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# Analysis and design of tall structure using monolithic construction

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**Abstract** — *In the seismic design of buildings, reinforced concrete structural walls, or shear walls, act as major earthquake resisting members. Concrete walls are provided for the additional gravity force resistant. The properties of these seismic shear walls dominate the response of the buildings, and therefore, it is important to evaluate the seismic response of the walls appropriately. In these paper conventional, monolithic with external walls structural systems and monolithic with internal wall system for G+20, G+25, G+30 storey was studied with the help of ETABS v 15 analysis and design. Additional Parameters like Lateral displacement, storey drift are calculated for both the structures. we concluded that there is drastic improvement in the monolithic structure as compared to conventional structure in term of strength as well as cost.*

***Keywords-***: *Conventional Structural System, Monolithic Structural System, ETABS v 13*

## 1 INTRODUCTION

### 1.1. Tall structure

Tall structure can be define as the multistory building generally constructed by a various structural frames, and provided with high speed elevators and amenities provided with extraordinary height with ordinary room spaces such as low rise building. In short it is the expression of the city's power base, representing its private and public investments.

### 1.2. Monolithic structure

In Monolithic System; all walls, slabs, stairs, together with door and window openings are cast in place in one operation at site by use of specially designed formwork, easy to handle with less labour and equipment efforts modular form work made of Aluminum Plastic composite. In this system the lateral and gravity load resisting system consists of reinforced concrete walls and reinforced concrete slabs. Reinforced concrete structural walls are the main vertical structural elements with a dual role of resisting both the gravity and lateral loads.

## 2 OBJECTIVES

- The objective of this study is to determine the suitability, adoptability and economic feasibility of monolithic structural system against conventional structural system.
- comparative study of conventional structural system with monolithic structural system and for both structural system comparison of storey drift, storey shear, storey displacement and base shear.
- Comparison with the conventional method and observe that the difference in time, cost, material etc.

## 3 METHODOLOGY

For this study, a 20-storey,25 storey and 30-storey building with a height of 3-meters for each storey is modeled. The sections of beam, column, shear wall is rectangular with common dimensions. The buildings are modeled using software ETAB v 15, three different models

1. Conventional Structural System (beam-column structural system)
2. Monolithic with only external wall structural system
3. Monolithic with external as well as internal wall structural system

Dead load & live load calculation is as per IS 875, and Earthquake load calculation is as per IS 1893 , wind load as per is-875 , taking EQ Zone-III by using static coefficient method.
The data for these frames are given below.

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Seismic Zone – III, No of storeys – 1 to 20, 1-25, 1-30. Floor Height – 3m, Thickness of Shear wall– 300mm, Materials – M30, Fe 500 , Depth of Slab – 150mm , Unit Weight of RCC – 25kN/m3 ,Type of soil – Medium. Size of beam 300x450 mm taken initially and increased as the design requirements.


*Figure 1: architectural plan*

## 4 RESULTS

After analyzing and designing above plan , we have compared following parameters and cost of above mentioned three system for 20 storey , 25 storey and 30 storey. Comparisons are as follows

