Dynamic Analysis of Regular Twin Tall RCC Structure with Various Sizes of Links at Most Effective Location

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Abstract: A Multi-Tower is a pair of tall structures that are connected by a link to each other. If there is a decline in the horizontal dimension of the construction field, it is better to go for high structures. Due to the cantilever action, wind loads and seismic loads there is always a problem at high vertical dimensions. The concept of "MULTI-TOWER WITH LINK" came into the picture to make the structure resistant to all these types of forces where the structure is more rigid and stable for the wind and seismic loads. Here analysis for 40 Storey and 50 Storey symmetric Structure, in which links of different sizes are provide at the most efficient location. Here analysis of the building with connecting structures will be carried out under lateral loading conditions. The ETABS Software had been used to model the structure. The model will be analyzed with the response spectrum for zone (IV&V) and the time history analysis for Bhuj Earthquake in Medium soil. The parameters like Storey Displacement and Base Shear to be studied for Lateral Loading.

Index Terms **- Twin Tall Linked Structure, Multi-Tower, Time History Analysis, Response Spectrum Analysis, Dynamic Wind Analysis.**

I. INTRODUCTION

New, tall and super-tall building are typically smaller, more flexible and more gently dampened than their predecessors, because the proposed advanced structural systems need materials of high strength. Recent building materials also have lighter cladding, and the availability of modern building techniques has facilitated and increased the trend towards ever-larger construction. Additionally, the number of stories in modern building has increased in highly populated cities with limited land. Consequently, under strong wind and severe earthquake loads modern building are more sensitive to dynamic excitation than previous structures.

If there is a decline in the horizontal dimension of the building field, it is better to go for high structures. Because of cantilever action, wind loads and seismic loads there is often a problem at high vertical dimension. The concept of "Twin-Tower with Link" came into the picture to make the structure resistant to all these types of forces, where the structure for the wind and seismic loads is more rigid, damp and stable.

Twin Tower is a pair of tall structures that are connected by a bridge. That structural connection like sky-garden, sky-bridge and corridor. The linked building system is modelled for towers as a rigid floor diaphragm and as a beam for each link fixed to the structural perimeter of the building. For the link, the seismic responses of the twin tower were calculated at different locations by using earthquake time excitation history. The weight of the damping device and the mass of the sky bridge were often ignored.

II. OBJECTIVES

- To find response of link structure under seismic load
- To find response of link structure under dynamic wind load
- To optimize link location
- To optimize link size

III. LITERATURE REVIEW

[3] Imad Shakir Abbood, Mahir Mahmod, investigated that the link at the top of the structure reduces displacement up to 6%. And also concluded that the link is more suitable at 0.8 height of the building.

[7]Sayed Mahmoud investigated that the link bridge at the top floor reduces the peak displacement up to 29% and increases the shear up to 50%

[9]Surendra Chaurasiya, Sagar Jamle, investigated that the when all floors are connected, the displacement reduces up to 20.37%. And drift reduces up to 22.04% when 5 floors are connected.

IV. METHODOLOGY

In present work the analysis of following structure with different location of link has been carried out.

i) Bare Frame (Regular structure)
ii) Regular Structure with Links at 0.4H+0.8H, 0.6H+0.8H and 1.0H+0.8H with initial 0.6B width of the link.
iii) Best location will be check for width optimization. With of link will be 0.2B and 1.0B.

The plan areas of the all structures are same for the analysis; also, the beam and column dimensions are same. The material properties such as Poisson ratio, Density of RCC, Density of Masonry, Young's modulus, compressive strength of steel and concrete etc. are kept constant in all buildings.

- Dynamic wind analysis is carried out for soil condition II.
- The Response Spectrum Analysis for Zone IV & Zone V is considered.
- The Time History of 2001- Bhuj Earthquake is considered.
- The result parameter includes the Base Shear and Displacement.

❖ **Structure and Section details**

Note: The dimensions are given for individual building.

