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Analysis of shear wall subjected to lateral load

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ABSTRACT

- The purpose of this study is to model and analyze the non planar shear wall assemblies of shear wall-frame structures. Three dimensional models, for open and closed section shear wall assemblies, have been developed.

- These models are based on conventional wide column analogy, in which a planar shear wall is replaced by an idealized frame structure consisting of a column and rigid beams located at floor levels. The rigid diaphragm floor assumption, which is widely used in the analysis of multi storey building structures, is also taken into consideration. The connections of the rigid beams are released against torsion in the model proposed for open section shear walls.

- Several shear wall systems having different shapes of wall-frame and flat plate shear wall assemblies have been analyzed by static lateral load, response spectrum where the proposed methods have been used. The results of these analyses are compared with the results obtained using common shear wall modeling techniques.

OBJECTIVES

The objectives of the project are:-

To carry out a frame analysis on shear wall models using ETABS non linear version 8.5 software.

To check the reliability of frame analysis method compare to wall frame shear wall and flat plate shear wall.

The study is focused on the determination of the ultimate lateral load due to wind and earthquake.

To find out and compare the different calculated value of those wall frame and flat plate shear wall structures.

To draw few recommendations based on the study.

METHODOLOGY

Analysis on shear wall structures can be analyzed by three types methods mention below:

Finite Element Analysis (FEA)

Continuous connection method (CCM)

Equivalent Frame Analysis (EFA)

For this study we applied **"Equivalent Frame Analysis (EFA) methods"** effectively.

Evaluate the when rigidities (GA) of the rigid frame bents and any wall frame bents:

$$GA = \frac{12E}{h\left(\frac{1}{G} + \frac{1}{C}\right)}$$

Values obtained in items a and b to evaluate:

$$\alpha H = H\sqrt{\frac{(GA)_t}{(EI)_t}}$$

Horizontal Displacements:

$$Y(Z) = \frac{wH^4}{8(EI)_t} K_1(\alpha H_1 Z/H)$$

Maximum story drift Index:

$$\frac{dy}{dz}(\max) = \frac{WH^3}{6(EI)_t} k_2(\max)$$

SHEAR WALLS SYSTEMS

Shear walls have been the most common lateral force resisting elements for tall building besides frame system.

The main intention of the research work presented in this thesis is to study the majority of the high rise building structures in Bangladesh have shear wall frame systems.

Structural forms of shear wall are commonly using buildings of 10 to 30 stories. Monolithic shear wall can be classified as short, squat or cantilever as in Figure 5.1 according to there height/depth ratio.

