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AN EVALUATION OF TWIN TOWER TYPE STRUCTURE HAVING CONNECTING AT VARIOUS HEIGHTS

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Abstract: Modern structures have extremely integrated and multi-functional architectural designs. A multi-tower is a group of two tall buildings that are linked to each other. In this work, the analysis of G+19 (60 m) twin towers connected at various heights is studied. The goal of this study is to ensure that connecting beams in twin tower structures that are subjected to lateral loads are used effectively and are positioned. The model is examined for static and dynamic analysis in this building, which is in Vadodara Zone III. The parameters like Storey Displacement, Drift and Base Shear are to be studied in ETABS software

Keyword: - Seismic Analysis, Wind Analysis, Etabs, Response spectrum analysis, story displacement, story shear, story drift

I. INTRODUCTION

In India after 19's there's a huge progress in wealth and populations but also in the requirement in construction is increased. So we try to make more convenient in buildings construction and reliable and try to provide tough structure in less land with huge facility for residence, malls, commercials sectors etc. A high rise tall type structure is a great option for this type of requirement in construction. But we know every things comes with pros and cons. as the heights increased there's an events naturally created is resisted to the tall building there's a big concern to the every tall type structure

Due to space problem and increased population every year .huge tall type structure is making impact in construction sector now days. Where there's a no room space in horizontally the vertical constructions is been grow. There are many probabilities in vertical construction but also a challenging after certain storeys of heights increased. It's addressed to the resistance of the wind load and earthquake load. That leads to the safety concern to the builders and engineers. Also increased a budget of building and material and safety features also for made them safe. Because the manually calculation is takes huge time and also project validity of construction is decreased. And takes so much time. Structural escalation is required .time put away in calculating of structural designs, every brief details, steadiness etc. can make work more speedy using software like Staad Pro, Etabs, and Tekla Structure .

The study is to perform the analysis on the tall high rise type structure with passage way between two towers and check hows the structural response against wind load and earthquake load in seismic zone 3.

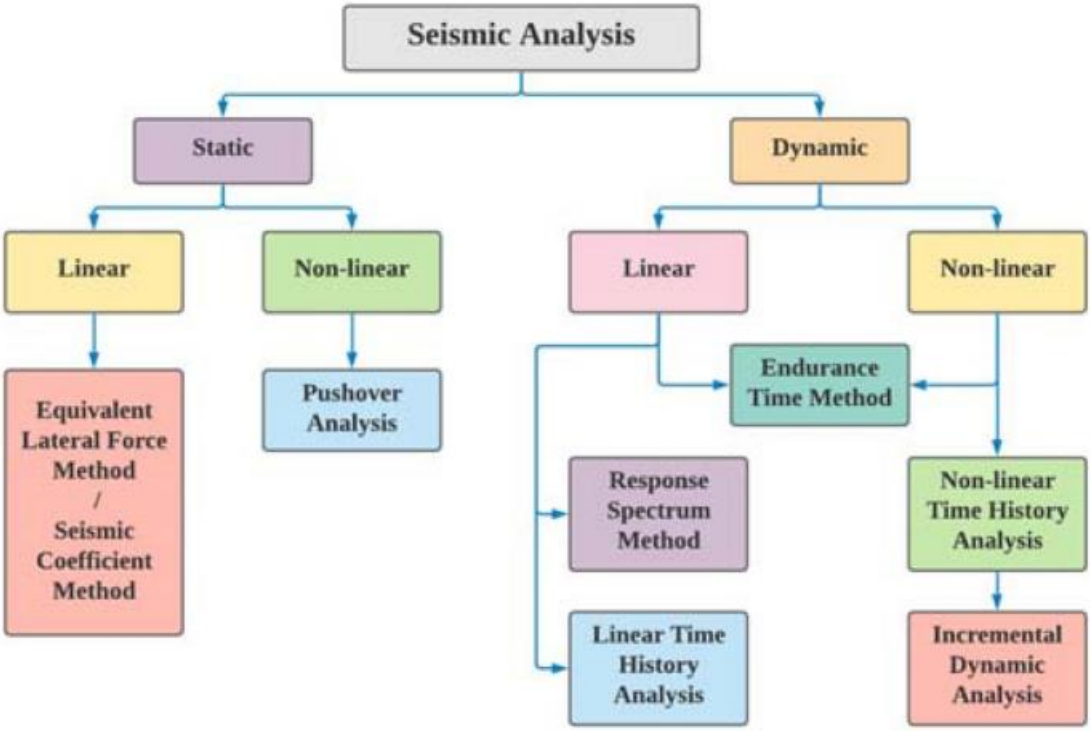
Method of the type of seismic analysis linear dynamic, statistical analysis techniques called response spectrum analysis that use to examine the structural drag in any direction and also try to make analysis of every element , joint of the structure and find the outcomes measures of the analysis on the modal method. Often known as superposition method.

The response spectrum analysis used in assessing the response in linear system with multiple degree of freedom However, they are only effective for minimal damping. When modes are identified by modal analysis, the appropriate response from the response spectrum is then selected. Then it will be combined and take it as a huge response. If the modal frequencies are not near, the standard combining tackle is the square root of the sum of the squares.

The storey drift is happening due to horizontal forces in x and y direction and it leads to deficiencies like cracks, rotation and huge impact to the structure we provide the structural steel bridge and checks the reaction of the building after that to check the response of the tall type twin tower structure. By providing at different heights and check the criteria about that concern.

In seismic analysis there is an some important criteria that leads to the huge impact in analysis mention next. Is seismic area categorized by Zone II, Zone III, Zone IV, and Zone V is four groups that are classified based on IS 1893 code criteria. The Zone II seismic condition is often relater's to as the low seismic zone, chased by the Zone III "medium seismic zone," the Zone IV "high seismic zone" and the Zone V "severe condition." The seismic load's magnitude is influenced by the seismic coefficient factor Z values

Based to the IS 1893 code, Zone II has a value of 0.10, Zone III of 0.16, Zone IV of 0.24, and Zone V of 0.36. The additional page of the IS 1893 code shows the various seismic zones for most significant Indian cities.