Storey	40 Storey and 50 Storey
Plan Dimension	30m X 30m
Bays in X-Direction	5
Bays in Y-Direction	5
Bay Width in X-Direction	6m
Bay Width in Y-Direction	6m
Floor Height	3.5m
Shear wall Thickness	230mm
Slab Thickness	150mm
Link Length	6m
Link Width	18m, 6m and 30m
Beam Dimension	300mm X 550mm
Column Dimension	600mm X 600mm
Live Load on Roof	2 KN/m^2
Live Load on Floors	3 KN/m^2
Floor Finish	1.5 KN/m^2
External Wall Load	13.8 KN/m^2
Internal Wall Load	6.9 KN/m^2
Parapet Load	2.3 KN/m^2
Concrete Grade	M30
Earthquake Parameters	Zone IV&V
Importance Factor	1.5
Steel Grade	Fe500

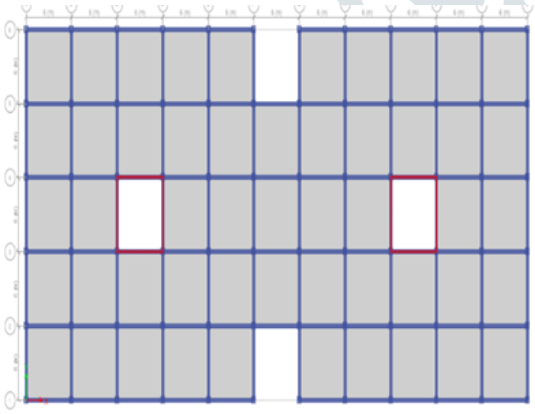


Fig 1. Plan View of Linked Twin Building

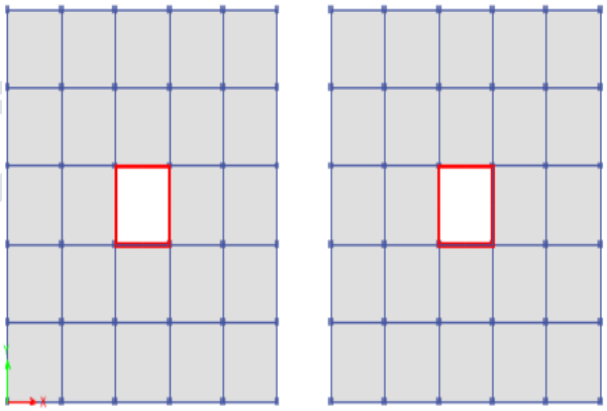


Fig 2. Plan View of Twin Building Without Link

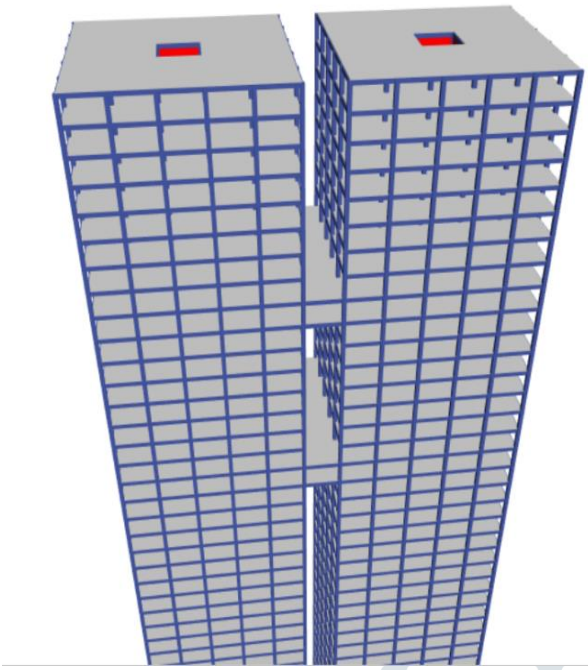


Fig 3. Elevational View of Linked Twin Building

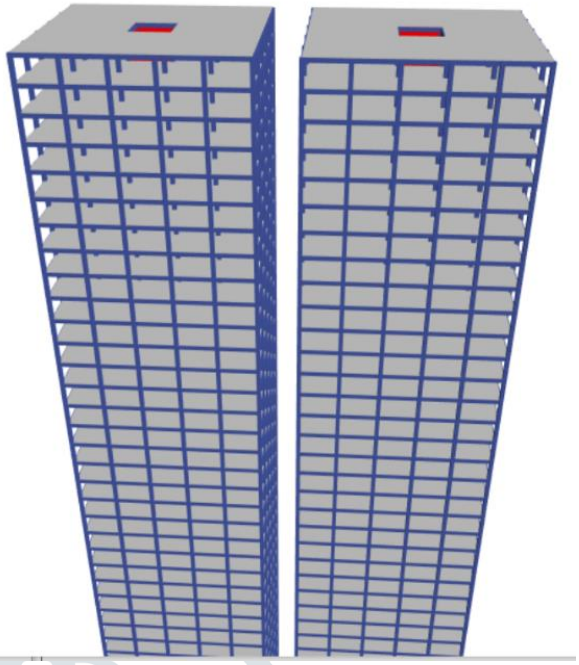
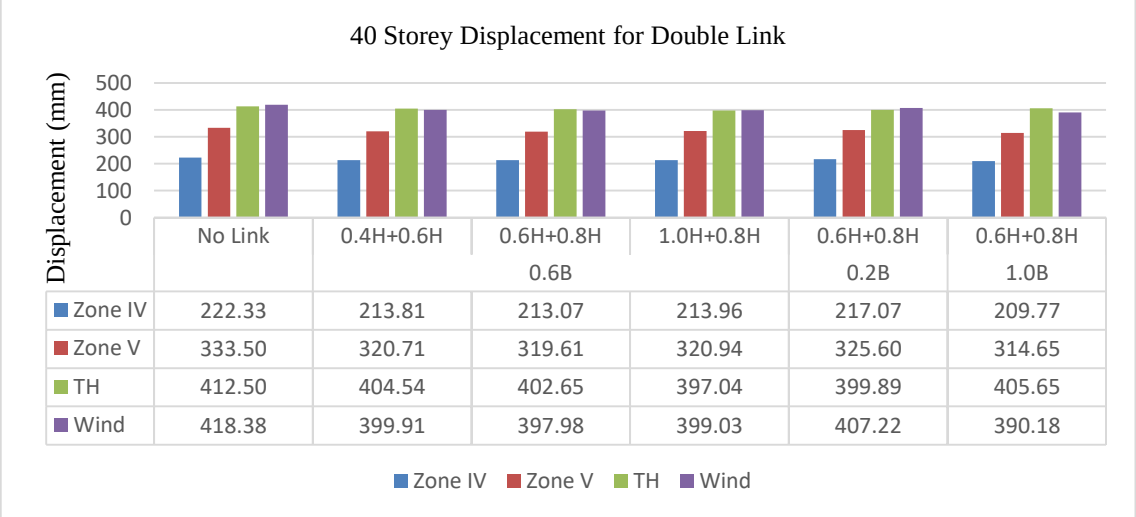


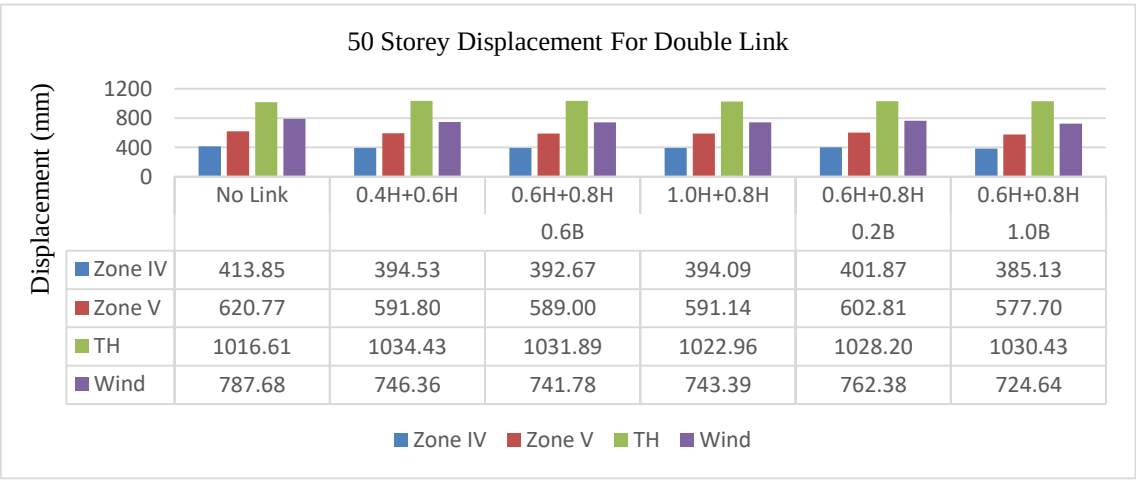
Fig 4. Elevational View of Twin Building Without Link

