DYNAMIC EARTHQUAKE ANALYSIS OF G+20 STOREY PODIUM TYPE BUILDING WITH DIFFERENT SHEAR WALL LOCATIONS

[1]Mayur S. Nandha, [2]Jignesh H. Solanki, [3]Hirenkumar P. Makwana, [4]Dharmesh Ladumor
[1]P.G. Student, Department of Civil Engineering, NGI, Junagadh, Gujarat, India,
[2]Assistant Professor, Department of Civil Engineering, NGI, Junagadh, Gujarat, India
[3] Structure Engineer, Bhuj-Kutch
[4]P.G. Student, Department of Civil Engineering, NGI, Junagadh, Gujarat, India.
[1] Department of Civil Engineering,
[1] NGI, Junagadh, Gujarat, India

Abstract: The aim of present work is to study the performance of podium type building with shear wall under dynamic earthquake loading at different RC wall location for specific G+20 storey building and to compare the results in terms of different parameters. Here for comparison G+20 storey rectangular podium building is taken and four different RC wall location is taken. Earthquake zone V is considered and soil profile is loose (III). For dynamic analysis response spectrum method (IS 1893-2016) is used in ETABS V17.0 software. Results are compared in terms of storey drift, storey shear & displacement.

***Index Terms* – Podium Building, RC wall, Optimization, Response Spectrum Method, Storey Displacement, Storey Drift, Storey Shear, ETABS 17.0.**

1. INTRODUCTION

In this era of vertical development of buildings podium building is very popular due to its' multitasking nature. Increasing population and same amount of land availability creates land crises in mega and metro cities, to overcome this problem podium is reliable solution. Large variation in plan and elevation creates large stiffness variation and this variation makes structure unstable, so proper analysis method and design techniques used to make it safe and economic.

Here some podium buildings are shown in Fig.

(a) (b) (c)

Fig-1: Podium Buildings (a) Oberoi Skyz-Mumbai (b) Bharat Sky Vistas-Mumbai (c) Orchid Heights-Mumbai.

2. RESEARCH SIGNIFICANCE

Podium buildings are generally high rise, so it is necessary to analyze for dynamic loading conditions as well as lateral forces should consider while analyzing structure.

In this paper G+20 storey podium building is considered and four possible RC wall location are taken for comparison, and stiffness of infill wall is also considered in analysis. Results are compared in terms of storey drift, storey shear and storey displacement. The objective of this study is to find appropriate location of RC wall in podium type building.

3. MODELING AND ANALYSIS

3.1 BUILDING CONFIGURATION:

Here for study purpose G+20 storey podium building is taken which having base dimension 48m x 44m up to fourth storey and after that dimension is 24m x 20m up to top. Height of typical storey height are 3.1m and podium storey height are 3.5m. Total height of building is 66.7m. For comparison four possible RC wall location is taken and stiffness of infill wall is also considered while analysis.

3.1.1 MATERIAL DATA:

Grade of Concrete: M30
Grade of Rebar Steel: Fe500
Density of Masonry: 21.2068 kN/m^3
Compressive Strength of Masonry (f'_m): 10 MPa
Modulus of Elasticity of Masonry ($E=550\ f'_m$): 5500MPa

3.1.2 SECTION DATA:

Size of Column: 500mm x 500mm
Size of Beam: 250mm x 350mm
Depth of Slab: 150mm
Thickness of RC wall: 200mm
Thickness of Outer Masonry wall: 230mm
Thickness of Inner Masonry wall: 150mm