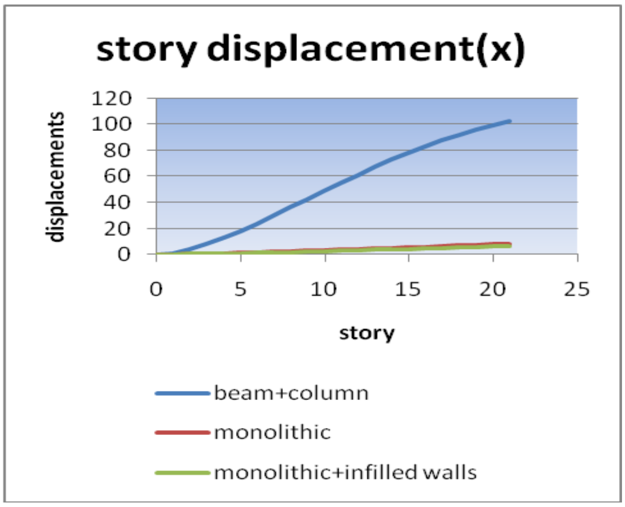


*Figure 2: comparison of displacement in x direction for 20 storey*

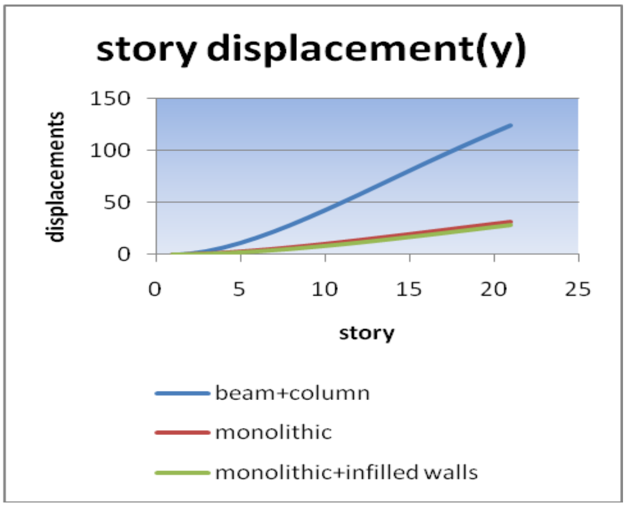


*Figure 3: comparison of displacement in y direction for 20 storey*

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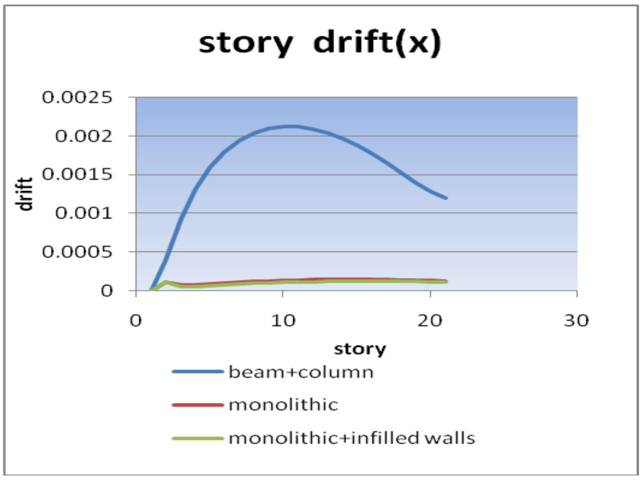


