mm is beam size and 125mm slab thickness in the 8-G multi story building.

## 3.3 The Basic Building Dimensions in CFT

we use the CFT column in commercial building the column dimension is 1000x1000mm, flange thickness is 13,25,38,50, beam size use 300x250mm, slab thickness is 125mm.It’s 8-G commercial building, then column size smaller between the RCC column dimensioned in below table 3.1.

Table3.1: CFT Column Details

| **Parameter** | **Dimension Size** |
|---|---|
| Length x Width | 32000mm x 24000mm |
| No of Story | 8 |
| Story height | 3000mm |
| Beam | 300mm x 250mm |
| Column | 1000mm x1000mm |
| Slab Thickness | 125mm |
| Support Condition | Fixed |

## 3.4 The Basic Building Dimensions in RCC

we use the RCC column in commercial building the column dimension is 2000x2000mm,1500x1500mm,1800x1800mm, beam size use 400x350mm, slab thickness is 125mm.It’s 8-G commercial building, then column size big, RRC column details in below table 3.2.

Table3.2: RCC Column Details

| Parameter | Dimension Size |
|---|---|
| Length x Width | 32000mm x 24000mm |
| No of Story | 8 |
| Story height | 3000mm |
| Beam | 400mm x 350mm |
| Column | RC1 to RC3 |
| Slab Thickness | 125mm |
| Support Condition | Fixed |

## 3.5 Building with Conventional CFT and RCC Column

We can use the left column in1000x1000 mm, flange thickness 50mm, beam size 300x250 mm, its total 5,512 sqft commercial building. CFT column uses a decrease in column size. The modern structure uses the CFT column, our building is an 8-G story commercial building and I use the CFT column shown in figure 3.1.

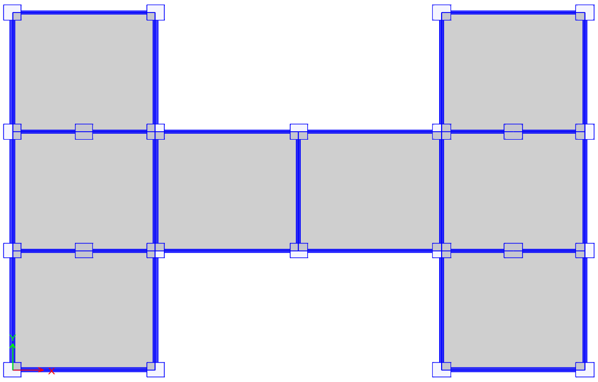


Figure 3.1: 2D View of 8 stories I-shape Building in CFT Column

We can use the RCC column in 2000x2000 mm, beam size 400x350 mm, slab thickness 125 mm, it's total 5,512 sqft commercial building. RCC column increase the column size but CFT use the decrease the column size in the figure below 3.2&3.3

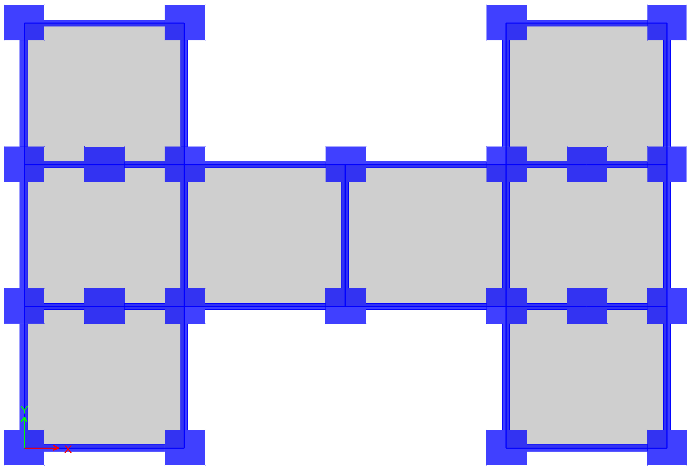


Figure 3.2: 2D View of 8 stories I-shape Building in RCC Column

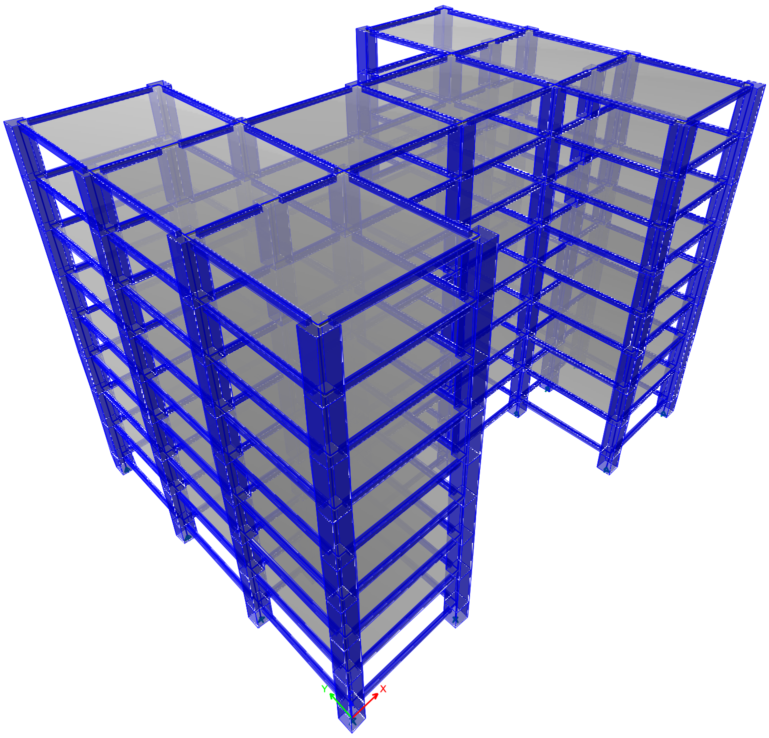


Figure 3.3: 3D View of 8 stories I-shape Building

## 3.6 Computer Software Used

Version ETABS 2016 (*ETABS*, n.d.)(ETABS - Documentation - Computers and Structures, Inc. - Technical Knowledge Base, n.d ).Three-dimensional modeling was used, with linear viscoelastic analysis cases. A graph from data analysis was also generated using Microsoft Excel (Excel 2021 - Microsoft All of the design showcasing and the study were completed with the help of ETABS (*ETABS*, n.d.) Lifecycle.)

## 3.7 Properties of Materials

For design by using ETABS (*ETABS*, n.d.) - Documentation - Computers and Structures, Inc. - Technical Knowledge Base, n.d.) for design  I used ACI318- 08(318 Building Code Topic, n.d.) and for the different zone in Wind load and Earthquake, I used AISC7-10 (ASCE/SEI 7-10, 2013) or Download PDF Bangladesh National Building Code BNBC (BNBC, 2020) BNBC code must be followed because ETABS (*ETABS*, n.d.) software so followed code such as-AISC7-10 (ASCE/SEI 7-10, 2013).

## 3.8 The Building's Gravity Loads

Stresses include "dead," or fixed, loads such as the force of a building's wall, tile floors, materials, or mechanical equipment, but also "live," or transitory, loads such as the weight of snow. According to BNBC 2020 (BNBC, 2020) for commercial building structure design forces include dead load and live load and seismic load on the different zone in our country. Below the gravity load table 3.3.

Table 3.3: Gravity Loads in Building

| **Parameters** | **Loads** |
|---|---|
| Live Load | 100 Psf |
| Floor Finish | 25 Psf |
| Partition Wall | 33 Psf |
| Top floor live load | 61 Psf |

Table 3.3 demonstrates that in a commercial plant, I use a 100 Psf live load on every floor except for the roof, which has a 61 Psf live load. I applied 25 Psf and a floor finish in our building. According to BNBC 2020 (BNBC, 2020), I can still use whether in 33 percent of both the Live Capacity or a least of 1.2 KN/m with partial walls, however, we utilized the least of 1.2 KN/m2, that we changed to 3.584 KN/m2 after our analysis.

## 3.9 Wind Load

Wind load is the "load" imposed on a structure by wind velocity and air density. Suction pressure is created when low-pressure zones emerge on the property as a consequence of elevated winds. When someone is so strong that they can even lift the roof corner off a house. The Wind Load, as we know it, is described in table 3.4.

Table 3.4: Wind data for DHAKA in Zone 2

| **Parameter** | **Value** |
|---|---|
| Wind speed (M/hr.) | 147 |
| Exposure type | B |
| Importance factor | 1 |
| Story range | Ground floor to Roof story |

The wind speed and the design (and surfaces) of the structure are usually what determine wind loads, making them challenging to predict. The building's shape may worsen any over-or even under effects. For my I-shape construction, I utilized a wind speed of 147 mph, which is the same as in Dhaka. Our exposure pattern is B, with importance factor 1 being the most important component.

## 3.10 Earthquake Loads

Seismic loads, which refers to the transfer of a seismic activity agitation to a structure, are one of the essential notions in earthquake engineering. It can happen at a structure's ground contact surfaces, adjoining structures, or via gravitational waves from such a tsunami. BNBC 2020 (BNBC, 2020) there are four seismic zones in our country this building also do the different wind and earthquake load apply, analysis. The seismic load is spread from the foundation to that same top or roof, as shown in Table 3.5.

Table 3.5 Seismic data for seismic zone 2

| Parameter | Value |
|---|---|
| Seismic zone | Zone 2 |
| Zone factor | 0.28 |
| Type of soil | $R_1$ |
| Site coefficients, $F_v$ | 2.7 |
| Site Coefficient $F_a$ | 1.35 |
| Importance factor | 1 |
| Numerical coefficient factor, Rw | 8 |
| Ct | 0.016,0.9 |
| Details of story | Ground floor to Top story |

There seem to be four seismic zones: zone 1, zone 2, and zone 3. Zone 1 is 0.12, zone 2 is 0.15, zone 3 is0.28 and zone 4 is 0.36, wind speed is also zone 2 Dhaka cities wind speed are 147m/hr, I use zones 1 to 4 and soil type S1 in our office building. The key fixing to ground the popular tale has been R=8, which stands for the mathematical proportion factor.