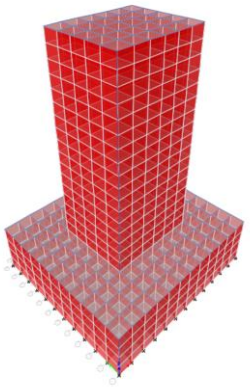
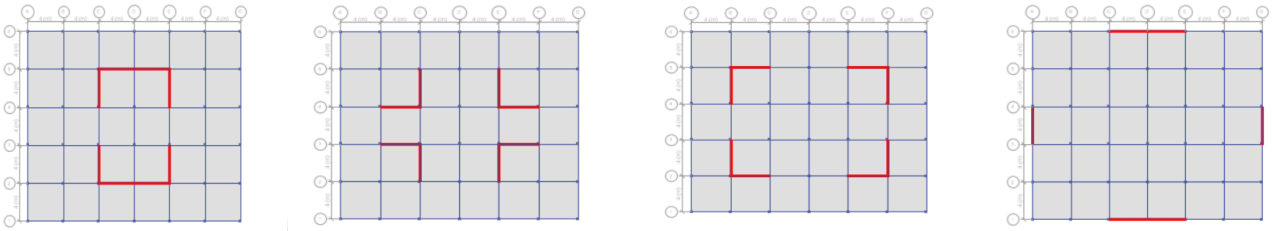


Fig-2: 3D View of Building Model

3.2 MODEL PREPARATION

Modelling is done using ETABS v17.0 software.



(a) (b) (c) (d)

Fig-3 (a) Model SW1 (b) Model SW2 (c) Model SW3 (d) Model SW4

3.3 DYNAMIC ANALYSIS METHODS AND LOADING DATA

Live Load on typical floor: 4 kN/m^2
Live load on roof: 1.5 kN/m^2
Seismic Zone: V
Importance factor: 1.5
Response Reduction factor: 3
Type of Soil: III (Loose)
Damping: 5%

3.3.1 RESPONSE SPECTRUM ANALYSIS:

As per IS 1893-2016 response spectrum is the representation of maximum response of a spectrum of idealized single degree of freedom system of different natural periods but having same damping, under the action of the same earthquake ground motion at their basis. Here in fig-4 its described in pictorial form.

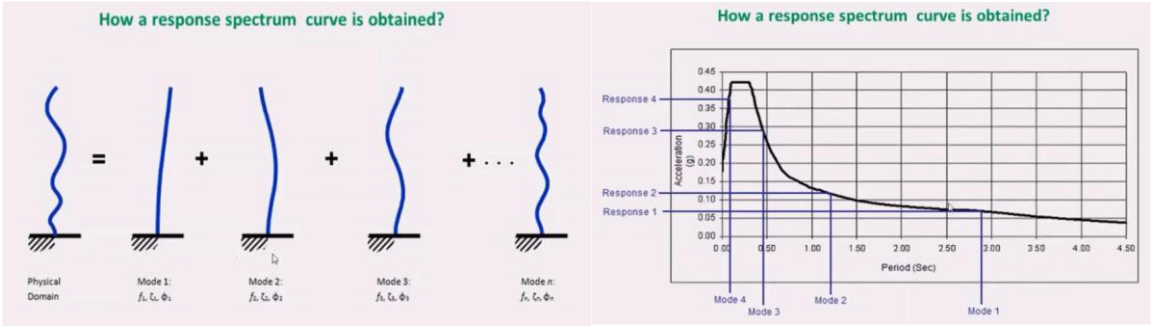


Fig-4 Response Spectrum Curve Determination

4. RESULT ANALYSIS

Results are obtained from ETABS v17.0 software in terms of storey displacement, storey drift and storey shear. These results are exported in excel to make charts.