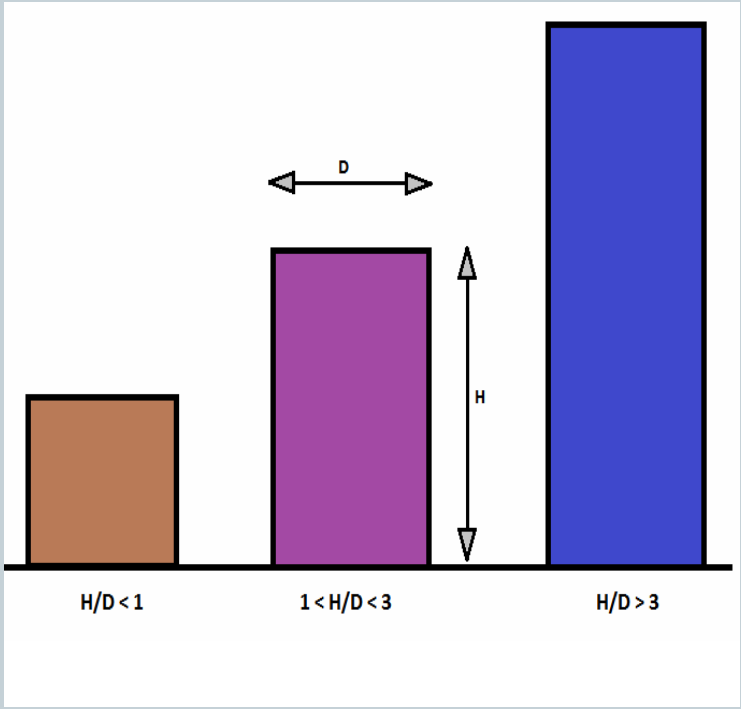


Figure 5.1: Shapes of Shear Wall

EQUIVALENT LATERAL FORCE METHOD

A building structure subjected to lateral forces obtained by the equivalent lateral force method is shown in Figure 6.1. A triangular distribution of equivalent lateral loads with zero loading at the base of the structure is considered in the analysis.

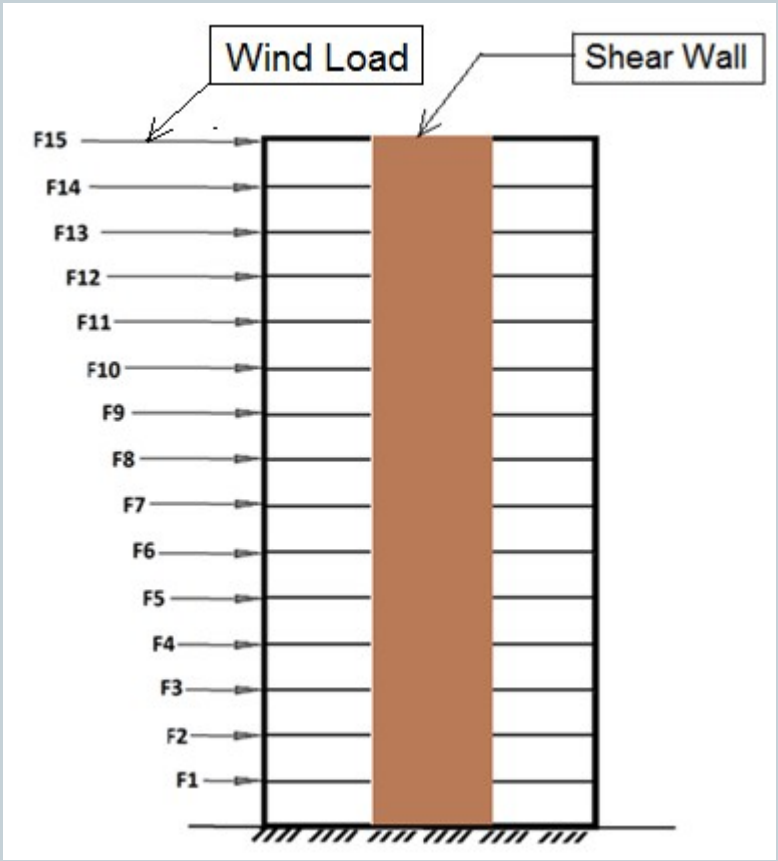


Figure 6.1 : Building structure subjected to equivalent wind loads

SHEAR WALLS

A shear wall is a wall that resists lateral
wind loads which acts parallel to the plane of the wall

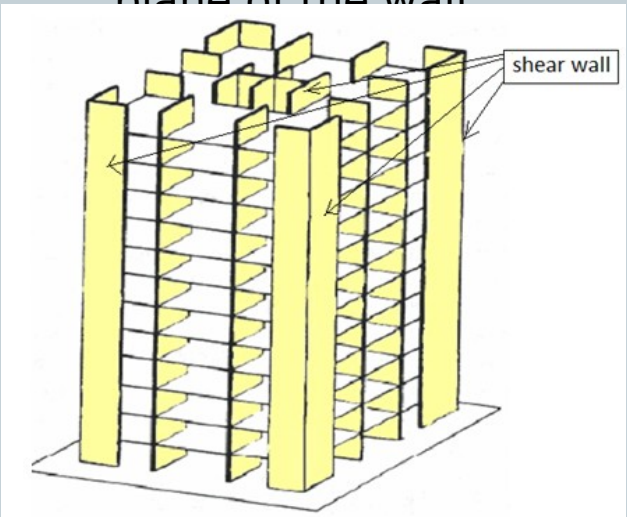


Figure 7.1 : Shear wall frame structure

Wind results in a pressure on the surface of the
building pressure increases with height