*Figure 4: comparison of drift in x direction for 20 storey*

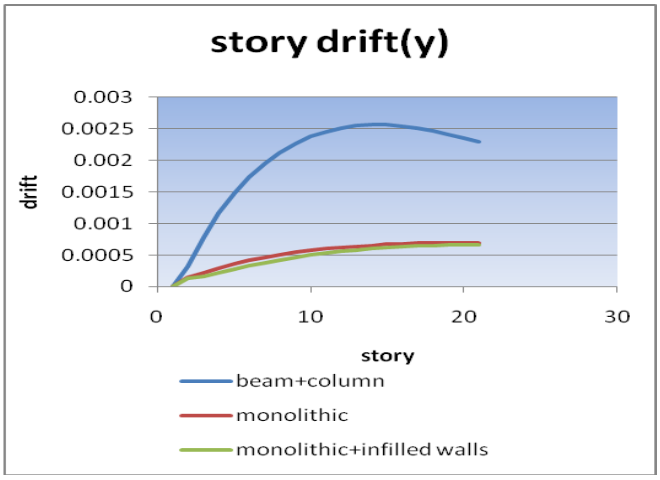


*Figure 5: comparison of drift in y direction for 20 storey*

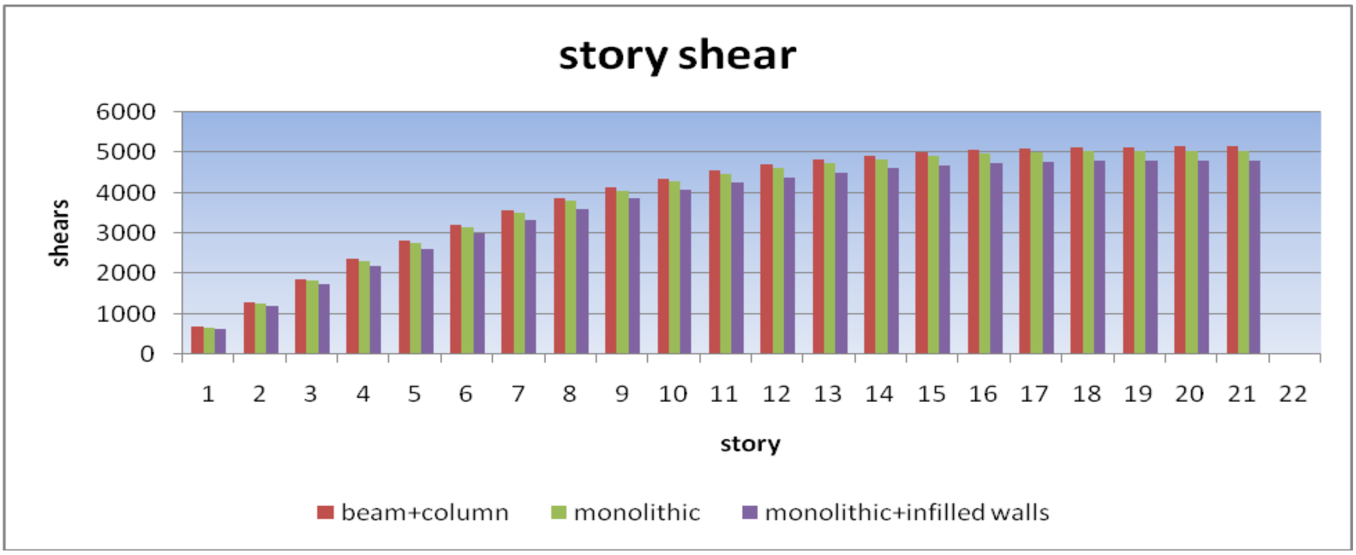


*Figure 6: comparison of storey shear for 20 storey*

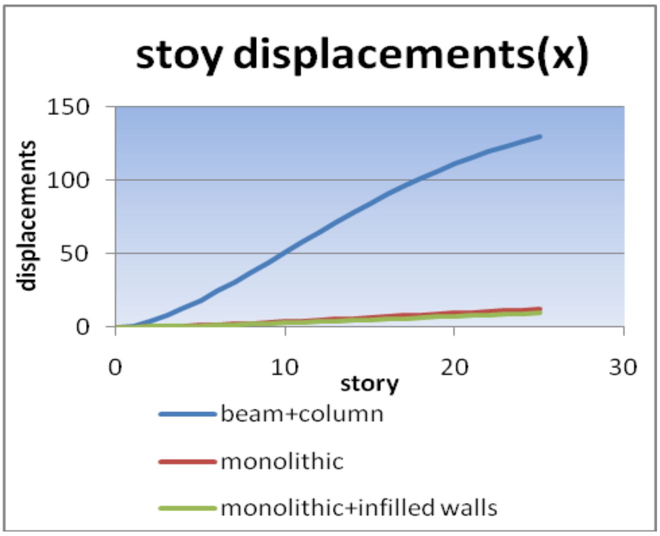