## 3.11 Load Combination

"Provision 2.7.3 suspicions" for "Mixes of Load impacts for Strength Design Method" are followed according to BNBC 2020 (BNBC, 2020) and the heap mixes are accounted for under proviso 2.7.3.1, i.e. The load combination shown in table 3.6.

Table 3.6: Load Combinations

| No | Basic Load Combinations |
|---|---|
| i | 1.4A1 |
| ii | 1.2A1+1.6A2 |
| iii | 1.2A1+A2 |
| iv | 1.2A1+0.8BR1 |
| v | 1.2A1-0.8BR1 |
| vi | 1.2A1+0.8BR2 |

| | |
|---|---|
| vii | 1.2A1-0.8BR2 |
| viii | 1.2A1+1.6BM1+A2 |
| ix | 1.2A1-1.6BM1+A2 |
| x | 1.2A1+1.6BM2+A2 |
| xi | 1.2A1-1.6BM2+A2 |
| xii | 1.2A1+SR1 |
| xii | 1.2A1-SR1 |
| xiv | 1.2A1+SR2 |
| xv | 1.2A1-SR2 |
| xvi | 0.9A1+1.6BM2 |
| xvii | 0.9A1-1.6BM1 |
| xviii | 0.9A1+1.6BM2 |
| xix | 0.9A1-1.6BM2 |
| xx | 0.9A1+SR1 |
| xxi | 0.9A1-SR1 |
| xxii | 0.9A1+SR2 |
| xxiii | 0.9A1-SR2 |

## 3.12 Flow work Step

For this workflow chart, I've summarized everything I've done during the entire project.

Step-1: I chose an I-shape building as my design, and we followed Bangladesh's design code, BNBC2020.

Step 2: Beam, column, and slab section material properties were specified.

Step 3: First apply RCC column and modeling, analysis.

Step 4: Same size CFT column, beam apply, flange thickness also different.

Step 5: Input seismic value and wind speed in zone 2.

Step 6: Design and Analysis of Structure.

Step 7: Discussion and comparison in both RCC and CFT column models.

## 3.13 Summary

We discussed the presentation of presenting and research of working with diverse seismic zones, as well as varied breeze load Software Program used for the planning and examination in this section. The code was followed. The structure's description demonstrates, there are various types of restrictions that are imposed on construction and Flowchart of Work. We can use two types of columns. First, I use the different size RCC column but RCC column size gets to the huge than I can use CFT column size. We also different sizes of CFT column used. CFT column sizes are decreases within the RCC column.

# CHAPTER 4

# RESULT AND DISCUSSIONS

## 4.1 Introduction

In this section, I will present our findings, which are based on the inspection and analysis of the I-shape construction. According to the analysis of the multi-story commercial building, the story upsetting second changes in direct proportion to story height. Furthermore, the behaviors of I-shape and H-shape buildings to the collapsing different seismic zone are nearly identical. The value of story float relocation increased with story elevation until the eighth story, when it reached its peak, and then began to deteriorate. Mode structures are discovered by thorough investigation, and it may be discovered that uneven plans deface more than even forms.

## 4.2 CFT AND RCC COLUMN CASE SERIAL

Case CC1 to CC12 is a concrete-filled tube (CFT) column flange thickness is a different 13,25,38,50 but column size is same.RC1 to RC3 is a reinforcement concrete column its size is 2000x2000mm.RCC column sizes are huge but CFT column sizes are decrease with RCC columns.The column case is shown in table 4.1.

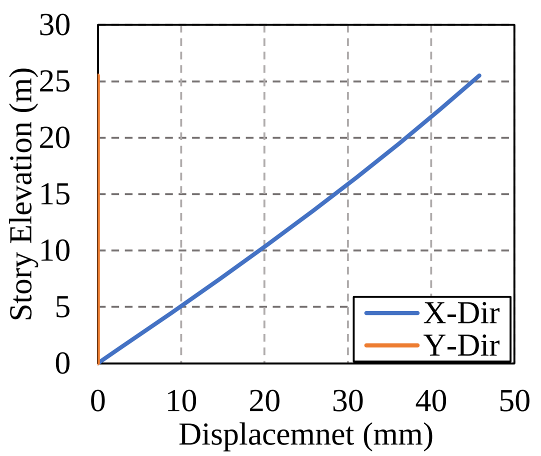
Table 4.1: Column Case

| Case no | Size of column (mm) | The thickness of steel tube (mm) |
|---|---|---|
| CC1 | 800x800 | 13 |
| CC2 | 800x800 | 25 |
| CC3 | 800x800 | 38 |
| CC4 | 800x800 | 50 |
| CC5 | 900x900 | 13 |
| CC6 | 900x900 | 25 |

| | | |
|---|---|---|
| CC7 | 900x900 | 38 |
| CC8 | 900x900 | 50 |
| CC9 | 1000x1000 | 13 |
| CC10 | 1000x1000 | 25 |
| CC11 | 1000x1000 | 38 |
| CC12 | 1000x1000 | 50 |
| RC1 | 1500x1500 | |
| RC2 | 1800x1800 | |
| RC3 | 2000x2000 | |

## 4.3 Displacement with Earthquake and Wind load

The maximum story displacement with earthquake and wind load in the different seismic zone in BNBC 2020 (BNBC, 2020). This building is eight-story commercial building, I can use the CFT 800x800 mm to 1000x1000mm column, flange thickness is 50 mm, and different seismic co-efficient values., Its 1500x1500, 1800x1800,2000x2000mm column, 400x350mm beam size use the Rcc building RCC column size are big but CFT column size are small. So we can use the modern structure in CFT column because RC1 column size in huge than RC1 structure also effect the structure cost.



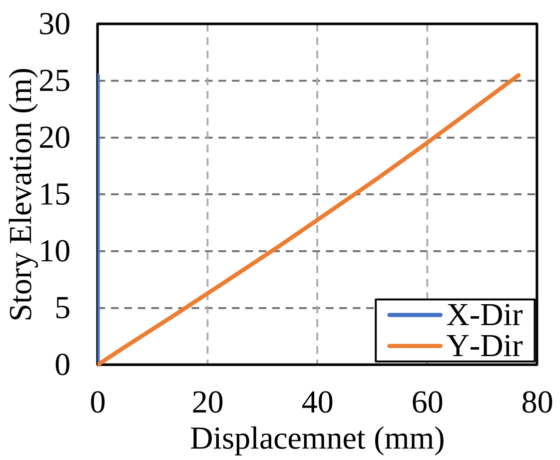




Figure 4.1: Seismic Displacement in RC1

RC1 case1 we can use the RCC column in 1500x1500mm, 400x350mm beam size, slab thickness 125mm are use the 8-G building, I tracked down the seismic and wind load tremor reaction for the two headings which one show underneath in the figure 4.1 .

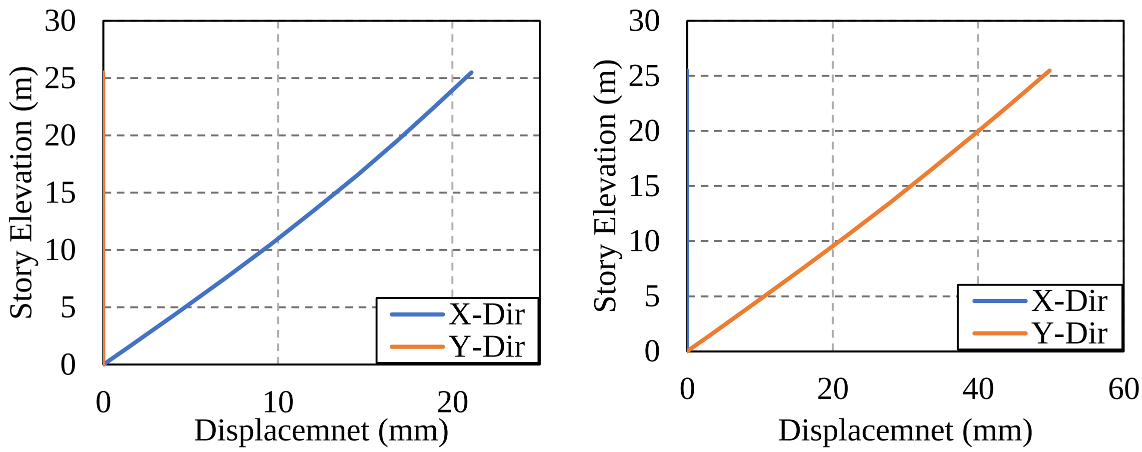



Figure 4.2: Wind speed Displacement in RC1

Zone2 and case RCC1 I can use the Ss 0.5,S1 0.2 and wind speed are 147 m/hr in Dhaka cities.1500x15000mm 400x350mm beam size, slab thickness 125mm are use the 8-G building, I tracked down the seismic and wind load tremor reaction for the two headings which one show underneath in the figure 4.2.