V. RESULTS

- **Maximum Storey Displacement**

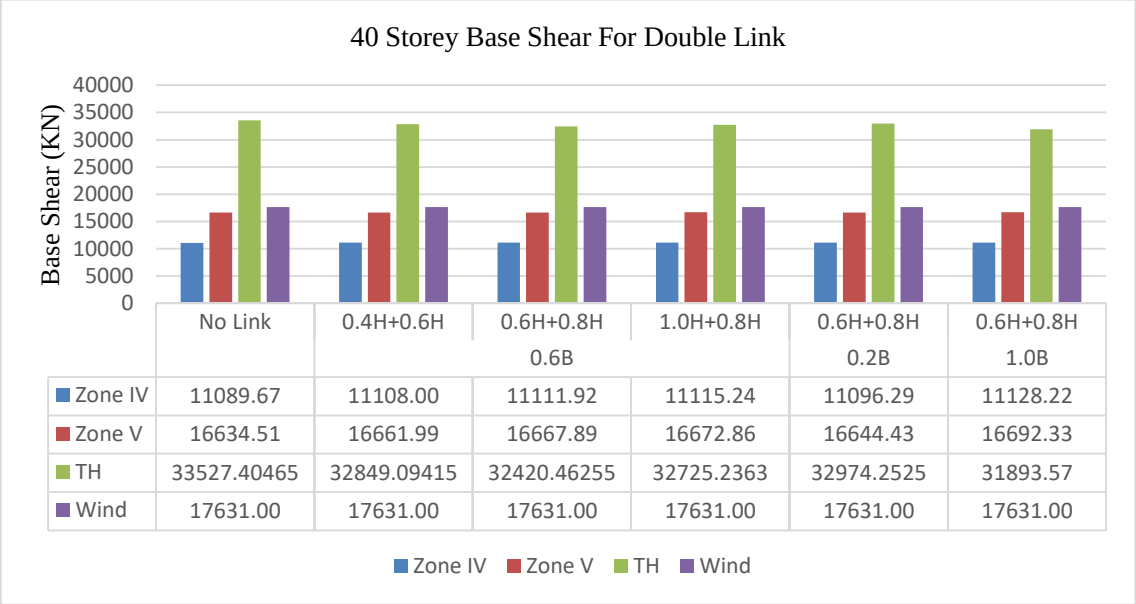


Maximum Displacement of 40 Storey



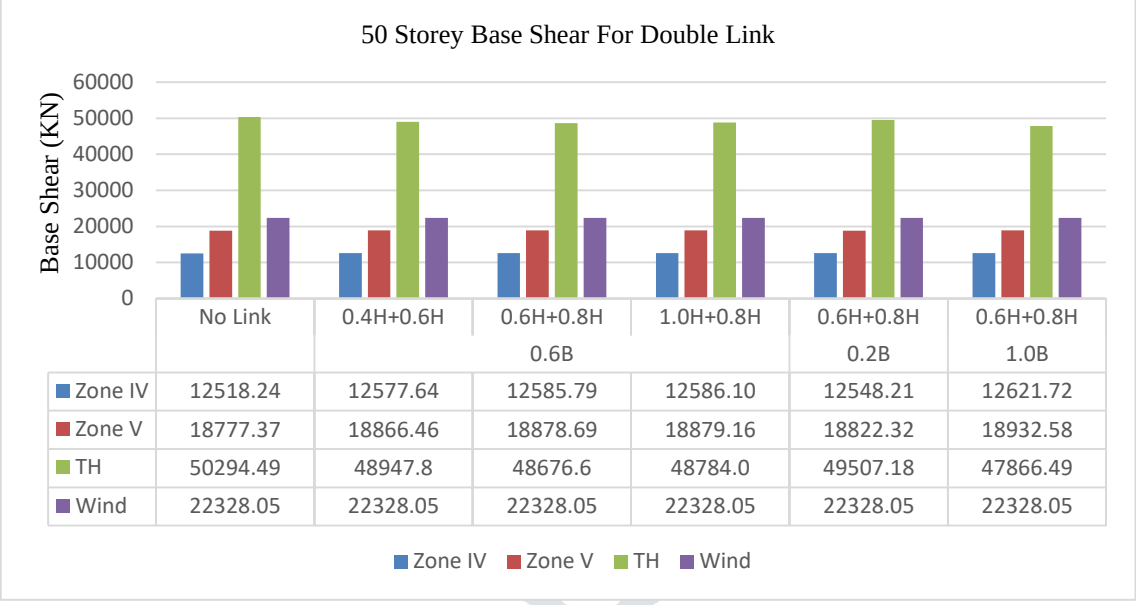
Maximum Displacement of 50 Storey

- **Base Shear**



	No Link	0.4H+0.6H	0.6H+0.8H 0.6B	1.0H+0.8H	0.6H+0.8H 0.2B	0.6H+0.8H 1.0B
Zone IV	11089.67	11108.00	11111.92	11115.24	11096.29	11128.22
Zone V	16634.51	16661.99	16667.89	16672.86	16644.43	16692.33
TH	33527.40465	32849.09415	32420.46255	32725.2363	32974.2525	31893.57
Wind	17631.00	17631.00	17631.00	17631.00	17631.00	17631.00

Base Shear of 40 Storey



	No Link	0.4H+0.6H	0.6H+0.8H 0.6B	1.0H+0.8H	0.6H+0.8H 0.2B	0.6H+0.8H 1.0B
Zone IV	12518.24	12577.64	12585.79	12586.10	12548.21	12621.72
Zone V	18777.37	18866.46	18878.69	18879.16	18822.32	18932.58
TH	50294.49	48947.8	48676.6	48784.0	49507.18	47866.49
Wind	22328.05	22328.05	22328.05	22328.05	22328.05	22328.05

Base Shear of 50 Storey

VI. Conclusion

- In the Case of 0.6B best case is 0.6H+0.8H and the displacement reduces up to 4.35%, 2.39% and 5.12% in Response Spectrum, Time history And Wind Analysis Respectively for 40 Storey Building.
- In the Case of 0.2B the displacement reduces up to 2.36%, 3.05% and 2.67% in Response Spectrum, Time history And Wind Analysis Respectively for 40 Storey Building.