*Figure 7: comparison of displacement in x direction for 25 storey*

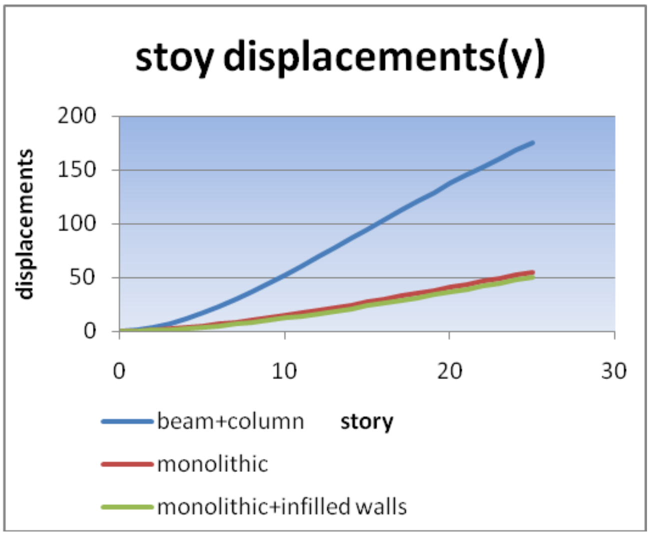


*Figure 8: comparison of displacement in y direction for 25 storey*

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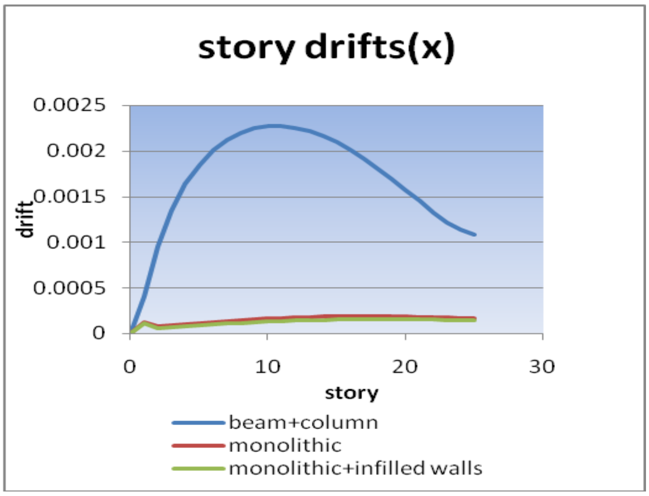