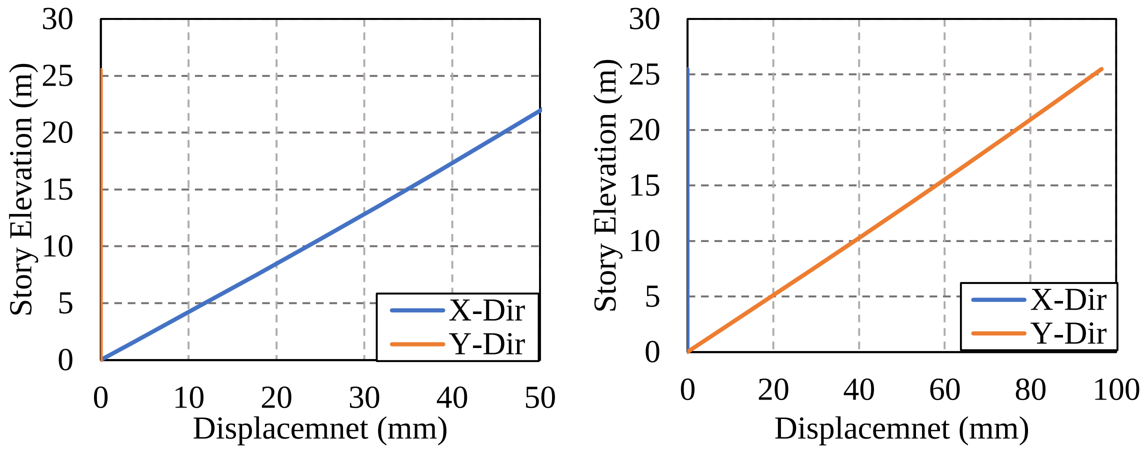



Figure 4.3: Seismic Displacement in RC2

RC2 case1 we can use the RCC column in 1800x1800mm, 400x350mm beam size, slab thickness 125mm are use the 8-G building, I tracked down the seismic and wind load tremor reaction for the two headings which one show underneath in the figure 4.3 .

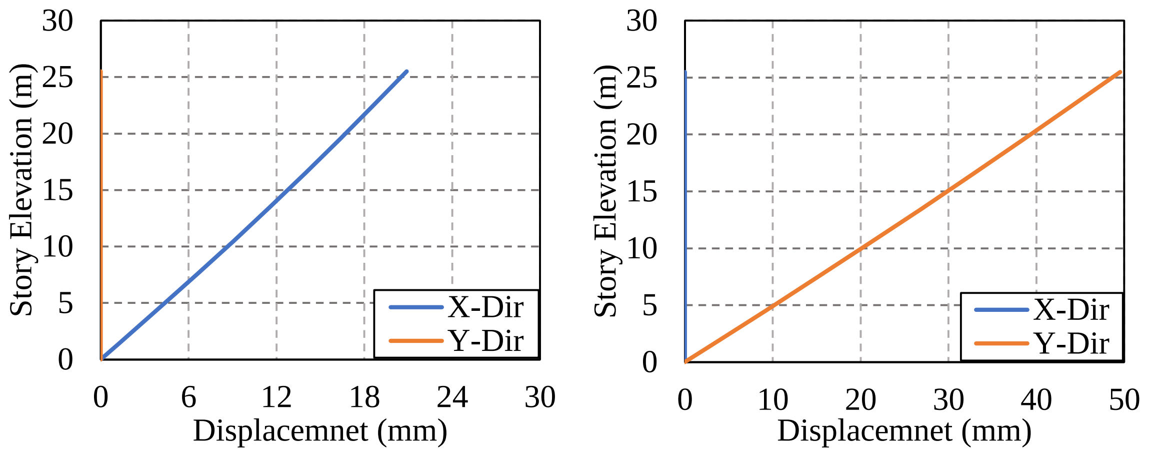



Figure 4.4: Wind speed Displacement in RC2

Zone2 and case RC2 we wind speed are 147 m/hr in Dhaka cities.1800x1800mm RCC column size, 400x350mm beam size, slab thickness 125mm are used in the 8-G building, I tracked down the seismic and wind load tremor reaction for the two headings which one show underneath in figure 4.4.

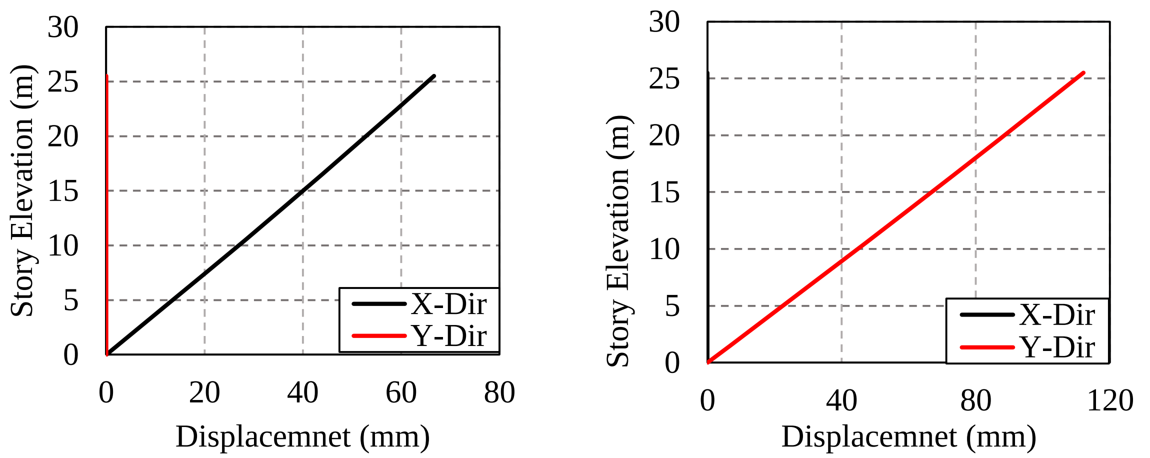



Figure 4.5: Seismic Displacement in RC3

RC3 case1 we can use the RCC column in 2000x2000mm, 400x350mm beam size, slab thickness 125mm uses the 8-G building, I tracked down the seismic and wind load tremor reaction for the two headings which one show underneath in figure 4.5 .

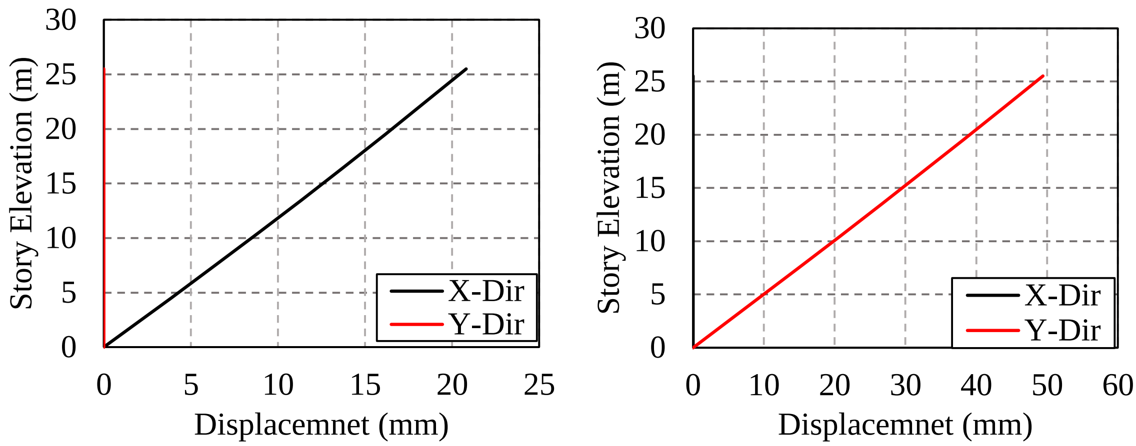



Figure 4.6: Wind speed Displacement in RC3

Zone2 I can use the Ss 0.5,S1 0.2 and wind speed are 147 m/hr in Dhaka cities.2000x2000mm 400x350mm beam size, slab thickness 125mm are use the 8-G building, I tracked down the seismic and wind load tremor reaction for the two headings which one show underneath in the figure 4.6

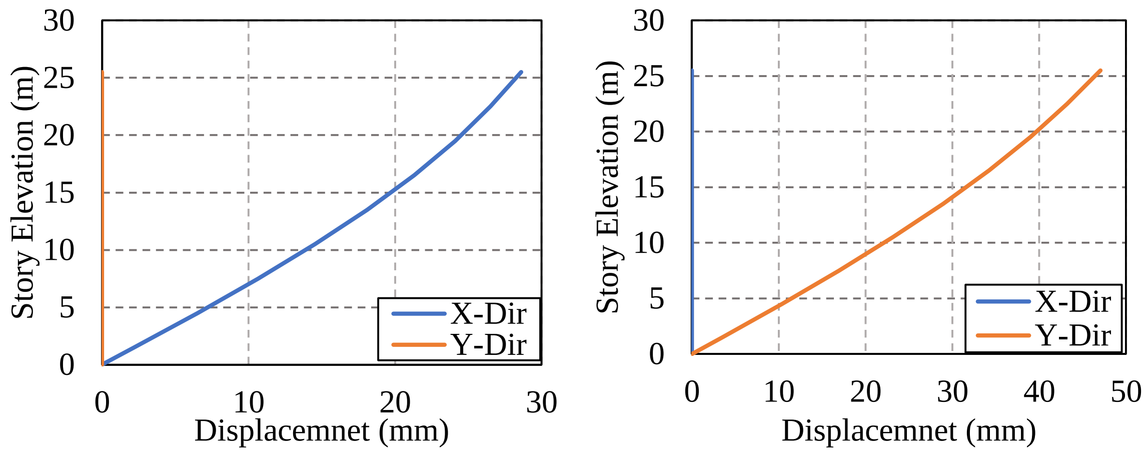



Figure 4.7: Seismic Displacement in CC1

CC1 case1 we can use the CFT column in 800x800mm, flange thickness is 13mm 300x250mm beam size, slab thickness 125mm are use the 8-G building, I tracked down the seismic and wind load tremor reaction for the two headings which one show underneath in the figure 4.7 .