Steel Pathway

A Steel pathway Bridge is been construction in aim of the emergencies like fire, earthquakes, facility for going one tower to another. A steel bridge is taking at various heights in previous studies but the heights concern in some studies is little unclear to the public survey. In this we use the mild steel so that there not make huge impact in loading and be useful to the structure and make tall structure more useful.

Fig 1: pathway

Some places the skyways is made up of materials like glass floor , steel roof and also of glass wall and glass roof also Metropolitan skyways all the time appear as encased or covered footbridges that safeguard walkers from the climate. Open-top present day skyways in mountains currently frequently have glass bottoms. Here and there encased metropolitan skywalks are made absolutely from glass, including roofs, walls and floors. Likewise, a few metropolitan skyways capability stringently as straight stops intended for strolling. The two towers connecting to each other at different heights leads to helpful against the windward direction ,and also in drift of storey because of the drag due to horizontal forces and rotational forces . Connecting privately managed rail stations or other forms of transportation with their own, long footbridges. Skyways occasionally rise significantly higher, like in the case of PETRONAS Towers, but typically link on the first few levels above the ground floor. Most of the time, retail businesses occupy the space in the buildings connected by skyways. The link Is provided because of the it makes dragging little less or not we have to check by analysis

According to is 875 part3 some criteria is needed for designing building after decided heights passed is mention below by code references the wind load. This load falls under the lateral loading condition, acting perpendicular to the gravity force. The wind load analysis is determined according to the IS 875 part 3 code provisions. The wind load on the building structure is only considered if the building height exceeds 10 meters, as per the IS 875 specifications.

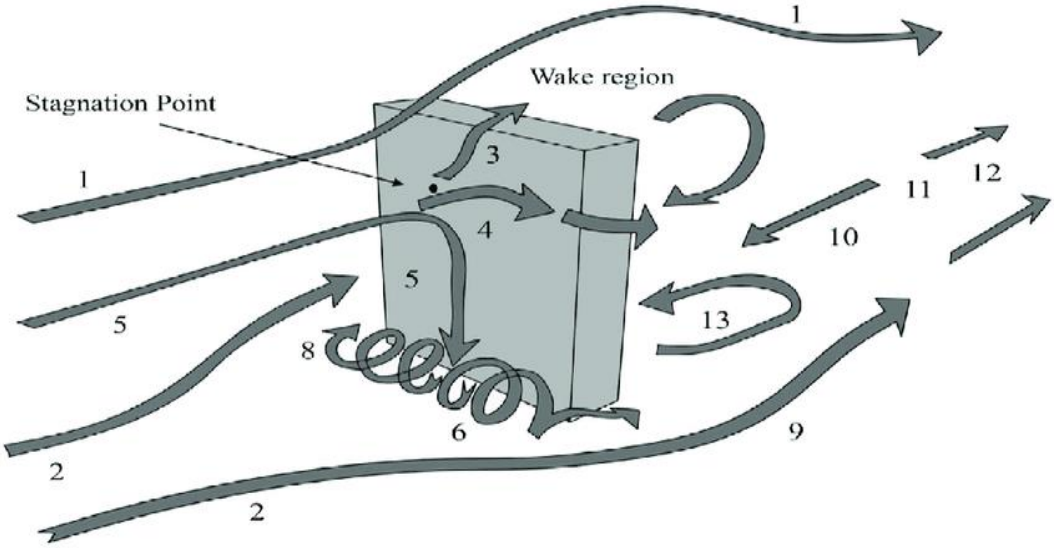


Fig 2: wind load on structure

Sky scrapper to each tower located at different heights is close immediacy now days It is possible to connect tall buildings which are close to each other so as to expand what is left in physical space. The interconnected structures may include sky gardens, podium constructions, or, as addressed in this work, sky bridges, among others. In order to evaluate and build a sky bridge linking two large buildings, there are plenty of design factors that will be emphasized in this study. This article summarizes a thorough literature review of the world's existing sky bridges.

To forecast how these structures will behave structurally under lateral loading, it is essential to understand the dynamic features of connected tall buildings. When buildings are related through sky bridges, free vibration properties such mode shapes, natural frequencies, and modal mass participation ratios are changed.

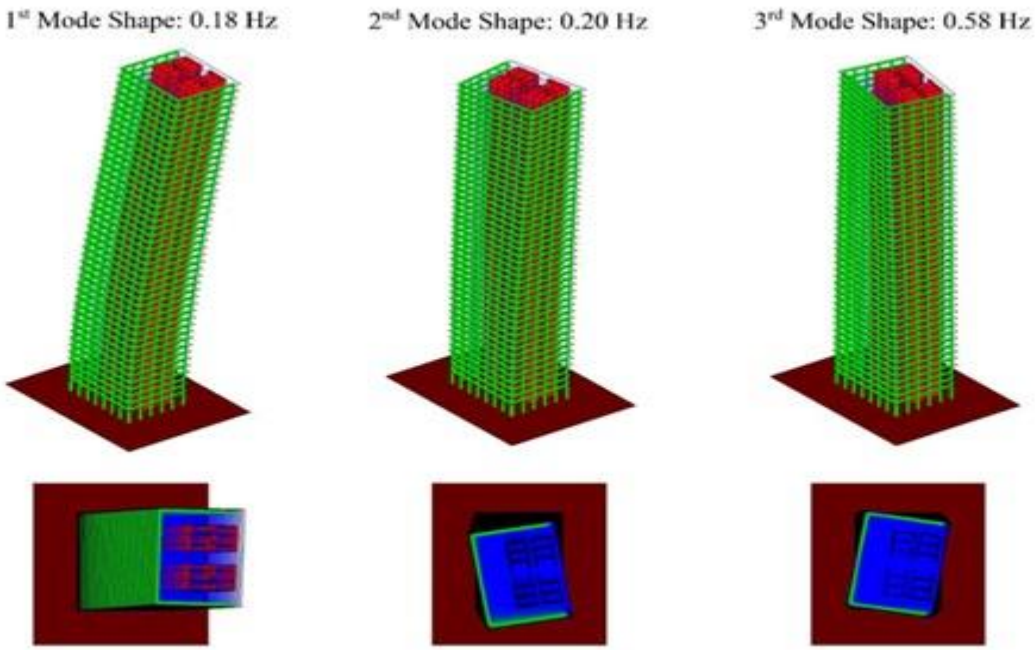


Fig 3: seismic response

The seismic response of the structure is in always in this directions as per past seismic data study. Seismic loads are connected to the gravity load and nodes in the building, shape, element sizes etc. factors that are much important in the analysis we have to focus the earth quake resistant building models like by providing bracings, shear walls, etc..

