STUDY BEHAVIOUR OF MUTISTOREY BUILDING WITH AND WITHOUT SHEAR WALL AND DAMPERS USING DIFFERENT TYPES OF SOIL IN SEISMIC ZONE V

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Abstract: The late history of earthquakes has shown that if the structures don't look to be properly designed and prepared with needed quality might cause nice injury to social systems. This accuracy has resulted in to make sure safety against earthquake forces of tall structures, thus, thereought to verify unstable responses of such building for planning earthquake resistant structures by carrying unstable analysis of social organization. In the present work dynamic analysis of G+17 RC multi-storied framed building considering Bhuj earthquake is disbursed by Equivalent Static methodology and Time history analysis and responses of such construction are relatively considered with the assistance of ETABS software package. The analysis is computed by using the code IS 1893-2002. These analyses are disbursed by considering fifth seismic zone and for this zone and hence the conduct is assessed by taking 3differing types of soils particularly hard, Medium and Soft. Shear wall at different posts are set to evaluate the conduct. Dampers are used to encourage the energy waste within the structure that they're put in in order that the social system requires to resist lease giver quantity of earthquake forces. The parameters like Base shear, Story drift and most high displacement area unit compared. From the results, it's counseled that time history analysis ought to be performed because it predicts the structural response additional accurately than the Equivalent Static Method.

Key Words: Regular plan G+17 storey regular building, Equivalent static analysis, IS 1893:2002 part 1, Time History Analysis, provisions, Etabs software package, shear wall, dampers.

1.1 INTRODUCTION

The process of urbanization has been a typical feature throughout the centuries, globalization and Growth of high rise buildings are that they would like of current population; earthquakes have the capacity for causing the best damages to these high rise constructions. Hence, it's critical to require into account the unstable load for the planning of high-rise structures. Earthquakes occurred in the recent past, notably inside the province of Gujarat (Bhuj, 2001) have shown that if the structures aren't properly designed and created with needed quality could cause nice injury to social systems and additionally loss of spirit. Reinforced concrete buildings are destructed on an awfully giant scale in the Bhuj earthquake of Jan twenty sixth 2001, albeit these buildings are analyzed and designed as per IS code. The damages are caused by the inconsistent unstable response, irregularity in mass and set up, soft construction and floating column etc. Hence it becomes needed to be done to test out the actual unstable performance of building subjected to seismic forces. Time history analysis offers a set of realistic behavior of the construction. It proposes a great deal of accurate seismic responses than response qualitative analysis due to it includes material nonlinearity and dynamic nature of earthquakes.

The seismic movement of the ground causes the building to quake and causes structural malformation within the building. Completely different parameters relating to this deformity like frequency of vibration, time period and amplitude are of great importance and defines the general response of the societal organization. This overall response conjointly depends on the dispersion of seismic forces at intervals the structure that once more depends on the strategy that is used to calculate this distribution. Completely different ways of three-dimensional dynamic analysis of structures became more effective in use together with the issue of engineering science. Earthquake is generated by prominent unleash of energy in the earth’s crust that makes seismic waves. In nature, earthquake forces are accidental & unsure natural hazards. AN engineer needs the tools for analyzing structures beneath the resolution of those kinds of powers. Earthquake masses are modeled to assess the natural process of the structure with a transparent understanding that risk is to be expected however it ought to be determined. In this paper an analytical study is made to search out response of standard structures by static and dynamic methodology. The work contains the equivalent static and dynamic analysis (i.e) Time History Analysis of G+17 storey regular building in Etabs software package. For time history analysis, seismic ground motion record Bhuj located in zone V near considered to evaluate reaction of the constructions. For analyzing seismic behavior of structures, mathematical model of the structures is needed to go out; the parameter is a time period, maximum displacement, structure drift and base shear in kN characteristics in numerous elements of the construction. Behaviors of structures were found by comparing the results with different types of soil. Shear Wall and Dampers are applied to assess the behavior of the structure.

1.2 OBJECTIVES OF STUDY

The objectives of current study are as listed/follows below:

- To analyze a multistoried RC framed building (17 Storey) for available earthquake time histories considering Zone V using different types of soil

- To compare the unstable behavior of high-rise building for various earthquake intensities in terms of assorted answers like, base shear and displacements and story drifts.
- Analyzing the implications from completely different ways of research.
- To compare the impact of Bhuj earthquake on the performance of the RCC multistoried building by Equivalent Static technique and Time history technique
- To analyze the RCC high-rise building for unstable forces.
- To Calculate Variance in Base Shear in numerous forms of Soil
- To Calculate Variance in story Drift, story Displacement in numerous forms of Soil
- To discover out that technique is economical.
- To recover out the result once the shear wall is applied to RC building and also the variation caused by it.
- To find out effects caused by the damper once applied to the structure.
- Dynamic responses under Bhuj earthquake are looked into.