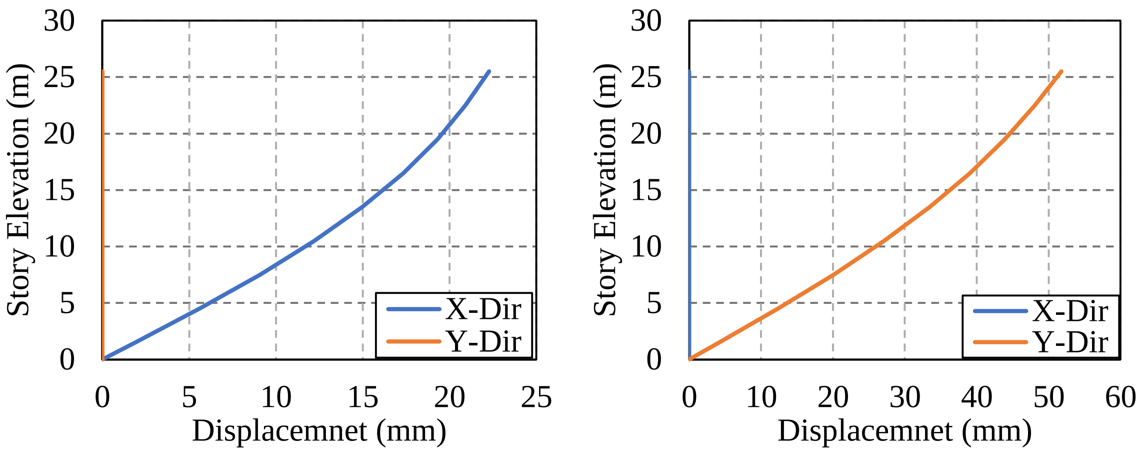



Figure 4.8: Wind load Displacement in CC1

Zone2 case CC1 I can use the Ss 0.5,S1 0.2 and wind speed are 147 m/hr in Dhaka cities.800x800mm CFT column size, flange thickness is 13mm 300x250mm beam size, slab thickness 125mm are use the 8-G building, I tracked down the seismic and wind load tremor reaction for the two headings which one show underneath in the figure 4.8.

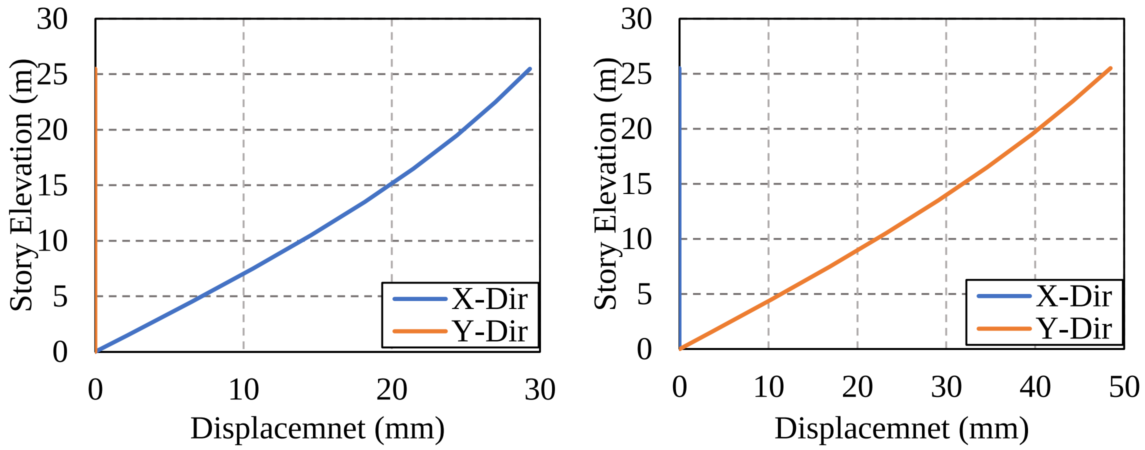



Figure 4.9: Seismic Displacement in CC2

CC2 we can use the CFT column in 800x800mm, flange thickness is 25mm 300x250mm beam size, slab thickness 125mm are use the 8-G building, I tracked down the seismic and wind load tremor reaction for the two headings which one show underneath in the figure 4.9.

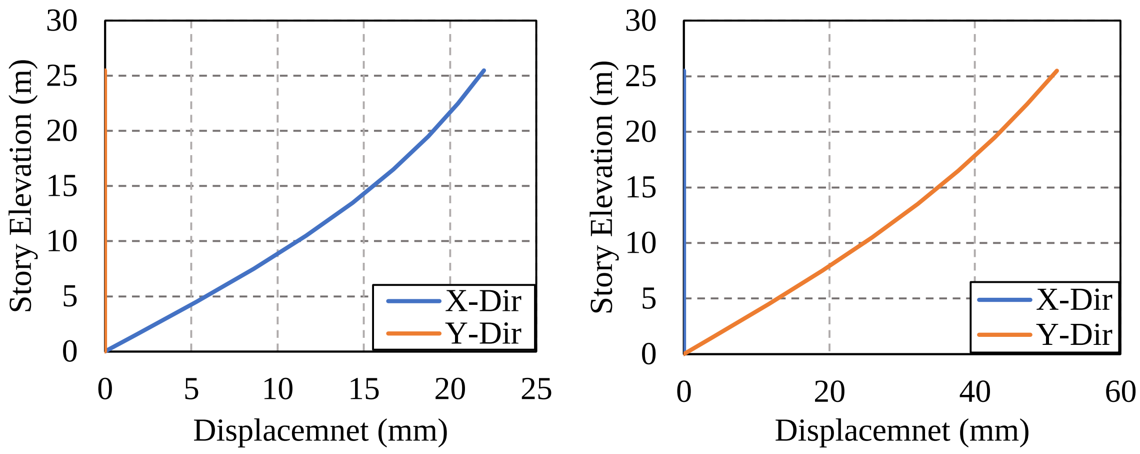



Figure 4.10: Wind load Displacement in CC2

Zone2 CC2 I can use the Ss 0.5,S1 0.2 and wind speed are 147 m/hr in Dhaka cities.800x800mm CFT column size, flange thickness is 25mm 300x250mm beam size, slab thickness 125mm are use the 8-G building, I tracked down the seismic and wind load tremor reaction for the two headings which one show underneath in the figure 4.10.

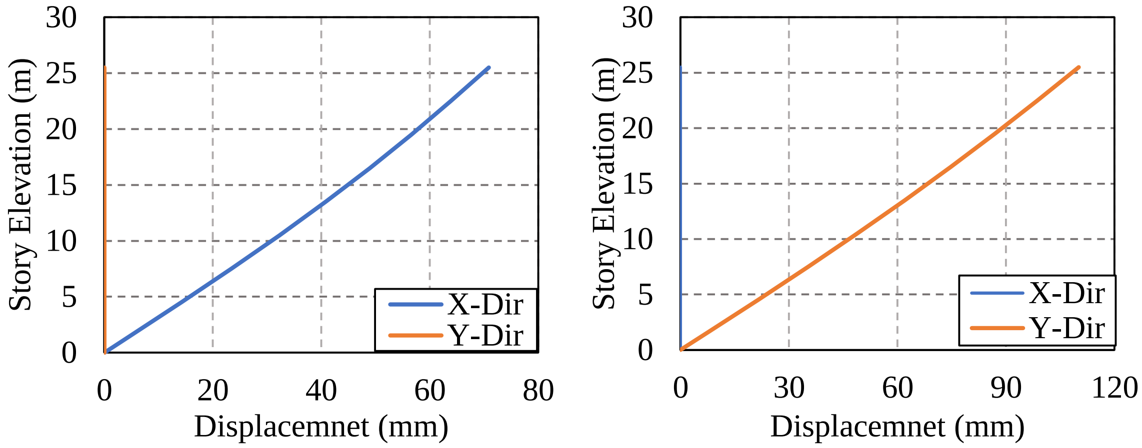



Figure 4.11: Seismic Displacement in CC3

CC3 we can use the CFT column in 800x800mm, flange thickness is 38mm 300x250mm beam size, slab thickness 125mm are use the 8-G building, I tracked down the seismic and wind load tremor reaction for the two headings which one show underneath in the figure 4.11.

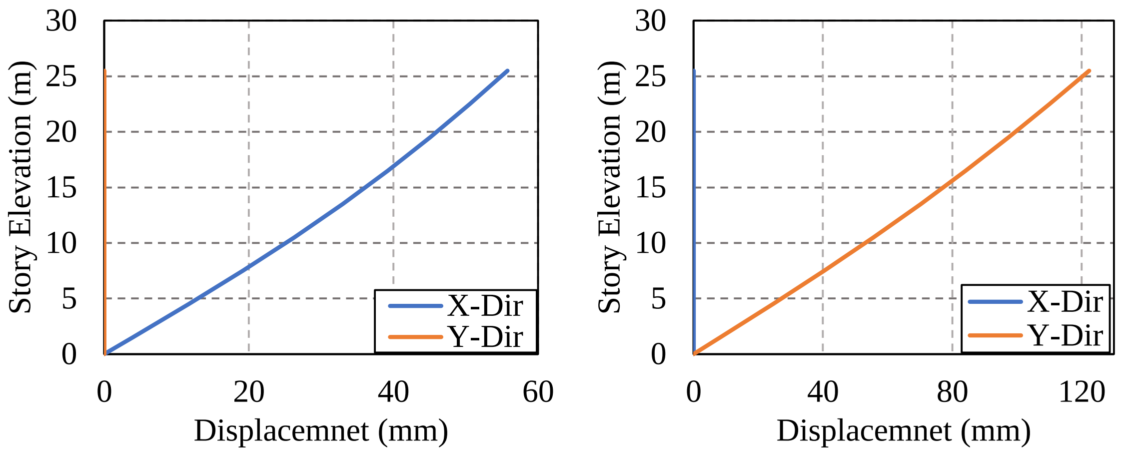



Figure 4.12: Wind load Displacement in CC3

Zone2 CC3 I can use the Ss 0.5,S1 0.2 and wind speed are 147 m/hr in Dhaka cities.800x800mm CFT column size, flange thickness is 38mm  300x250mm beam size, slab thickness 125mm are use the 8-G building, I tracked down the seismic and wind load tremor reaction for the two headings which one show underneath in the figure 4.12.