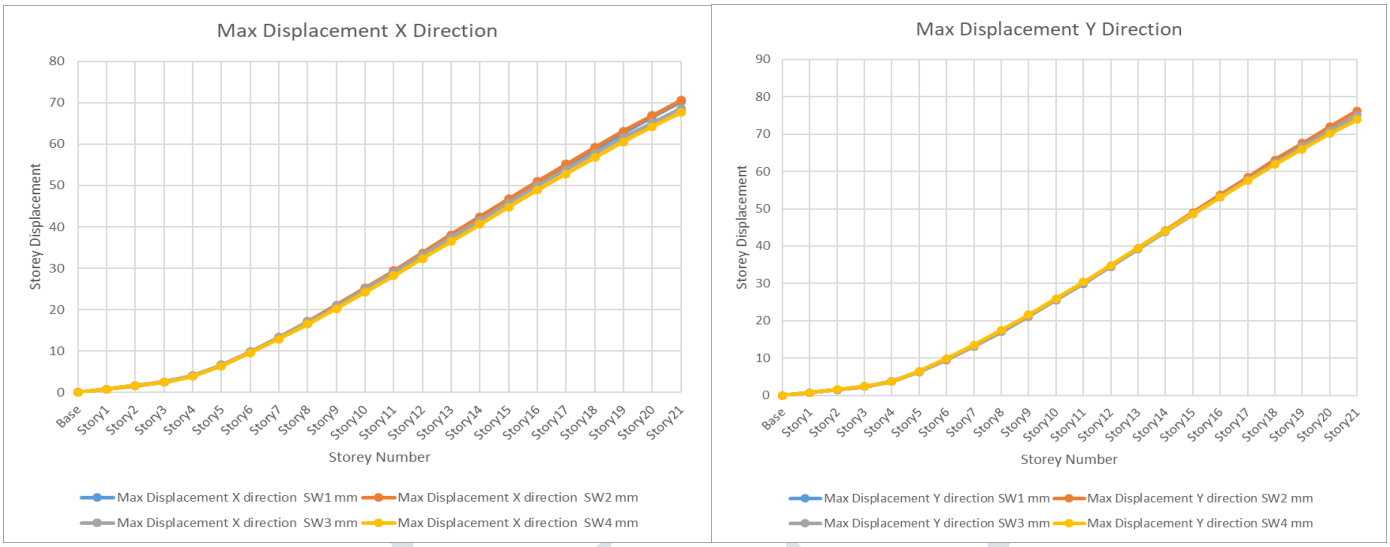


Chart-1: Max Storey Displacement in X & Y Direction

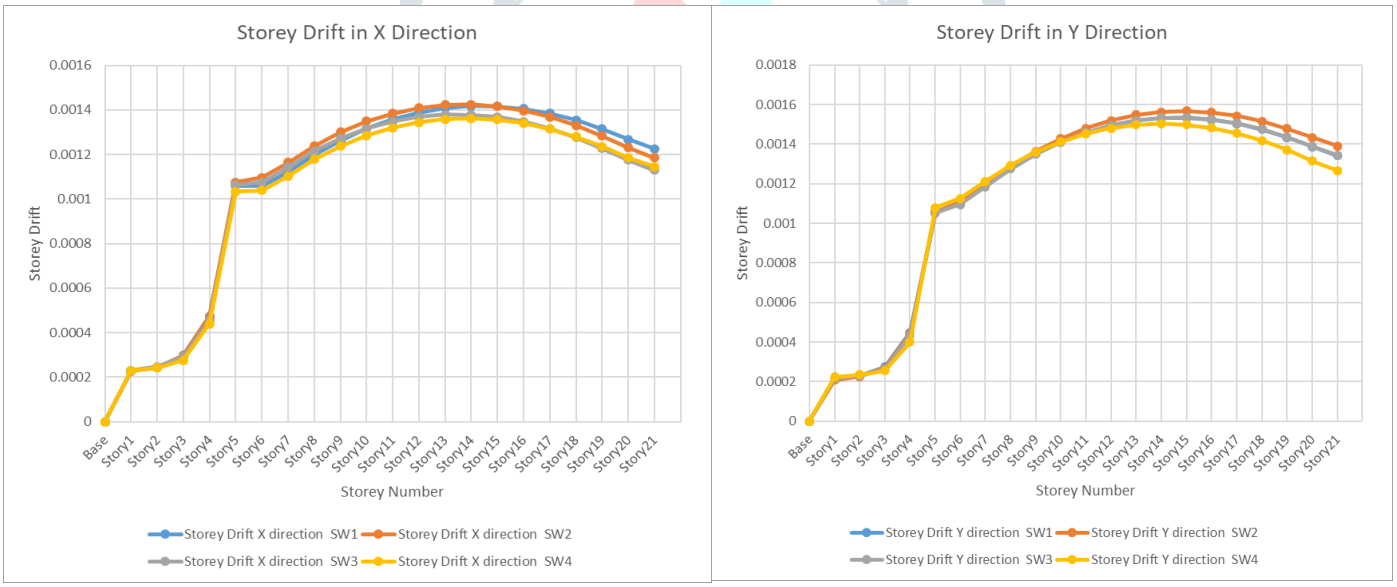


Chart-2: Max Storey Drift in X & Y Direction

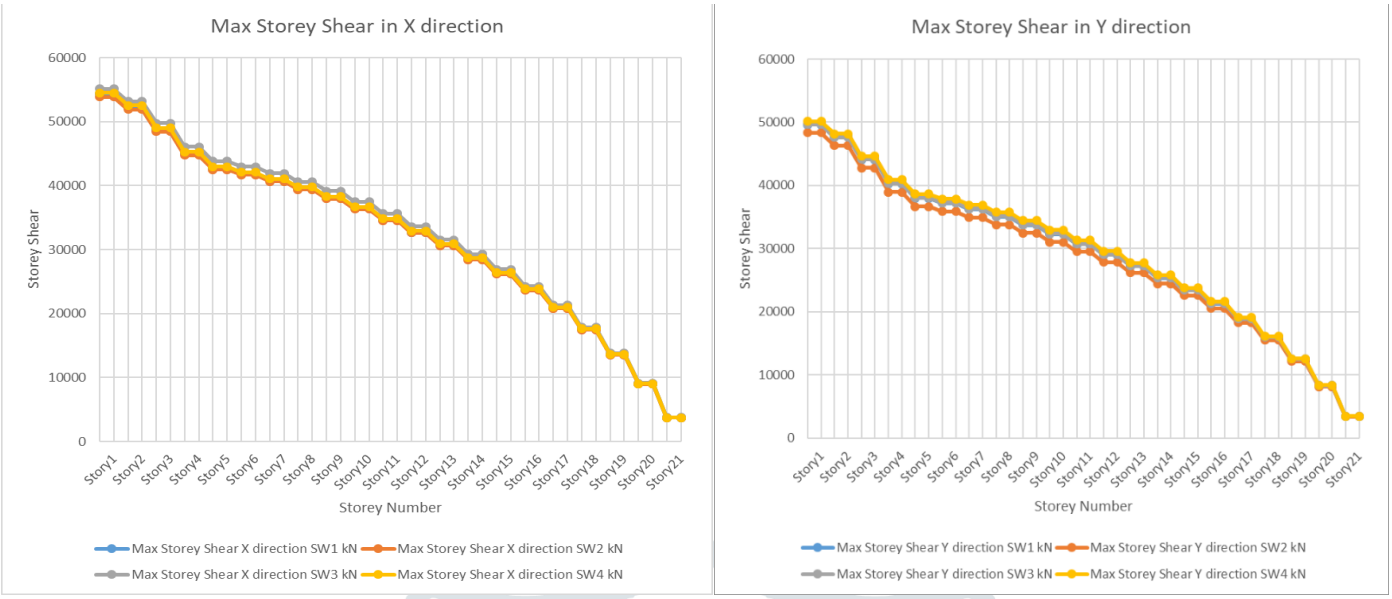


Chart-3: Max Storey Shear in X & Y Direction

5. CONCLUSIONS

For the analysis of G+20 storey podium type building with different RC wall layouts are considered and these are analyzed for dynamic loading using response spectrum method and get results in form of storey displacement, storey drift and storey shear using ETBAS 17.0 software.

From the results it is observed that,

- For dynamic analysis by response spectrum method SW4 model showing minimum displacement, it is increases about 1.5%, 3.12% and 1.6% in model SW1, SW2 and SW3 respectively.
- Max storey drift for SW4 model is quite less compare to other models and it is increases about 5.67%, 8.9% and 5.88% in model SW1, SW2 and SW3 respectively.
- Max storey shear for SW4 model high compare to other models and it is decreases about 1.13%, 3.76% and 1.07% in model SW1, SW2 and SW3 respectively.
- For this podium building fourth RC wall layout means SW4 is showing less displacement and drift in compare to other layouts.
- For this podium building second RC wall layout means SW2 is showing higher displacement and drift compare to other layouts.
- Building is rectangular and behavior of building is almost same in both X and Y direction so there are quite same results for both X and Y directions.

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