1.3 METHOD OF ANALYSIS OF STRUCTURE:

As mentioned in Indian St&ard Code 1893:2002 after technique for examination have been prescribed to discover the plan sidelong loads,

a. Equivalent Static Analysis (ESA)
b. Time History Analysis (THA)

1.3.1 MODELING METHOD:

Model 1: consists of the bare frame with brick walls.
Model 2: consists of bare frame, brick walls, Shear wall at the ends of each corner.
Model 3: consists of bare frame, brick walls, shear walls as core wall, i.e. at the center and Dampers at corners
Model 4: consists of bare frame, brick walls, and dampers.
Model 5: consists of the bare frame with brick walls.
Model 6: consists of bare frame, brick walls, Shear wall at the ends of each corner.
Model 7: consists of bare frame, brick walls, and shear walls as core wall, i.e. at the center and Dampers at corners.
Model 8: consists of bare frame, brick walls, and dampers.
Model 9: consists of the bare frame with brick walls.
Model 10: consists of bare frame, brick walls, Shear wall at the ends of each corner.
Model 11: consists of bare frame, brick walls, and shear walls as core wall, i.e. at the center and Dampers at corners.
Model 12: consists of bare frame, brick walls, and dampers.

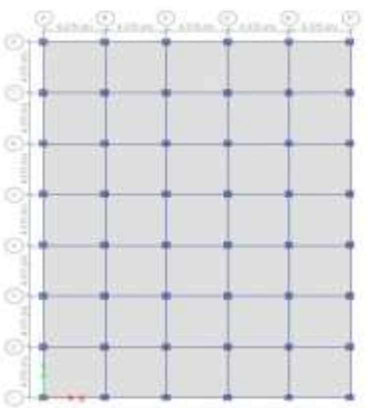
1.3.2 METHODOLOGY:

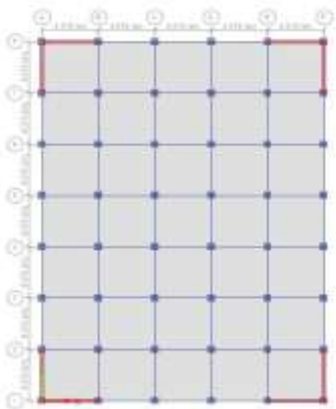
In this present work the time history analysis is taken into account for RCC structure. This is the G+17 construction business building having 3.6m height of every floor and 66.8m from the bottom level basement for the parking purpose to the seventeenth floor. There's one ground motion earthquake information i.e. Bhuj 2001 were utilized and results are compared to differing kinds of soils with or without the assessment of shear wall and dampers.

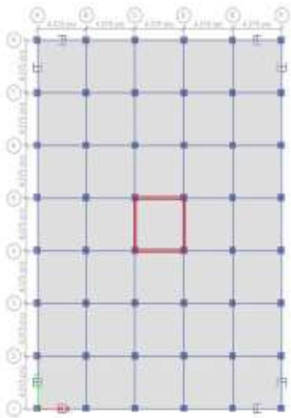
2. MODELING AND ANALYSIS:

The buildings that are required for the analysis are sculptured in Etabs software. For the current work, G+ 17 levels building with floor height 3.6 m is taken. The building holds five bays of 4.375 m in X and 7bays of 4.375m in Y directions. For buildings the modeling has been managed in keeping with IS code.