*Figure 9: comparison of drift in y direction for 25 storey*

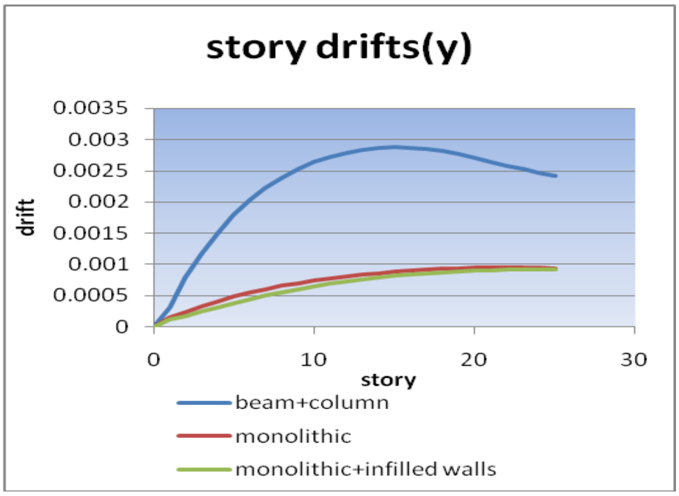


*Figure 10: comparison of drift in y direction for 25 storey*

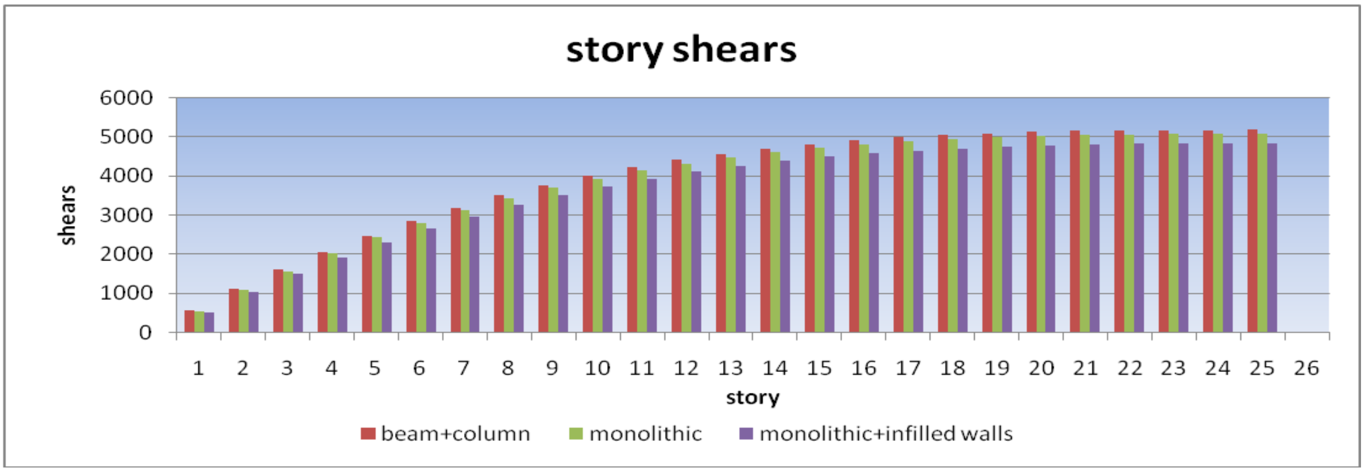


*Figure 11: comparison of storey shear for 25 storey*

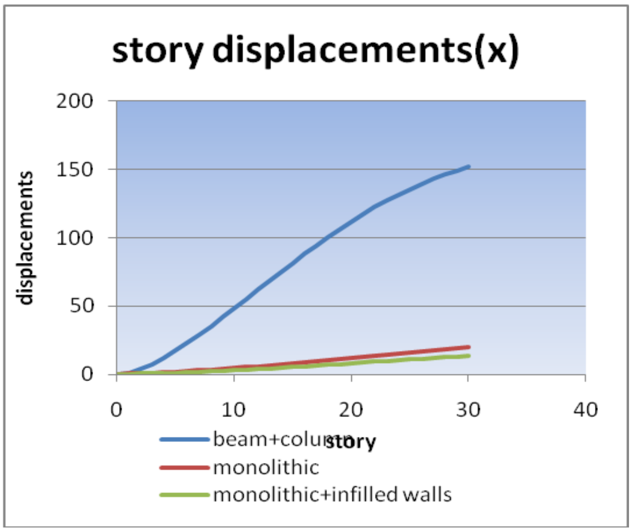


*Figure 12: comparison of displacement in x direction for 30 storey*

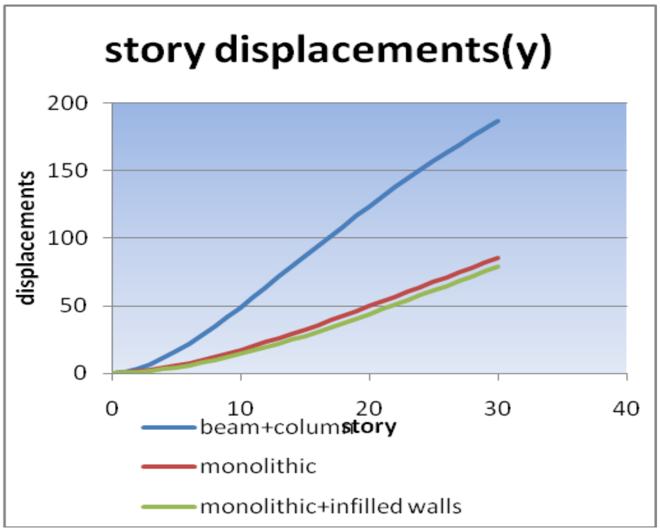


*Figure 13: comparison of displacement in y direction for 30 storey*

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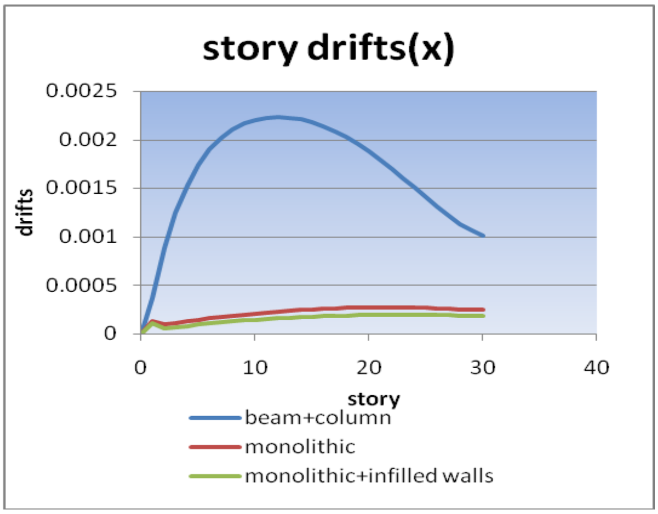