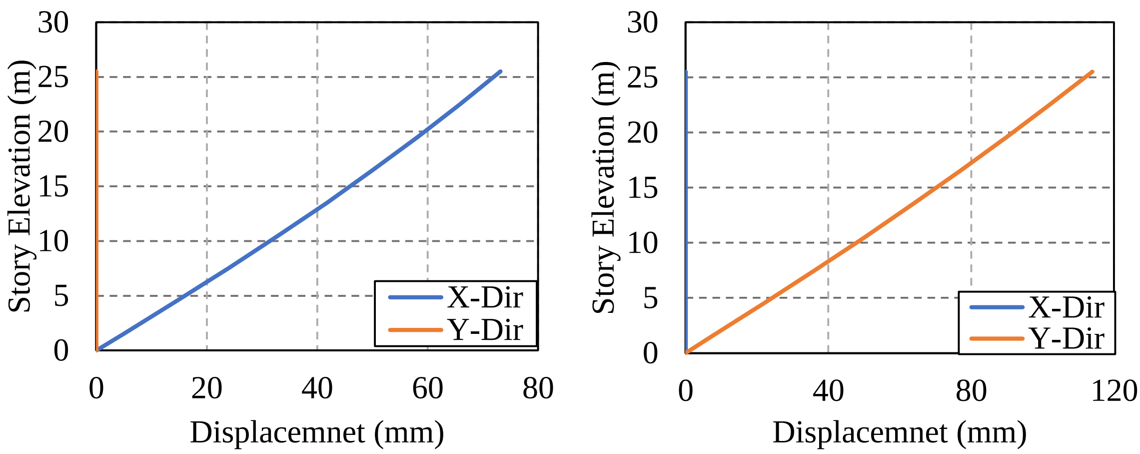



Figure 4.13: Seismic Displacement in CC4

CC4 we can use the CFT column in 800x800mm, flange thickness is 50mm  300x250mm beam size, slab thickness 125mm are use the 8-G building, I tracked down the seismic and wind load tremor reaction for the two headings which one show underneath in the figure 4.13.

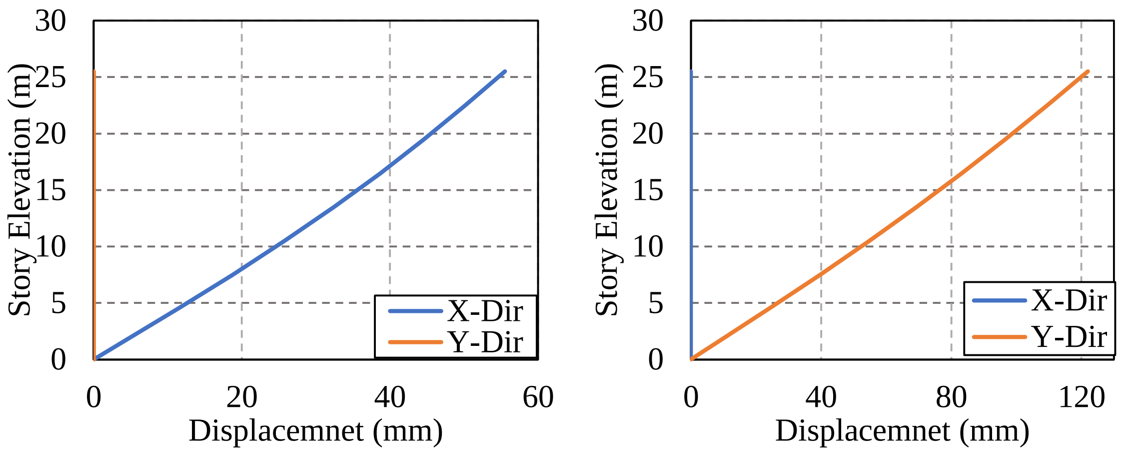



Figure 4.14: Wind load Displacement in CC4

Zone2 CC4 I can use the Ss 0.5,S1 0.2 and wind speed are 147 m/hr in Dhaka cities.900x900mm CFT column size, flange thickness is 13mm 300x250mm beam size, slab thickness 125mm are use the 8-G building, I tracked down the seismic and wind load tremor reaction for the two headings which one show underneath in the figure 4.14.

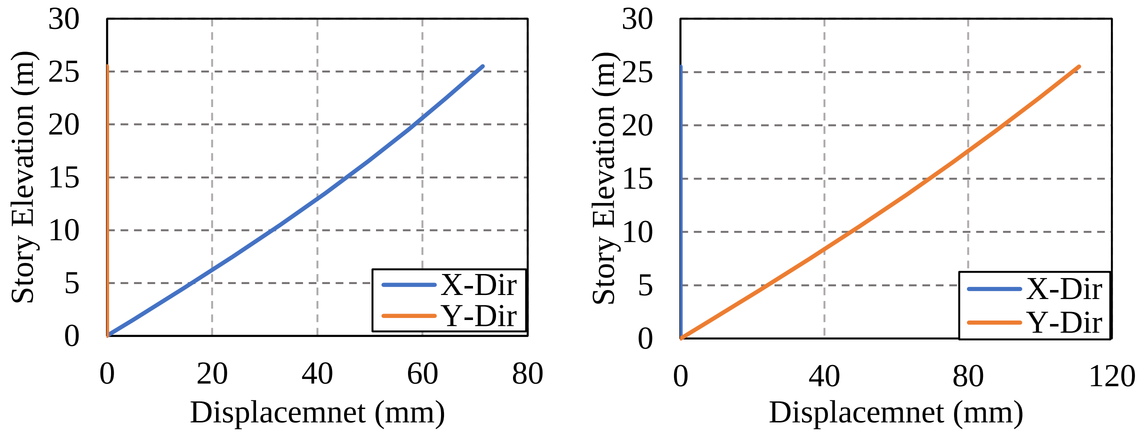



Figure 4.15: Seismic Displacement in CC5

CC5 we can use the CFT column in 900x900mm, flange thickness is 25mm 300x250mm beam size, slab thickness 125mm are use the 8-G building, I tracked down the seismic and wind load tremor reaction for the two headings which one show underneath in the figure 4.15.

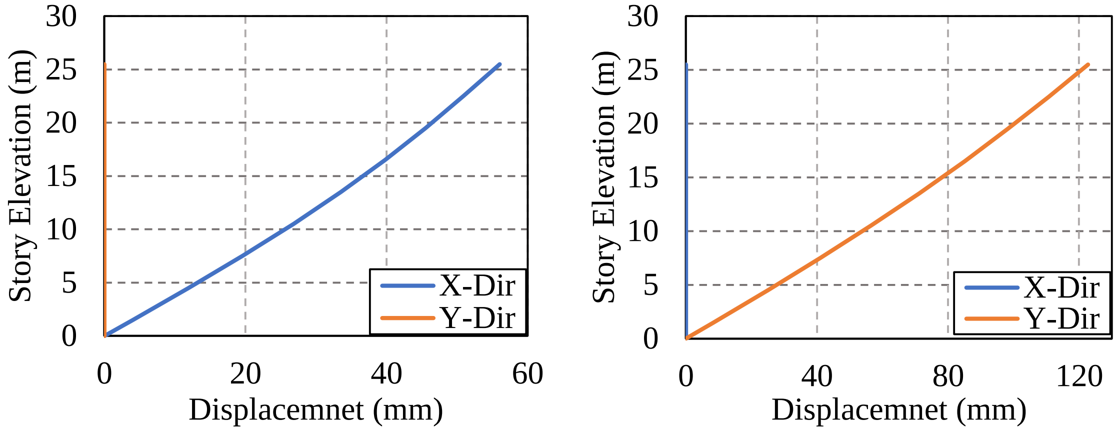



Figure 4.16: Wind load Displacement in CC5

Zone2 CC6 I can use the Ss 0.5,S1 0.2 and wind speed are 147 m/hr in Dhaka cities.900x900mm CFT column size, flange thickness is 25mm 300x250mm beam size, slab thickness 125mm are use the 8-G building, I tracked down the seismic and wind load tremor reaction for the two headings which one show underneath in the figure 4.16.