II. PERFORMANCE OF THE STRUCTURE

Because of the imperfections the distribution of mass, strength, and stiffness within the building structures is imbalanced. The analysis and design are greatly deeper when such structures are built in highly unstable areas. Plan irregularity and vertical irregularity are the two forms of deviations.

Plan irregularity, which causes structures to flex or twist in response to unstable forces, is frequently referred to as a dispersion of stiffness or strength within a structure's plan. Structures with irregular designs experience severe damage because the earthquake's response is torsion as well as travel. The term "vertical irregularity" is used to describe how the earth is laid out between adjacent levels of a multi-story building while there is a dispersion of mass at the building's summit. A poor structural mechanism might arise from an unstable force.

III. METHODOLOGY

The G+20 high rise two towers storey building with regular configuration is the one selected for this analysis. Both buildings' and conventional slab, shear wall, steel bridges taken for analytical analysis. Consist of an evaluation of the behavior of the building adopting several parameters. Three models with rectangular podium base, having steel pathway at different heights are used in this study. The objectives of the research are the behavior of the observation structure and the construction of twin tower structures of the same height but different level connecting passageway. The objectives of the research are the behavior of the inspection structure and the construction of two tall high rise structures of the same height but different levels connecting the floor to the passageway in seismic zone 3.

IV. MODEL info

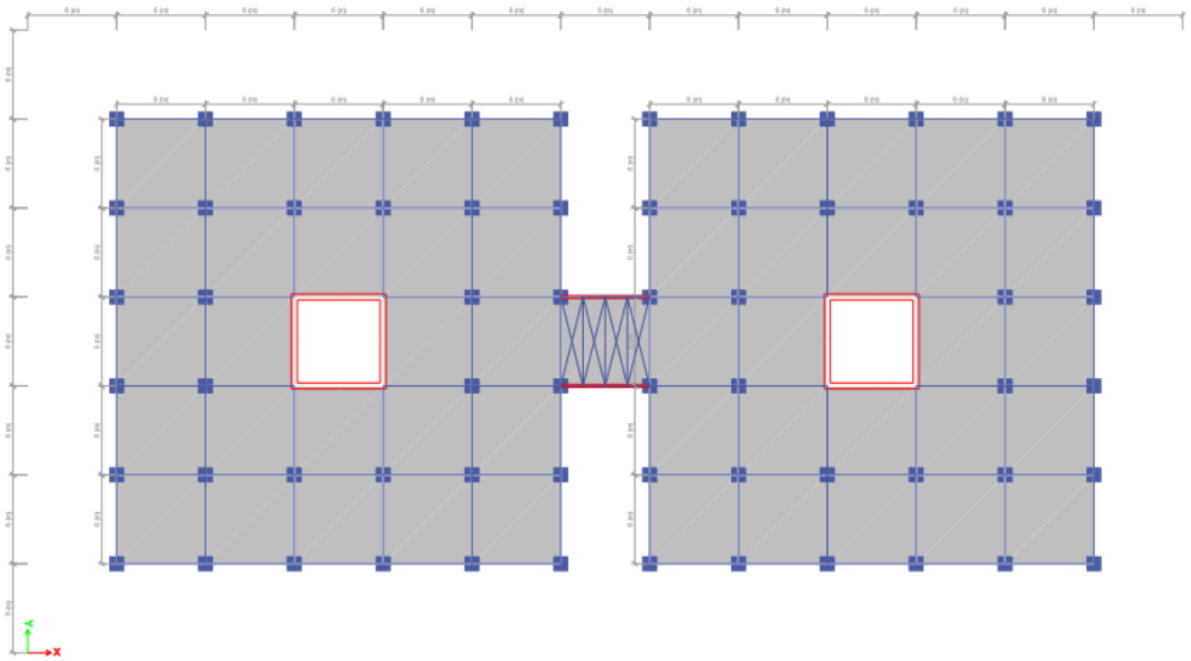


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Fig 4: twin tower 2d

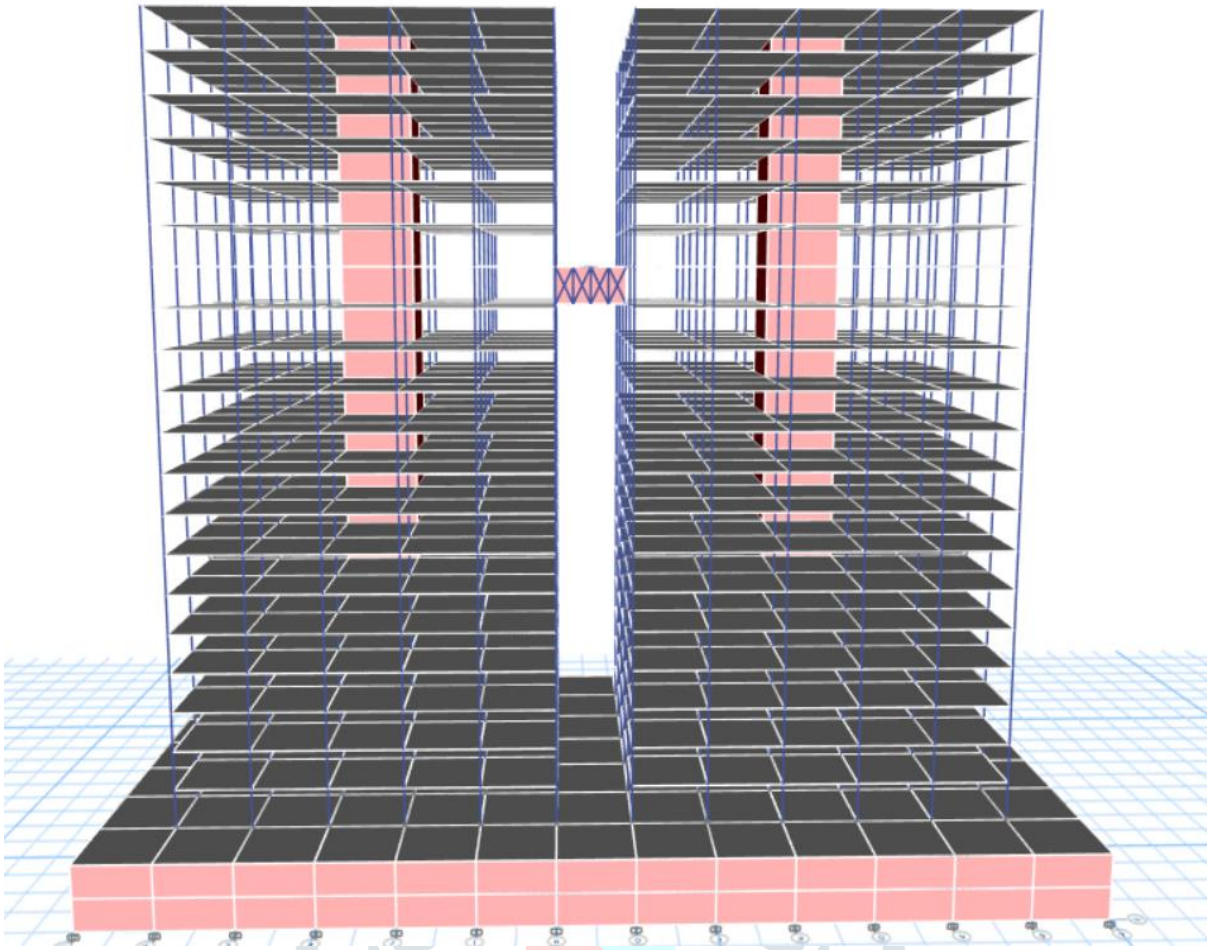


Fig 5: 3d model

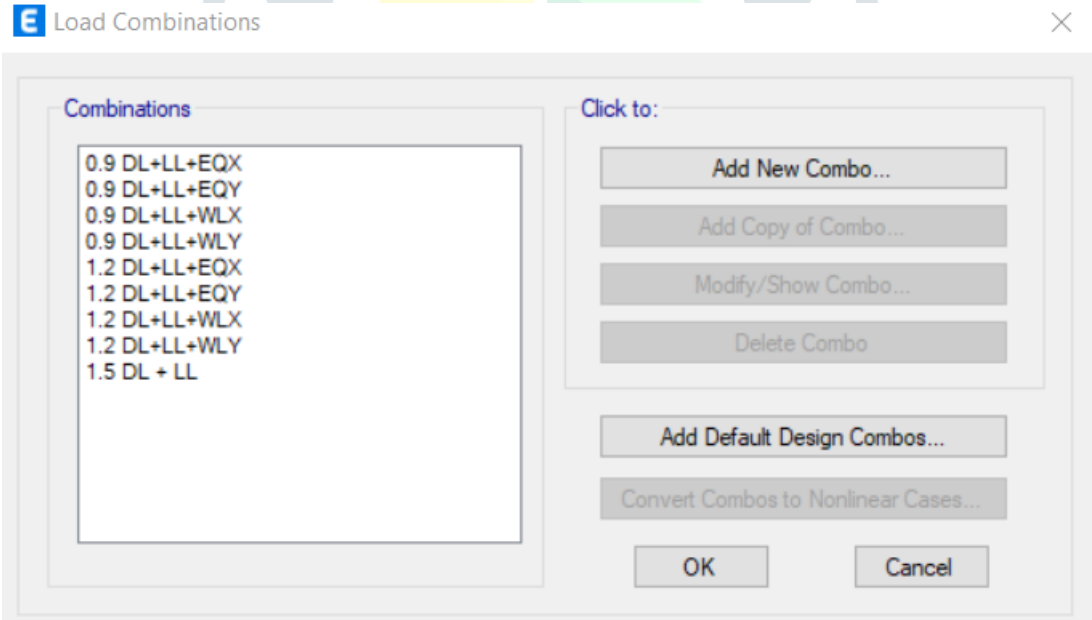
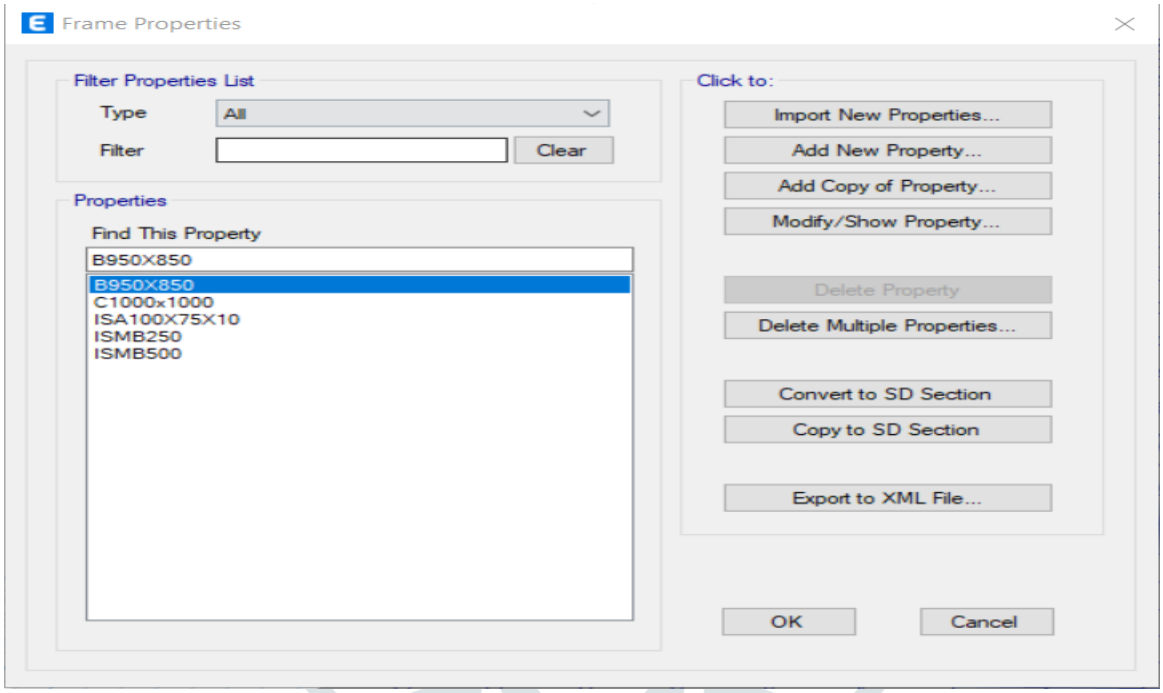
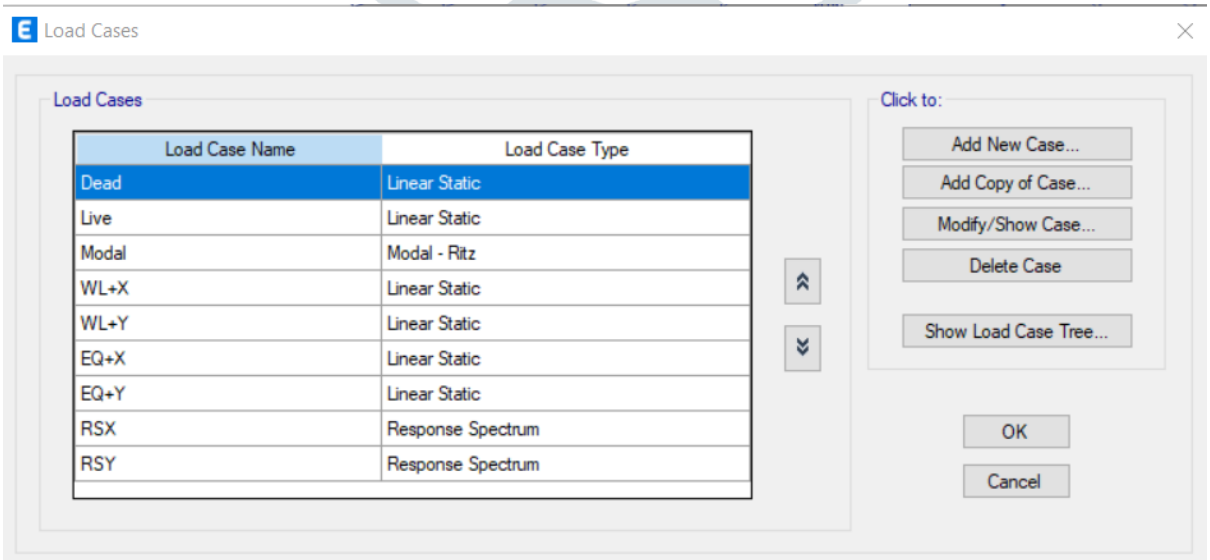


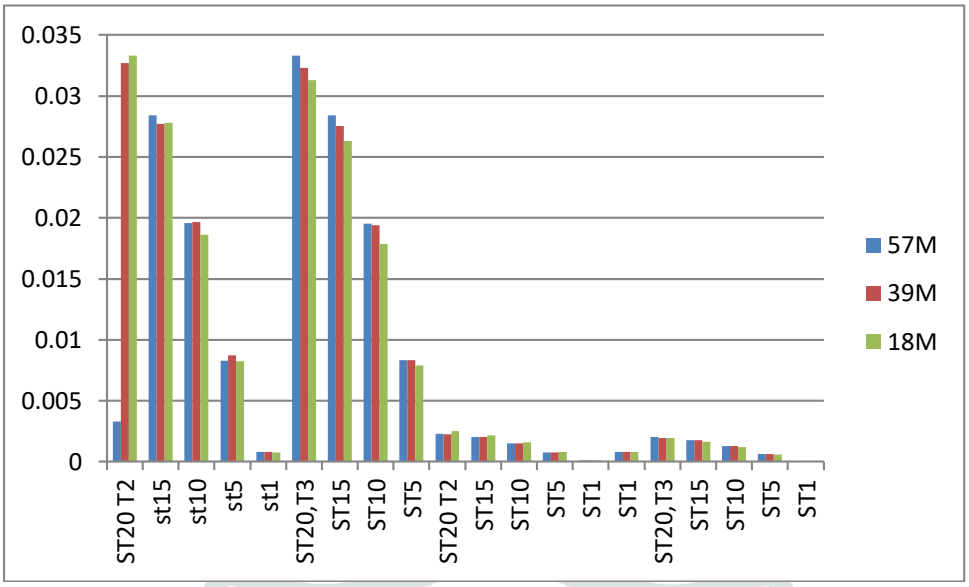
Fig 6 : load combination

DATA	T2	T3
Plan	30 X 30	30X30
Storey Height	3M	3M
Beam Size	950X850	950X850
Column Size	1000x1000	1000x1000
Floor Load	1.2 kN/m2	
Live load	4 kn/m2	
Earthquake zone	Zone 3, Soil Type Medium ,importance factor=1.2, Response Reduction Factor =3, Seismic Zone Factor =0.16	
Slab	200MM	
Wall	400MM	
Passageway Beam	ISMB250 & ISMB 500	
Passageway Column	ISA 100 X 75 X 10	