*Figure 14: comparison of drift in x direction for 30 storey*

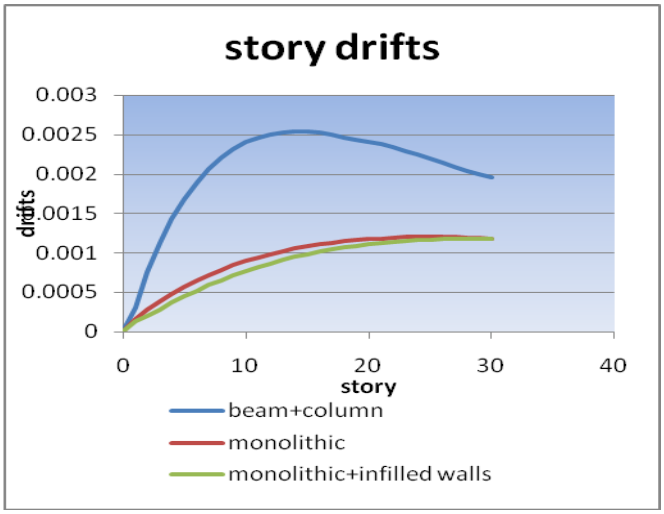


*Figure 15: comparison of drift in y direction for 30 storey*

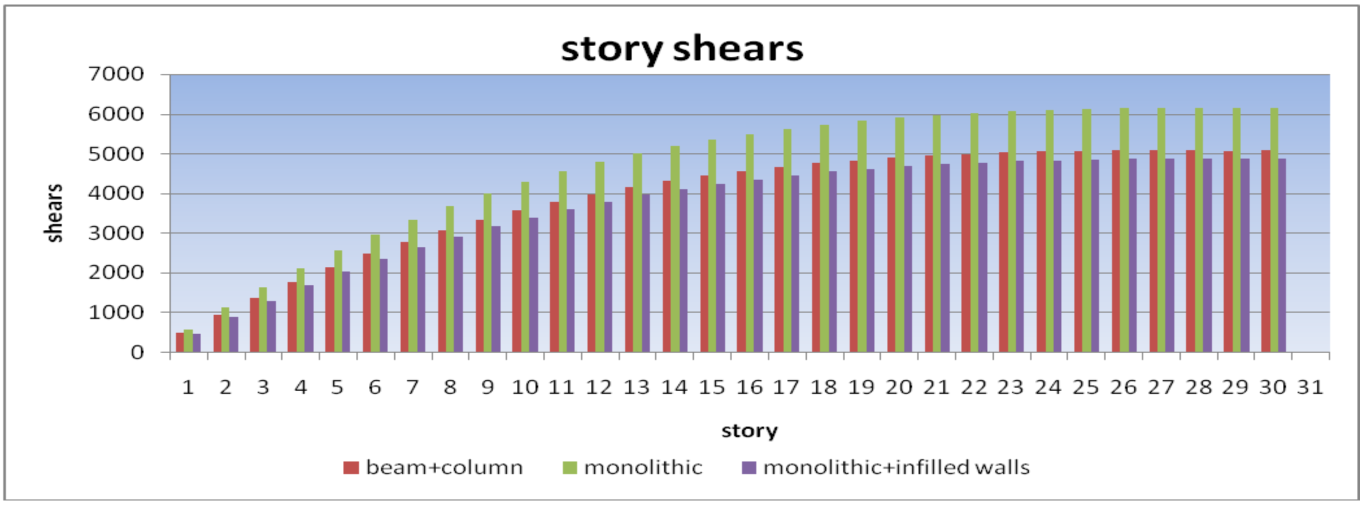


*Figure 16: comparison of storey shear for 30 storey*

## 5 CONCLUSION

***Comparison of strength parameter***

***For 20 storey***

For monolithic with external walls system ***displacement*** reduced to 71%to 92% and ***drift r***educed to 69% to 91% against conventional method.

For monolithic with internal walls system ***displacement*** reduced to 74 to 94% and ***drift*** reduced to 72 to 93%% against conventional method.

***For 25 storey***

For monolithic with external walls system ***displacement*** reduced to 65 to 85% and ***drift*** reduced to 65 to 84%% against conventional method.

For monolithic with internal walls system ***displacemen***t reduced to 70 to 87% and ***drift r***educed to 69 to 85%% against conventional method.

***For 25 storey***

For monolithic with external walls system ***displacement*** reduced to 59 to 89% and ***drift*** reduced to 55 to 87%% against conventional method.

For monolithic with internal walls system ***displacement*** reduced to 64 to 93% ***and drift*** reduced to 59 to 91%% against Conventional method.

***comparison of material***

For monolithic with external walls system ***steel*** has reduced to 30 to 35% against Conventional method.

For monolithic with internal walls system ***steel*** has reduced to 60 to 65% against Conventional method.
For monolithic with external walls system ***concrete*** has increased to 30 to 50% against Conventional method
For monolithic with internal walls system ***concrete*** has increased to 70 to 80% against Conventional method

***Comparison of cost***

For monolithic with external walls system ***cost*** has reduced to 5 to 20% against Conventional method.

For monolithic with internal walls system ***cost*** has reduced to 25 to 40% against Conventional method.

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