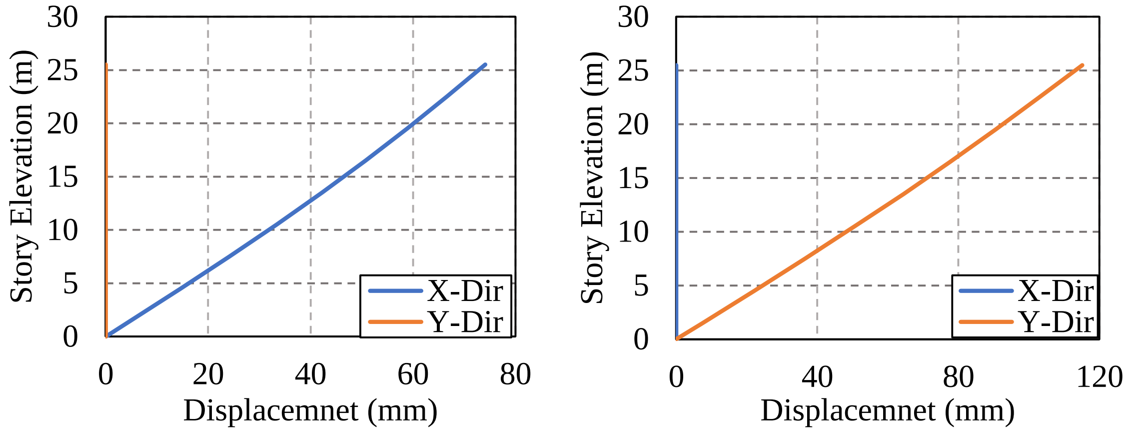



Figure 4.17: Seismic Displacement in CC6

CC7 we can use the CFT column in 900x900mm, flange thickness is 25mm 300x250mm beam size, slab thickness 125mm are use the 8-G building, I tracked down the seismic and wind load tremor reaction for the two headings which one show underneath in the figure 4.17.

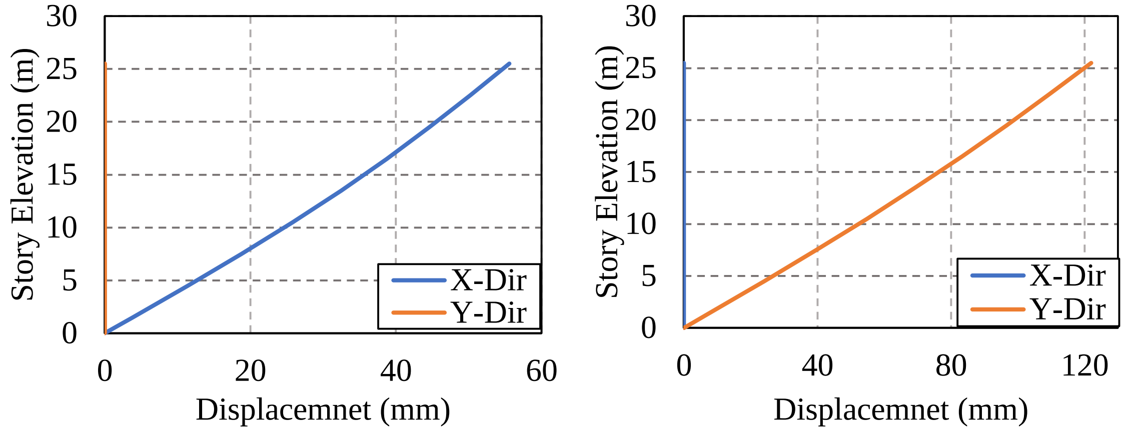



Figure 4.18: Wind load Displacement in CC6

Zone2 CC8 I can use the Ss 0.5,S1 0.2 and wind speed are 147 m/hr in Dhaka cities.900x900mm CFT column size, flange thickness is 38mm 300x250mm beam size, slab thickness 125mm are use the 8-G building, I tracked down the seismic and wind load tremor reaction for the two headings which one show underneath in the figure 4.18.

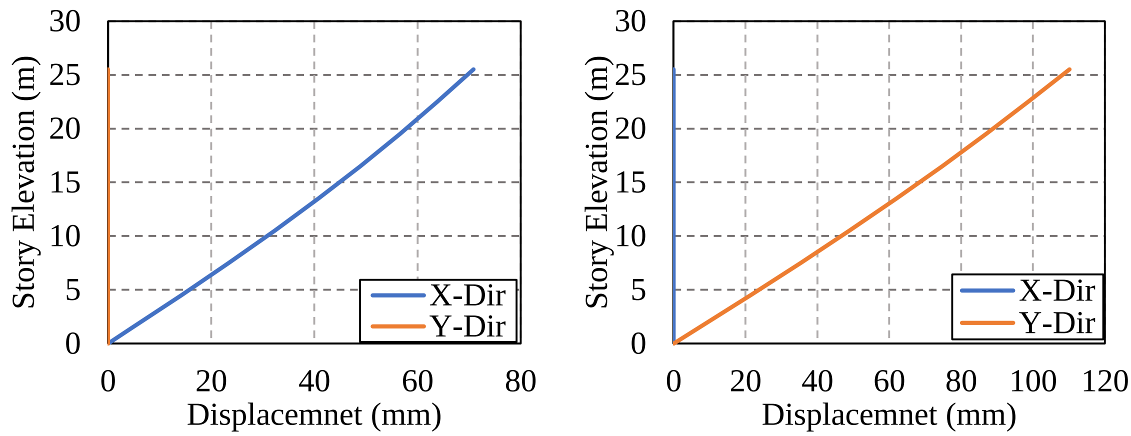



Figure 4.19: Seismic Displacement in CC7

CC9 we can use the CFT column in 900x900mm, flange thickness is 38mm 300x250mm beam size, slab thickness 125mm are use the 8-G building, I tracked down the seismic and wind load tremor reaction for the two headings which one show underneath in the figure 4.19.

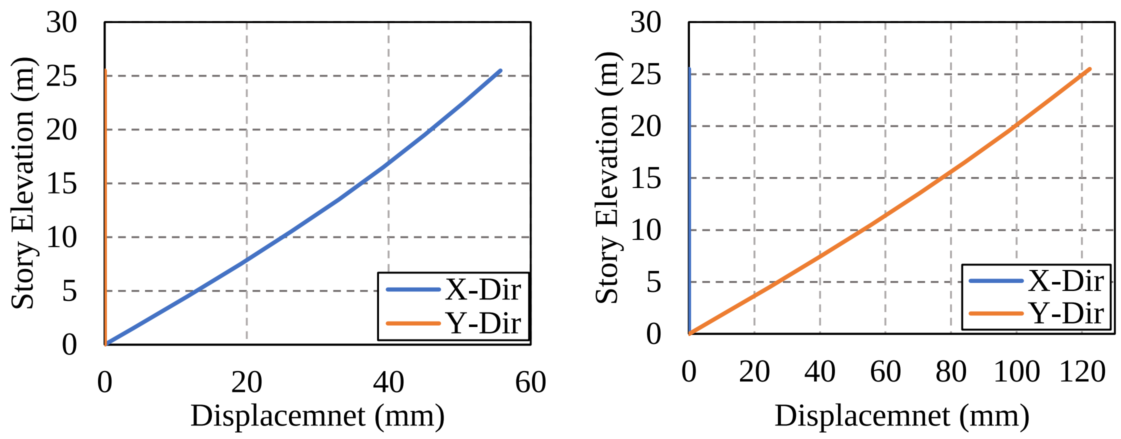



Figure 4.20: Wind load Displacement in CC7

Zone2 CC10 I can use the Ss 0.5,S1 0.2 and wind speed are 147 m/hr in Dhaka cities.900x900mm CFT column size, flange thickness is 50mm 300x250mm beam size, slab thickness 125mm are use the 8-G building, I tracked down the seismic and wind load tremor reaction for the two headings which one show underneath in the figure 4.20.

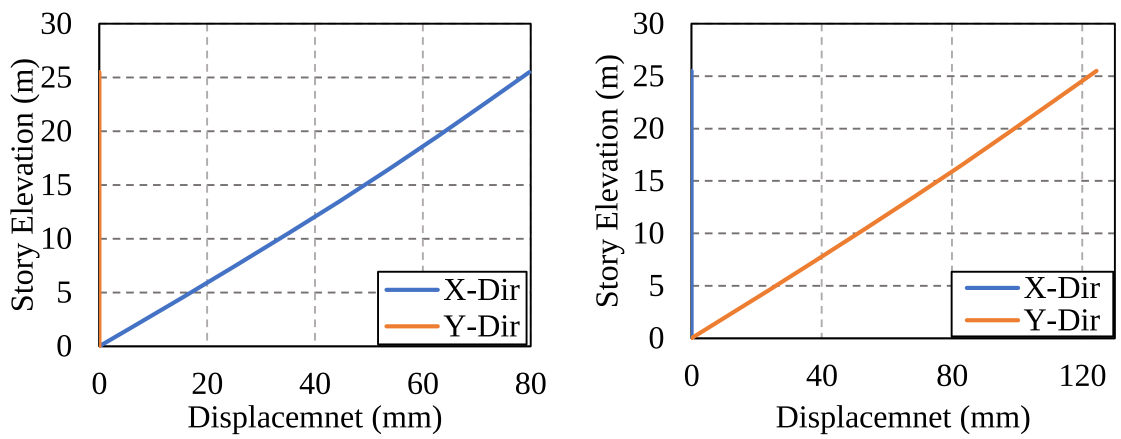



Figure 4.21: Seismic Displacement in CC8

CC21 we can use the CFT column in 900x900mm, flange thickness is 50mm 300x250mm beam size, slab thickness 125mm are use the 8-G building, I tracked down the seismic and wind load tremor reaction for the two headings which one show underneath in the figure 4.21.