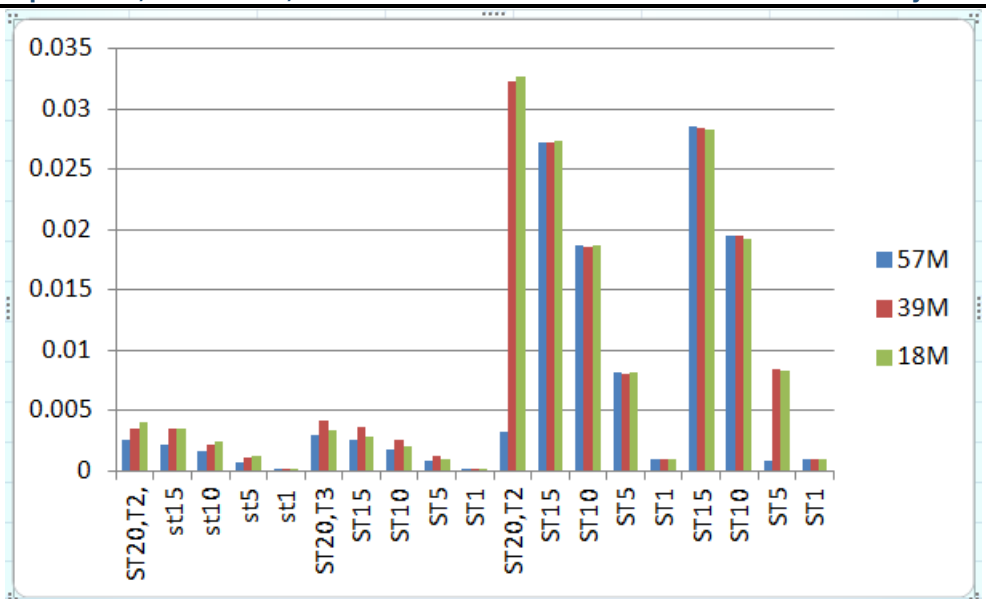


MAX STOREY DISPLACEMENT (M)



GRAPH 1:MAX.DISPLACEMENT T2,T3 , X DIR

	STOREY	57M	39M	18M
	ST20 T2	0.003305	0.032701	0.033324
T2,RSX	st15	0.028429	0.027725	0.027789
	st10	0.019563	0.019661	0.018627
	st5	0.008297	0.008715	0.008252
	st1	0.000814	0.000809	0.000784
	ST20,T3	0.033332	0.032307	0.031312
	ST15	0.02841	0.027543	0.02631
T3,RSX	ST10	0.019547	0.019401	0.017871
	ST5	0.008333	0.00833	0.007876
	ST1	0.000818	0.000824	0.000809
	ST20 T2	0.002294	0.002264	0.002512
	ST15	0.002049	0.002019	0.002171
T2,RSY	ST10	0.001516	0.001497	0.001595
	ST5	0.000752	0.00078	0.000819
	ST1	0.000095	0.000092	0.000098
	ST20,T3	0.00203	0.001964	0.001929
	ST15	0.001773	0.001787	0.001654
	ST10	0.001289	0.001311	0.001197
T3,RSY	ST5	0.00065	0.000652	0.000588
	ST1	0.000083	0.000084	0.000079



GRAPH 2:MAX.DISPLACEMENT T2,T3 , Y DIR

	STOREY	57M	39M	18M
T2,RSX	ST20 T2	0.003305	0.032701	0.033324
	st15	0.028429	0.027725	0.027789
	st10	0.019563	0.019661	0.018627
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T3,RSX	ST20,T3	0.033332	0.032307	0.031312
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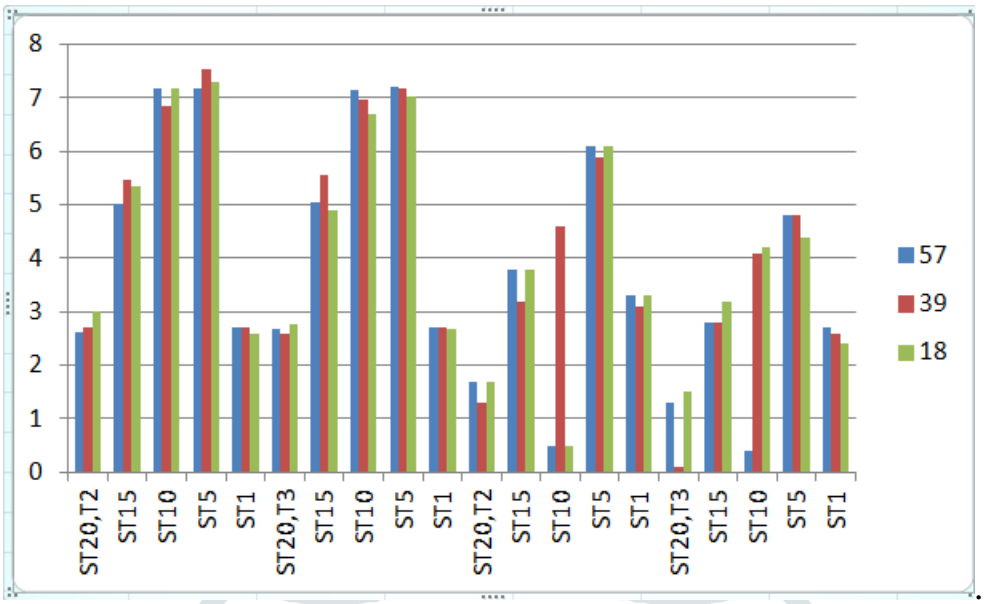
T2,RSY	ST20 T2	0.002294	0.002264	0.002512
	ST15	0.002049	0.002019	0.002171
	ST10	0.001516	0.001497	0.001595
	ST5	0.000752	0.00078	0.000819
	ST1	0.000095	0.000092	0.000098
T3,RSY	ST20,T3	0.00203	0.001964	0.001929
	ST15	0.001773	0.001787	0.001654
	ST10	0.001289	0.001311	0.001197
	ST5	0.00065	0.000652	0.000588
	ST1	0.000083	0.000084	0.000079