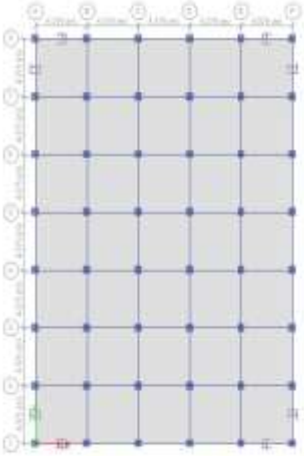
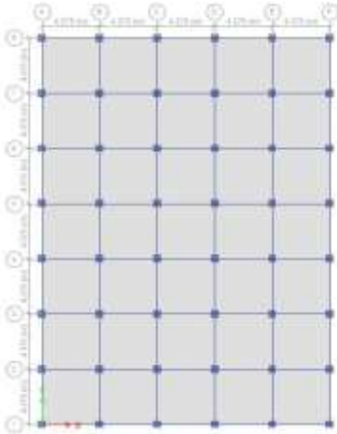
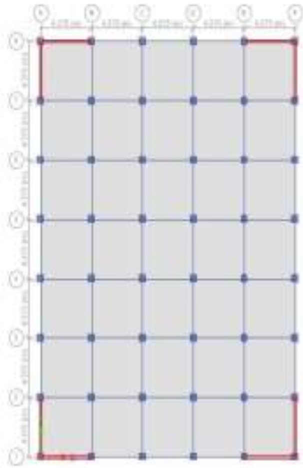
3.1 DESCRIPTION OF SAMPLE BUILDING



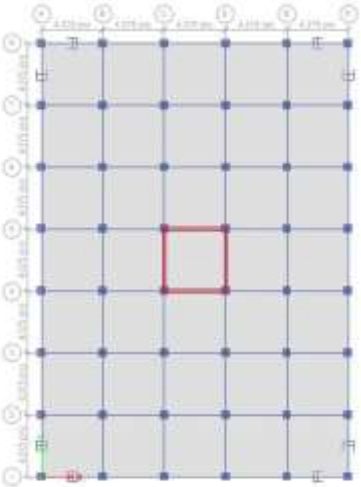
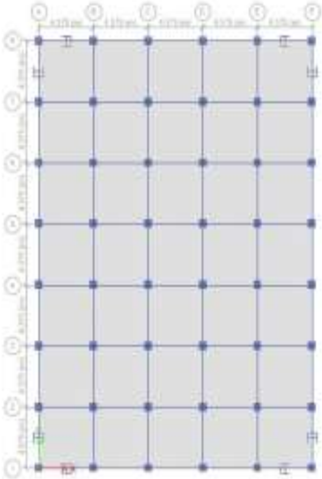
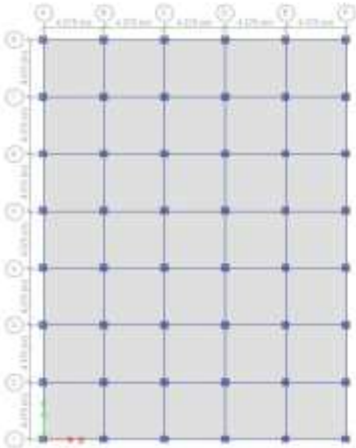




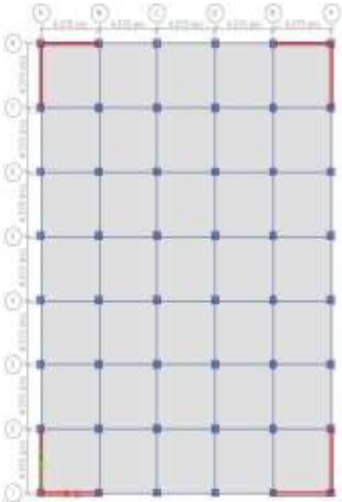
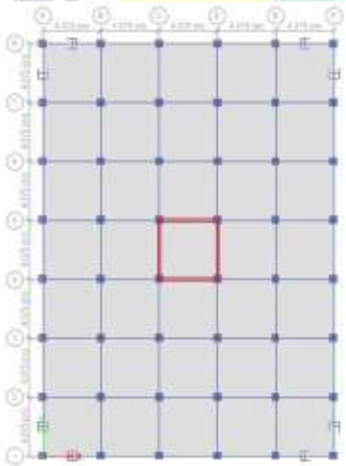
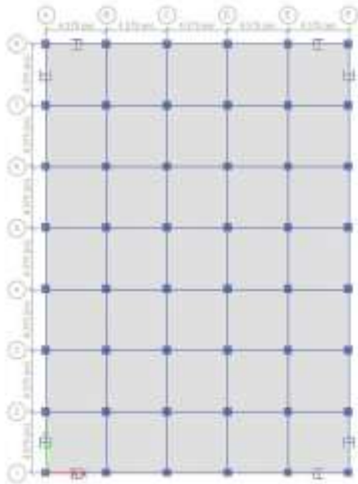
Model 1: **Model 2**: **Model 3**:

Model 4: **Model 5**: **Model 6**:

Model 7: **Model 8**: **Model 9:**

Model 10: **Model 11:** **Model 12**:

MODELING PARAMETERS:

GEOMETRICAL DETAILS:		
STOREY HEIGHT	=	3.6 m
DEPTH OF THE FOUNDATION BELOW GROUND	=	2 m
COLUMN SIZE	=	600X600mm
NO. OF STORIES	=	G+17 plus Basement
WALLS	=	230 mm thick brick wall
SLAB THICKNESS	=	150 mm in RCC
THICKNESS OF SHEAR WALL	=	200mm in RCC
BEAM SIZE	=	450X600mm
MATERIAL PROPERTIES:		
GRADE OF CONCRETE	=	M30 IN ALL CASE
GRADE OF STEEL	=	Fe500 (HYSD Bars)
YOUNGS MODULUS FOR M30 GRADE	=	30X10^6 KN/M^2
DENSITY OF REINFORCED CONCRETE	=	25 KN/M^2
POISSONS RATIO OF CONCRETE	=	0.2
DENSITY OF BRICK MASONRY	=	18 KN/M^2
POISSONS RATIO OF MASONRY	=	0.3

LOADING: -		
DEAD LOAD.	=	SELF WEIGHT.
FLOOR FINISH	=	1.5 kN/m^2 .
LIVE LOAD	=	3 kN/m^2
EARTHQUAKE LOAD	=	AS PER IS1893 (P
MASONARY WALL	=	12.41 KN/m
PARAPET WALL	=	3.14 KN/m
SEISMIC DEFINITION: -		
ZONE FACTOR ‘Z’	=	0.36 FOR ZONE V
IMPORTANCE FACTOR ‘I’	=	1
RESPONSE REDUCTION FACTOR ‘R’	=	5
SOIL TYPE	=	HARD SOIL,MEI LOOSE SOIL.

4. RESULTS & DISCUSSIONS

4.1 GENERAL

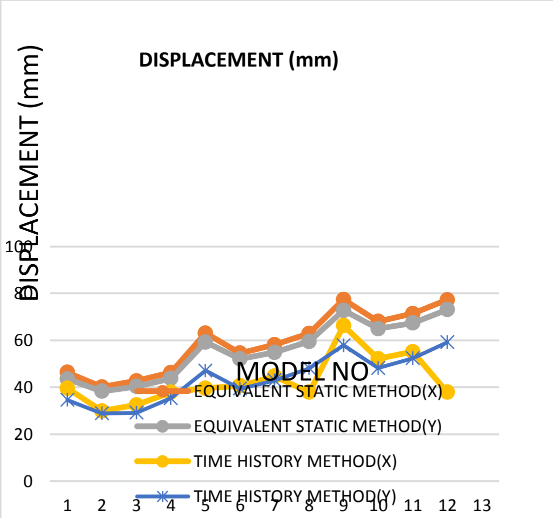
In this chapter, the results of analytical building models studied are presented & discussed. The results are included for building models & the response results are computed using the equivalnt static & Time History Analysis. The analyses of models are achieved through ETABS analysis package.

The results of, lateral displacements, storey drifts & base shear for the distinctive building models for each of above analyses are presented & compared.

- **STORY DISPLACEMENTS**

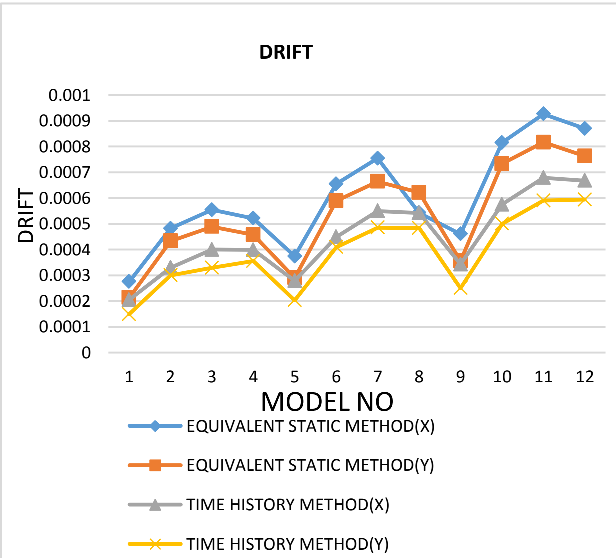
DISPLACEMENT				
	EQUIVALENT STATIC METHOD		TIME HISTORY METHOD	
MODEL NO	EQX	EQY	THX	THY
1	46.367	43.587	39.592	34.584
2	40.112	38.278	29.867	28.899
3	42.761	40.36	32.516	29.143
4	46.293	43.79	37.919	35.366
5	63.059	59.279	39.592	47.114
6	54.549	52.07	40.626	39.391
7	58.144	54.879	44.746	42.972
8	62.959	59.554	37.919	48.157