Positive Pressure, acts towards the surface of the building
Neg building

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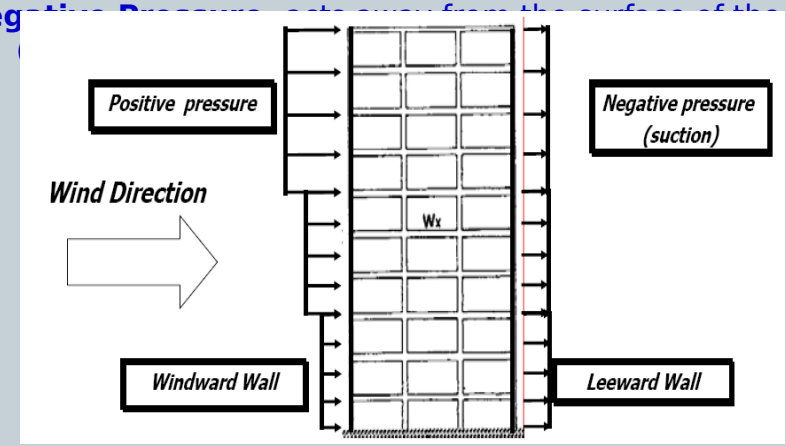


Figure 7.2: Directions of wind pressure

WORK PROCEDURE

FLOOR PLAN

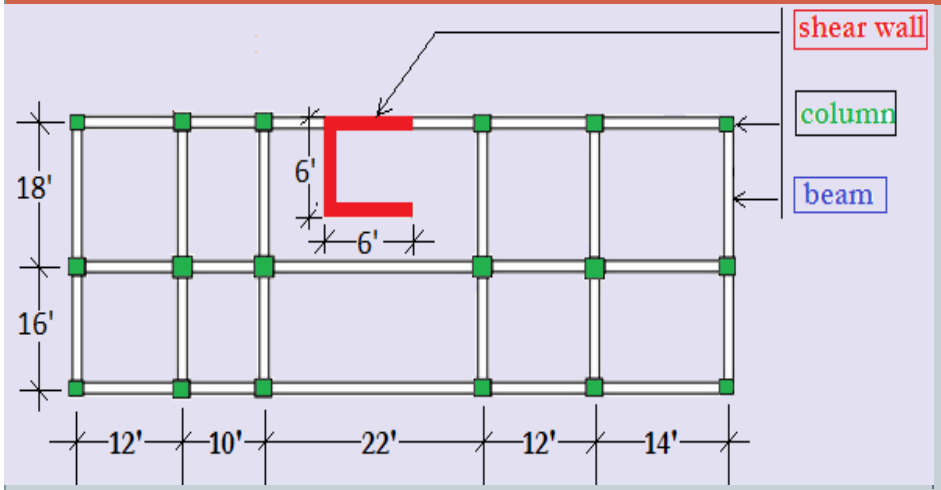


Figure 8.1: Typical floor plan of a shear wall-frame building structure (14 storied)