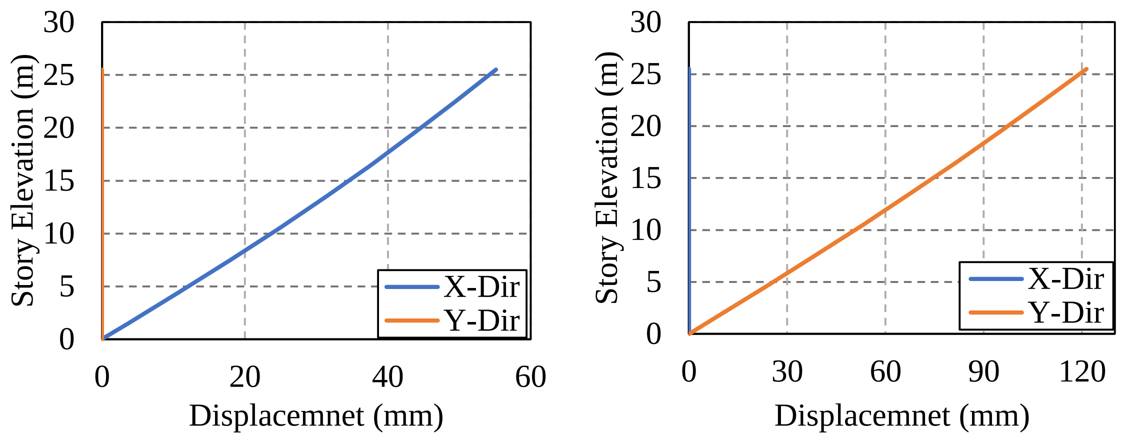



Figure 4.22: Wind load Displacement in CC8

Zone2 I can use the Ss 0.5,S1 0.2 and wind speed are 147 m/hr in Dhaka cities.1000x1000mm CFT column size, flange thickness is 50mm 300x250mm beam size, slab thickness 125mm are use the 8-G building, I tracked down the seismic and wind load tremor reaction for the two headings which one show underneath in the figure 4.22.

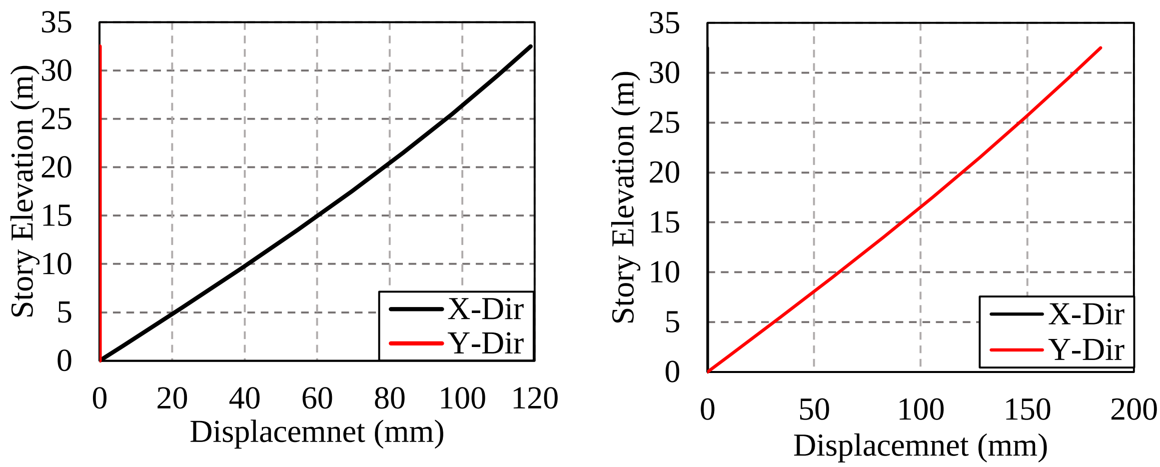



Figure 4.23: Seismic Displacement in CC9

CC23 case1 we can use the CFT column in 1000x1000mm, flange thickness is 13mm 300x250mm beam size, slab thickness 125mm are use the 8-G building, I tracked down the seismic and wind load tremor reaction for the two headings which one show underneath in the figure 4.23 .

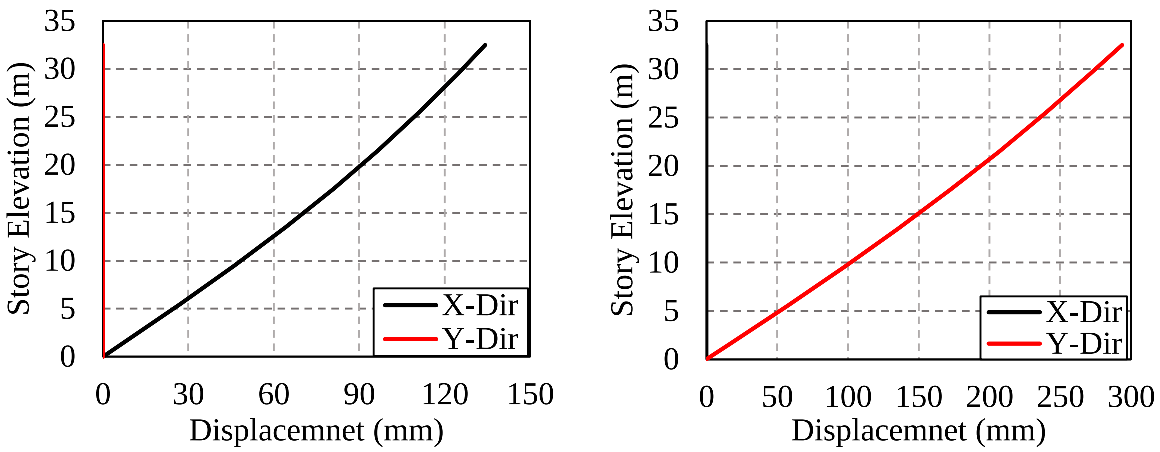



Figure 4.24: Wind load Displacement in CC9

Zone2 I can use the Ss 0.5,S1 0.2 and wind speed are 147 m/hr in Dhaka cities.1000x1000mm CFT column size, flange thickness is 25mm 300x250mm beam size, slab thickness 125mm are use the 8-G building, I tracked down the seismic and wind load tremor reaction for the two headings which one show underneath in the figure 4.24.

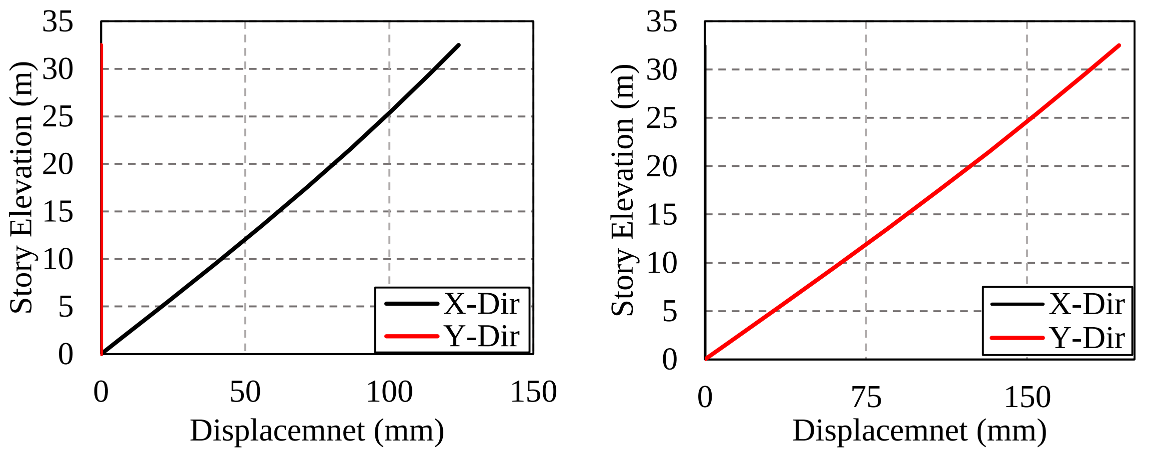



Figure 4.25: Seismic Displacement in CC10

CC25 case we can use the CFT column in 1000x1000mm, flange thickness is 25mm 300x250mm beam size, slab thickness 125mm are use the 8-G building, I tracked down the seismic and wind load tremor reaction for the two headings which one show underneath in the figure 4.25 .

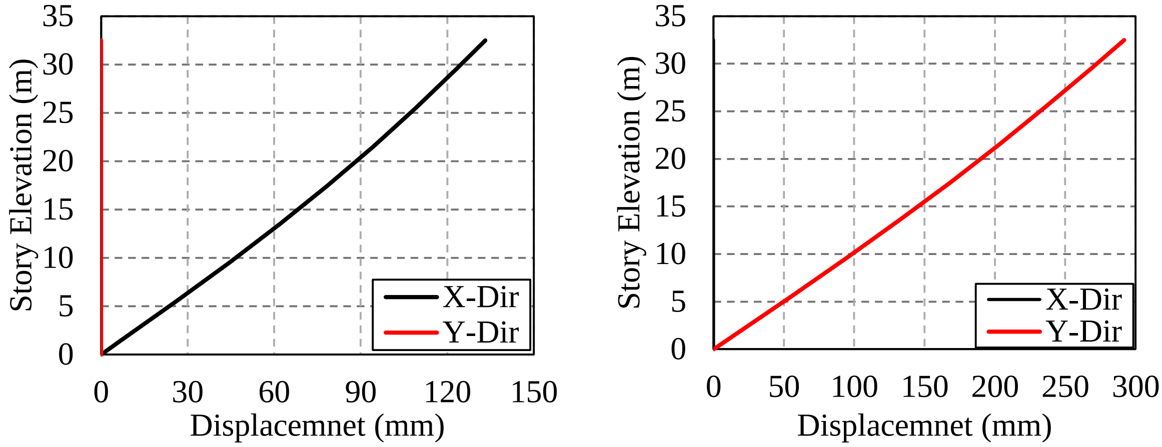



Figure 4.26: Wind load Displacement in CC10

Zone2 I can use the Ss 0.5,S1 0.2 and wind speed are 147 m/hr in Dhaka cities.1000x1000mm CFT column size, flange thickness is 25mm 300x250mm beam size, slab thickness 125mm are use the 8-G building, I tracked down the seismic and wind load tremor reaction for the two headings which one show underneath in the figure 4.26.