MAX. STOREY DRIFT (M)



GRAPH 3: MAX.STOREY DRIFT,X-DIR,T2-T3

STOREY	57	39	18	
ST20,T2	2.61	2.71	3.02	
ST15	5.03	5.48	5.34	T2 X-DIR
ST10	7.18	6.86	7.17	RSX
ST5	7.18	7.53	7.3	
ST1	2.71	2.7	2.58	
ST20,T3	2.69	2.6	2.76	
ST15	5.06	5.57	4.89	T3 X-DIR RSX
ST10	7.14	6.96	6.69	
ST5	7.21	7.19	7.03	
ST1	2.7	2.71	2.68	
ST20,T2	1.7	1.3	1.7	T2 X-DIR
ST15	3.8	3.2	3.8	RSY
ST10	0.5	4.6	0.5	
ST5	6.1	5.9	6.1	
ST1	3.3	3.1	3.3	
ST20,T3	1.3	0.1	1.5	T3 X-DIR
ST15	2.8	2.8	3.2	RSY
ST10	0.4	4.1	4.2	
ST5	4.8	4.8	4.4	
ST1	2.7	2.6	2.4	

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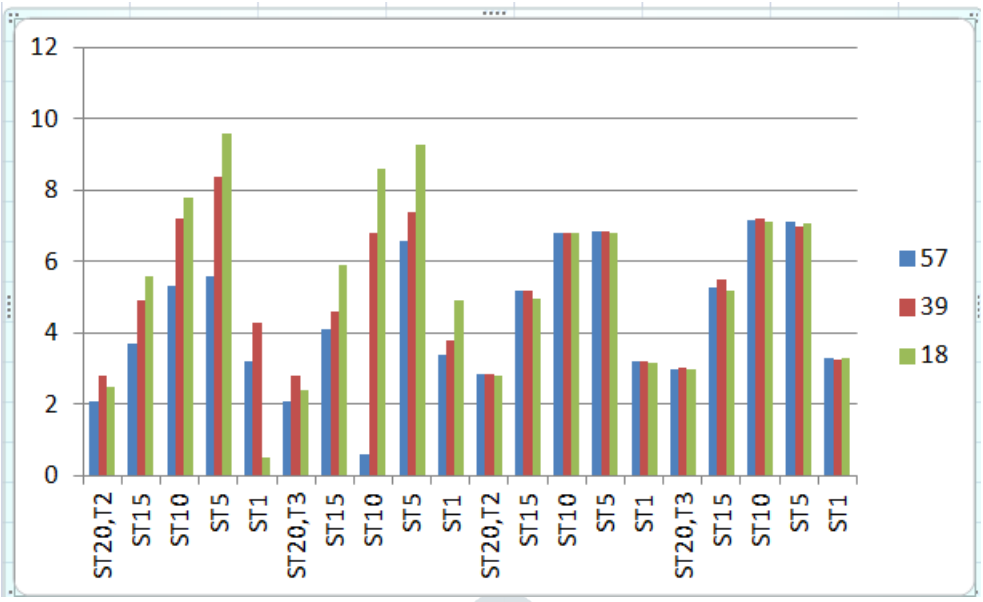
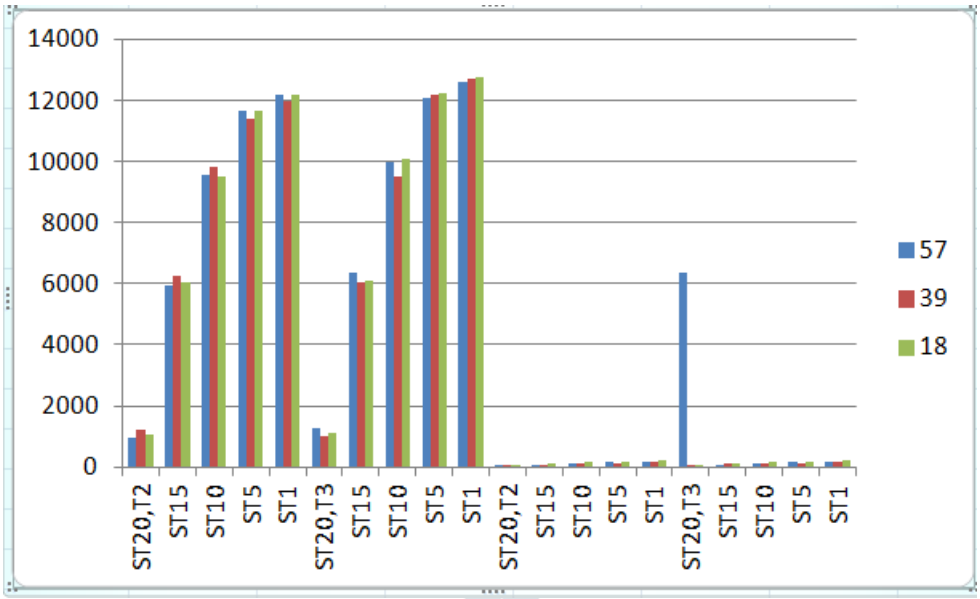