- In the Case of 1.0B the displacement reduces up to 5.65%, 1.66% and 6.74% in Response Spectrum, Time history And Wind Analysis Respectively for 40 Storey Building.
- In the Case of 0.6B best case is 0.6H+0.8H and the displacement reduces up to 4.77% and 5.62% in Response Spectrum, and Wind Analysis but increases 0.62 % in Time History Analysis for 50 Storey Building.
- In the Case of 0.2B the displacement reduces up to 2.89% and 3.21% in Response Spectrum and Wind Analysis for 50 but increases 1.14% in Time History Analysis for 50 Storey Building.
- In the Case of 1.0B the displacement reduces up to 6.94%and 8% in Response Spectrum and Wind Analysis but increases 1.36% in Time History Analysis for 50 Storey Building.
- The Maximum Base Shear increases up to 0.35% in Response Spectrum analysis and decreases up to 4.87% in Time History Analysis in the case of 1.0B for 40 Storey Building.

- The Maximum Base Shear increases up to 0.83% in Response Spectrum analysis and decreases up to 4.83% in Time History Analysis in the case of 1.0B for 50 Storey Building.

Therefor the Best location of Link is 0.6H+0.8H and the optimum width is 1.0B according to study. In 50 Storey values of shear and displacement are higher in Time History Analysis. It might be cause resonance condition.

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