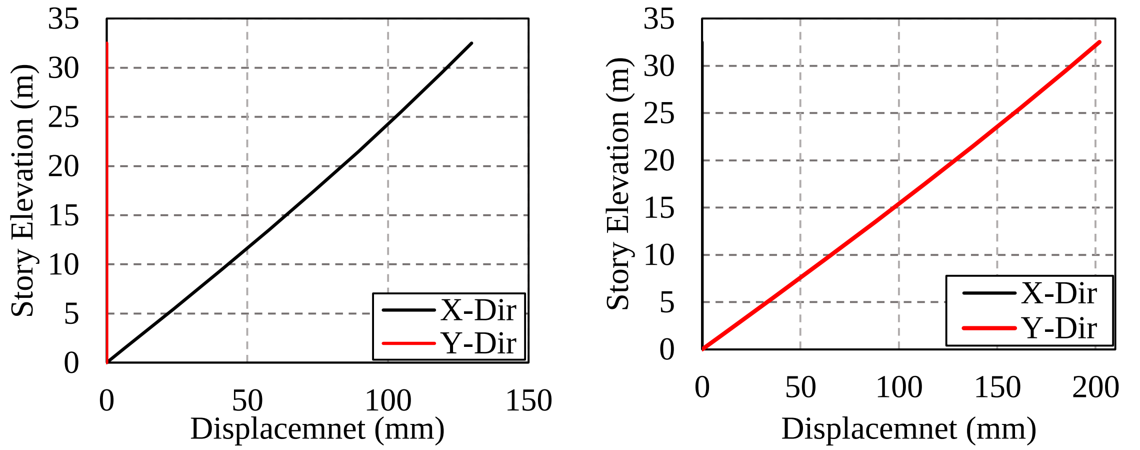



Figure 4.27: Seismic Displacement in CC11

CC27 we can use the CFT column in 1000x1000mm, flange thickness is 38mm 300x250mm beam size, slab thickness 125mm are use the 8-G building, I tracked down the seismic and wind load tremor reaction for the two headings which one show underneath in the figure 4.27.

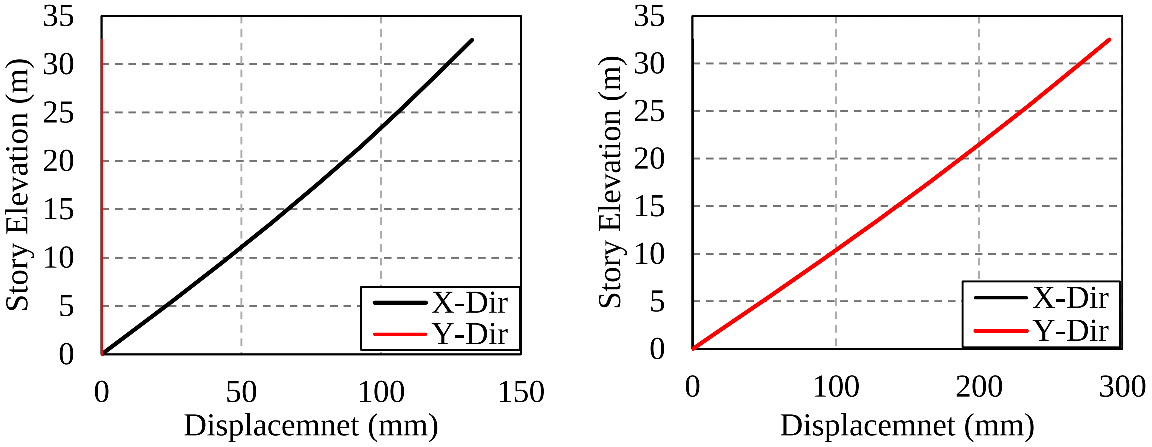



Figure 4.28: Wind load Displacement in CC11

Zone2 I can use the Ss 0.5,S1 0.2 and wind speed are 147 m/hr in Dhaka cities.1000x1000mm CFT column size, flange thickness is 38mm 300x250mm beam size, slab thickness 125mm are use the 8-G building, I tracked down the seismic and wind load tremor reaction for the two headings which one show underneath in the figure 4.28.

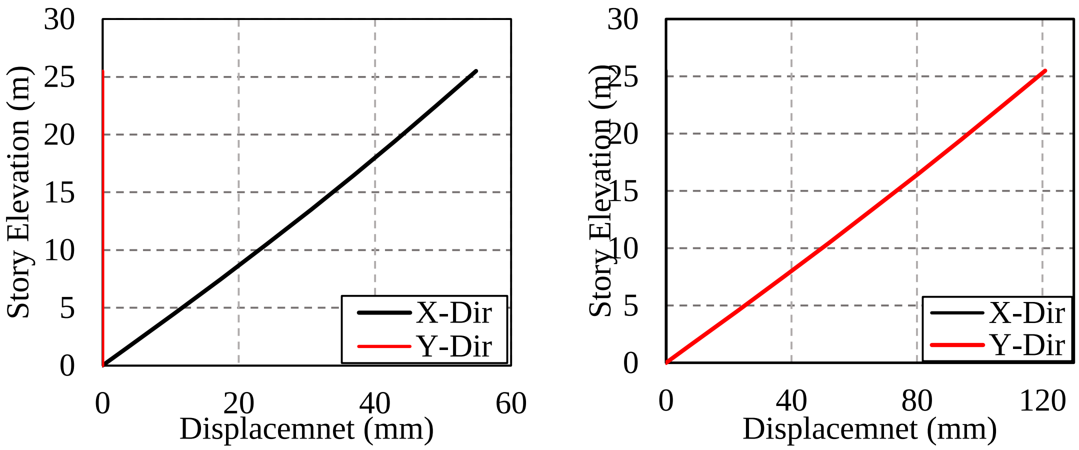



Figure 4.29: Seismic Displacement in CC12

CC12 we can use the CFT column in 1000x1000mm, flange thickness is 50mm 300x250mm beam size, slab thickness 125mm are use the 8-G building, I tracked down the seismic and wind load tremor reaction for the two headings which one show underneath in the figure 4.29.

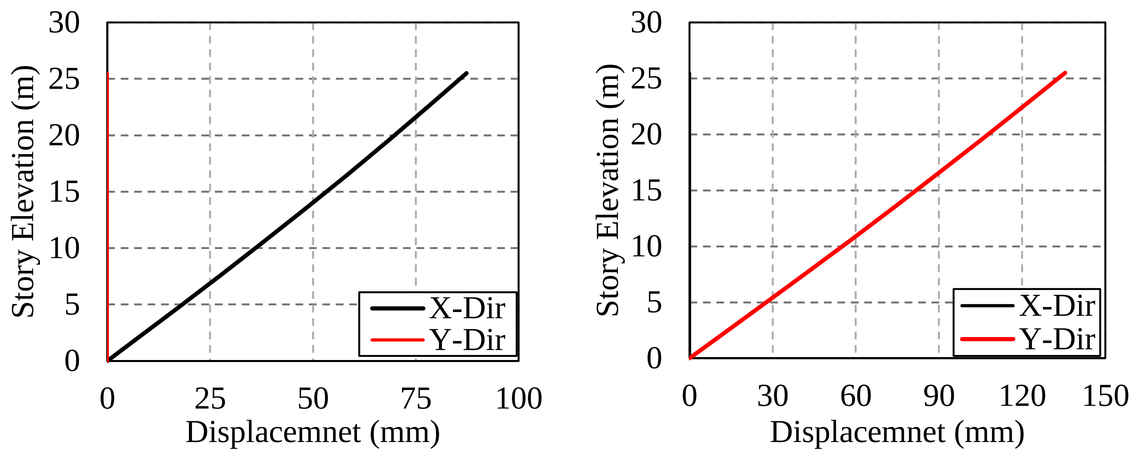



Figure 4.30: Wind load Displacement in CC12

Zone2 I can use the Ss 0.5,S1 0.2 and wind speed are 147 m/hr in Dhaka cities.1000x1000mm CFT column size, flange thickness is 50mm 300x250mm beam size, slab thickness 125mm are use the 8-G building, I tracked down the seismic and wind load tremor reaction for the two headings which one show underneath in the figure 4.30.

## 4.4 Summary

I explained the seismic and wind load deflection I acquired after analysis of modeling in this chapter because my main purpose of this study was to discover an RCC and CFT that on an appropriate column diameter after making the RCC and CFT in different seismic. For my I-shape structure, I received CFT column dimensions of 1000x1000 mm and RCC column measurements of 2000x2000 mm.

# CHAPTER 5

# CONCLUSION AND RECOMMENDATION

## 5.1 Conclusions

This report summarized the experiment results to approve the displacement behavior of a seismic zone 2 in concrete-filled tubular (CFT) and RCC columns.

- Before analysis we apply the first RCC column then found that the maximum displacement than apply the CFT column and get the minimum displacement in the CFT column.
- With the maximum displacement due to earthquake longitudinal direction for RCC column is decreased 23.7 % when compared to CFT column.
- Along with the maximum displacement due wind load in the longitudinal direction for RCC column is decreased 62% when compared to CFT column.
- After completing several case studies, CC12 shows better satisfaction than other cases.
- Finally, the CFT column requires less area than conventional reinforced columns and also shows better behavior in horizontal force conditions (Seismic and Wind).

## 5.2 Future Recommendation

CFT column uses the modern structure. I modeled and analysis with 8-G multi-story building in a different seismic zone. we use the different values in zone 2 than I can get the story displacement.

a) In both RCC and CFT constructions, the base shear for covered casing receives less attention than bracings and shear divider.

b) When compared to expose casing dislodging, uprooting lowers with presenting stiffeners and shear walls both for RCC and CFT structures strategy.

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