Type of Property to find

- B1=10″ X 18″ B2=10″ X 21″
- B3=10″ X 24″ C1=18″ X 21″
- C2=18″ X 24″ C3=21″ X 24″

3D VIEW OF BUILDING STRUCTURE

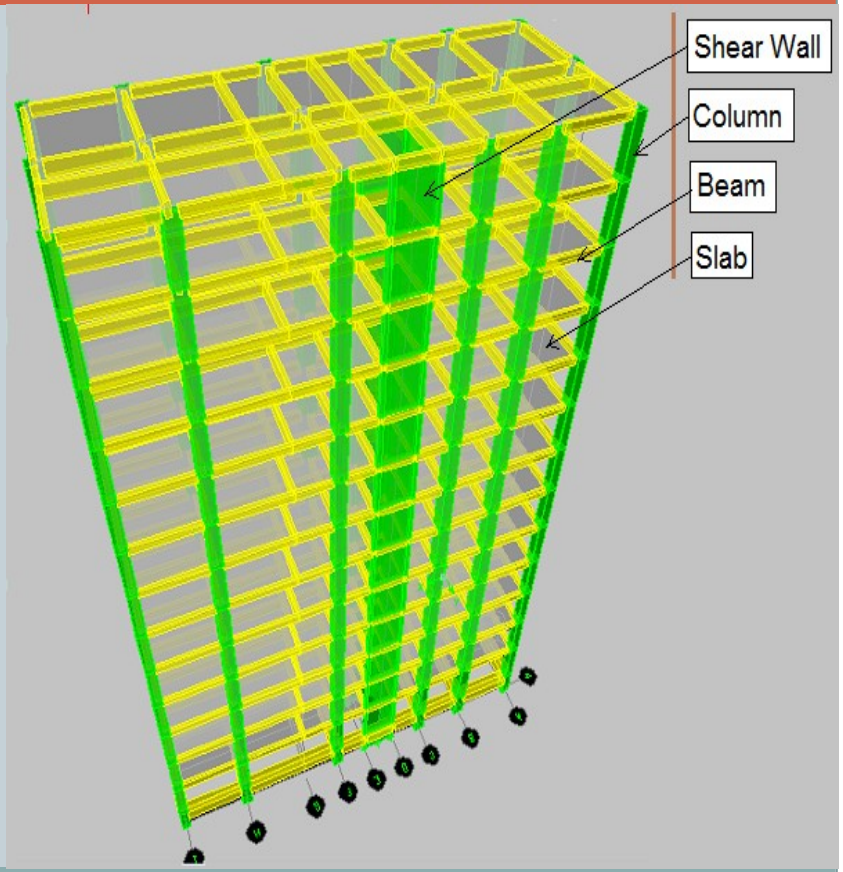


Figure 8.2 : Building 3D view

ASSUMPTION

CATEGORIES

The basic assumptions used in the modeling studies are presented. These assumptions are divided into three categories:

Material behavior
Element behavior
Structural behavior

METHOD & FACTORS

Used USD method

Given Load, code & factors:

- Dead load= 1.2
- Live Load = 1.6
- Earthquake Load = 1.0
- Wind Load = 1.0
- Code UBC 94
- Design Code ACI 318-99
- Site Co-Efficient, (s) = 1.2
- Importance factor, (I) = 1.0
- f'c = 4 ksi
- fy = 60 ksi

COMPARISONS

Comparative values of base moment due to lateral load (shear wall-1)

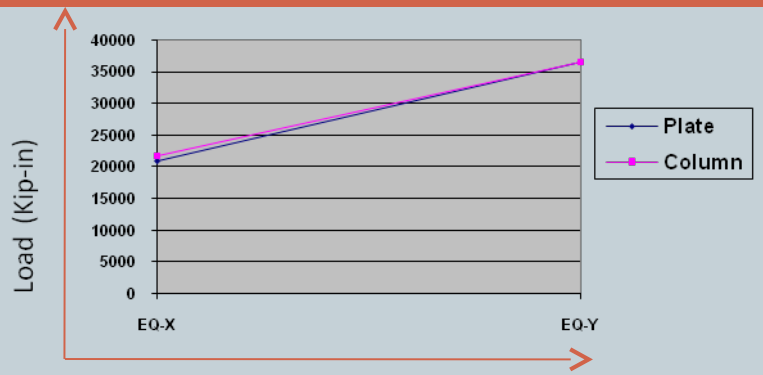


Figure10.1: Base moment comparison graph for earthquake.