GRAPH 4: MAX STOREY DRIFT ,Y-DIR ,T2-T3

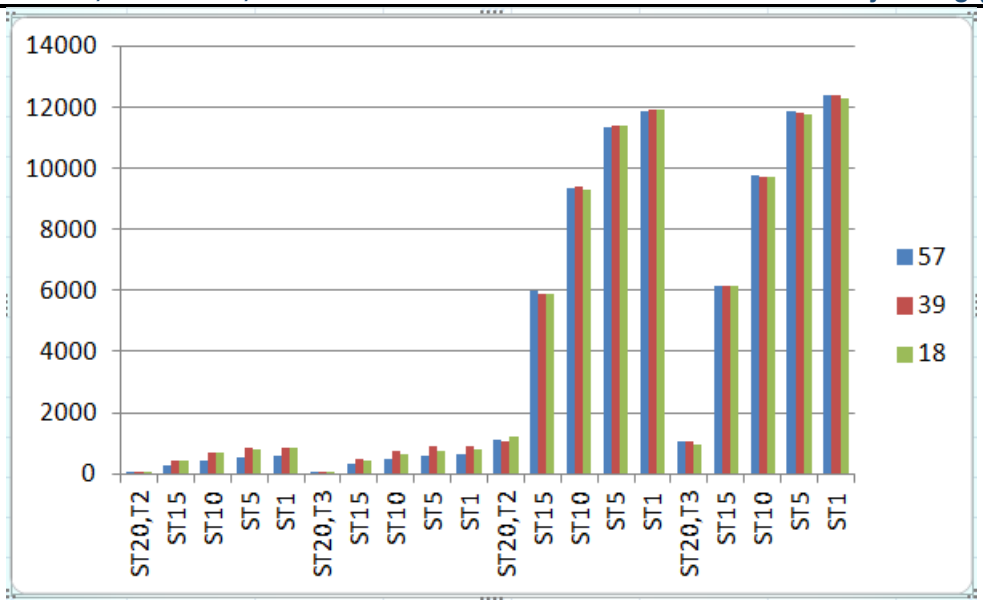
	STOREY	57	39	18
T2,RSX	ST20,T2	2.1	2.8	2.5
	ST15	3.7	4.9	5.6
	ST10	5.3	7.2	7.8
	ST5	5.6	8.4	9.6
	ST1	3.2	4.3	0.5
T3,RSX	ST20,T3	2.1	2.8	2.4
	ST15	4.1	4.6	5.9
	ST10	0.6	6.8	8.6
	ST5	6.6	7.4	9.3
	ST1	3.4	3.8	4.9
T2,RSY	ST20,T2	2.86	2.86	2.8
	ST15	5.18	5.18	4.96
	ST10	6.82	6.82	6.8
	ST5	6.87	6.87	6.8
	ST1	3.2	3.2	3.16
T3,RSY	ST20,T3	2.97	3.01	2.97
	ST15	5.27	5.52	5.19
	ST10	7.15	7.2	7.13
	ST5	7.1	6.99	7.08
	ST1	3.3	3.23	3.29

STOREY SHEAR(KN)



GRAPH 5: STOREY SHEAR, T2-T3, X-DIR

	STOREY	57	39	18
T2,RSX	ST20,T2	937.14	1221.82	1071.022
	ST15	5961.3	6241.35	6053.88
	ST10	9571.46	9844.48	9487.32
	ST5	11669.77	11415.94	11650.97
	ST1	12210.78	11970.34	12202.26
T3,RSX	ST20,T3	1272.46	983.93	1086.23
	ST15	6380.58	6024.16	6116.52
	ST10	9975.098	9530.85	10075.39
	ST5	12077.88	12169.3	12226.54
	ST1	12621.05	12726.3	12770.99
T2,RSY	ST20,T2	53.45	19.9	17.5784
	ST15	81.39	76.28	98.48
	ST10	124.72	109.09	154.77
	ST5	152.88	137.89	188.48
	ST1	183.15	178.1	199.38
T3,RSY	ST20,T3	6362.08	22.2611	17.38
	ST15	73.75	90.66	98.4
	ST10	116.38	137.18	151.83
	ST5	145.24	129.311	184.01
	ST1	176.26	169.92	193.07



GRAPH 6: STOREY SHEAR, T2-T3, Y-DIR

STOREY	57	39	18	
ST20,T2	23.2604	70.913	68.4707	
ST15	292.737	419.84	424.46	T2,RSX
ST10	445.15	692.3	678.48	
ST5	538.713	834.93	816.24	
ST1	570.246	867.77	854.33	
ST20,T3	25.29	77	70.18	
ST15	317.012	458.79	418.31	T3,RSX
ST10	492.81	730.168	663.7	
ST5	600.22	886.25	755.93	
ST1	633.88	923.55	793.88	
ST20,T2	1119.175	1049.32	1198.13	
ST15	5974.84	5899.01	5874.64	
ST10	9369.61	9393.01	9292.09	T2,RSY
ST5	11357.62	11405.56	11396.97	
ST1	11897.13	11942.21	11934.9	
ST20,T3	1074.49	1049.32	955.375	
ST15	6152.99	6157.99	6143.21	
ST10	9752.33	9741.08	9728.13	T3RSY
ST5	11860.62	11847.61	11755.59	
ST1	12421.33	12413.43	12318.38	

V. Results

Tower&Dir	Storey
T3(RSX),X-DIR	ST20(57M)
T2(RSY),Y-DIR	ST20(18M)

Tower&Dir	Storey
T2(RSX),X-DIR	ST5(18M)
T2(RSX),Y-DIR	ST5(18M)

Tower&Dir	Storey
T3(RSX)X-DIR	ST1(18M)
T3(RSY),Y-DIR	ST1(57M)

CONCLUSION

- The Max.Dispalcement happening between towers **T3 AT X-DIR** of **STOREY 20** OF METER **0.033332.**
- At that time Passage way of **57m** height are leads to working extreme.
  And at Y-DIR OF T2 is getting displaced **0.032605** at storey **20** and passageway of **(18m).**
- And after studied about the analysis its getting that for less **storey shear** safe peak for earthquake is **39m** passageway for better result.
- For **lesser storey drift** medium readings said us about level of what passageway is safe is **57m** passage way.
- For less **maximum displacement** the passageway of **18m** is safe for the twin tower type structure as per the analysis.
- The twin tower could be the biggest evolution in construction sector now days.

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