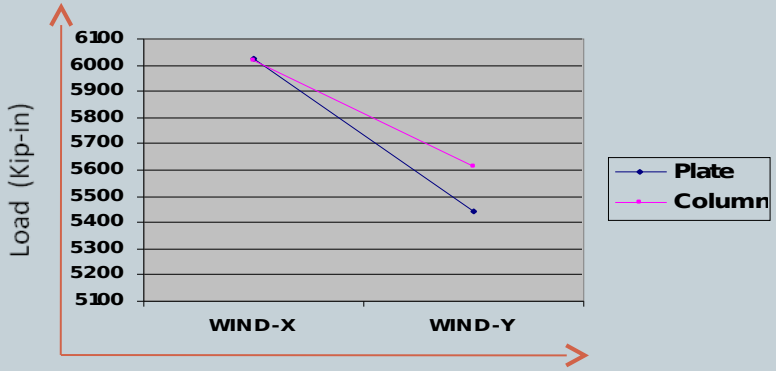


Figure 10.2: base moment comparison graph for wind

Comparative values of base moment due to lateral load (shear wall-2)

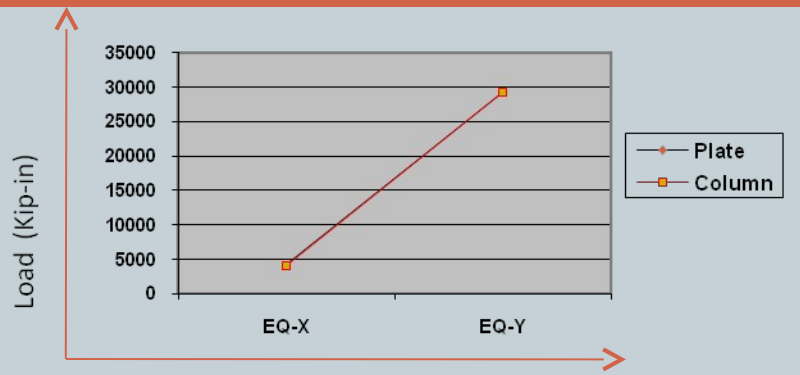


Figure 10.3: Base moment comparison graph for earthquake.

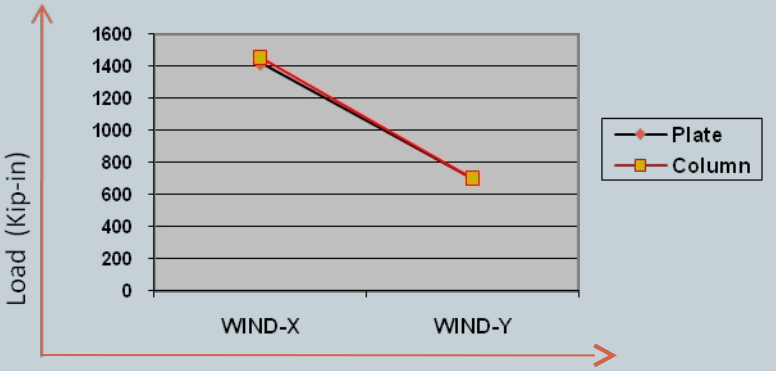


Figure 10.4: base moment comparison graph for wind.

FINDING OF THE STUDY

- **Values are closed :** analyzing of plate shear wall and column shear wall structures we have found base moment values are very closed.
- **Frame Methods are more accurate:** according to analysis of two methods that we have got more accurate results in frame method as a alternate for plate element method.
- **Economical And Memory Efficient:** the frame element method is more economical and memory efficient.
- **Frame analysis method is very simple rather than plate element method.**

CONCLUSION & RECOMMENDATION

Conclusion:

- Analyzed of Plate shear wall and column shear wall structures find base moment values are very closed.
- According to analysis of two methods that we get more accurate results in frame method as a alternate for plate element method.
- The frame element method is more economical and memory efficient.
- Frame analysis method is very simple rather than plate element method.

Recommendation:

- The study is used for building structure, similar study may be done for bridge structure.
- We have done this method by static analysis, but dynamic analysis should also be performed.

THANKS TO ALL