9	77.433	72.791	66.287	57.89
10	68.099	64.983	52.184	48.18
11	71.411	67.402	55.187	52.358
12	77.31	73.129	37.919	59.193



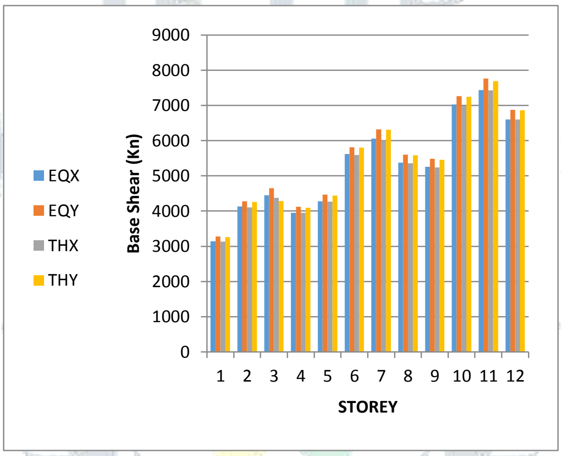
- **STORY DRIFT**

DRIFT				
	EQUIVALENT STATIC METHOD		TIME HISTORY METHOD	
MODEL NO	EQX	EQY	THX	THY
1	0.000275	0.000213	0.000205	0.000149
2	0.000482	0.000433	0.00033	0.0003
3	0.000554	0.000489	0.0004	0.000329
4	0.000521	0.000457	0.000399	0.000355
5	0.000374	0.00029	0.000279	0.000203
6	0.000655	0.000589	0.000449	0.000409
7	0.000754	0.000664	0.00055	0.000485
8	0.000542	0.000621	0.000542	0.000483
9	0.00046	0.000356	0.000343	0.00025
10	0.000815	0.000733	0.000575	0.0005
11	0.000926	0.000816	0.000679	0.00059
12	0.00087	0.000763	0.000668	0.000594



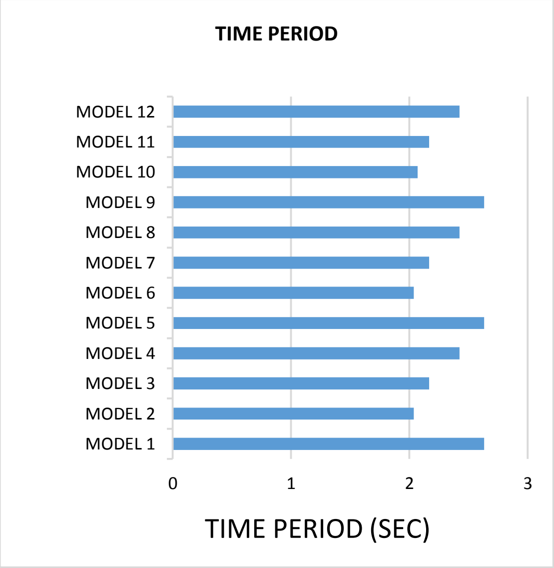
- **BASE SHEAR**

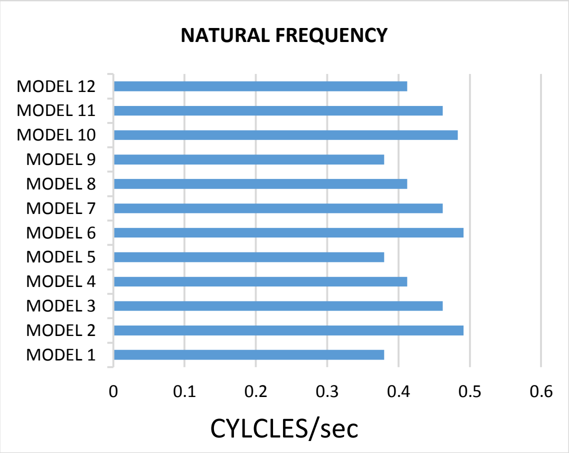
BASE SHEAR				
	EQUIVALENT STATIC METHOD		TIME HISTORY METHOD	
MODEL NO	EQX(KN)	EQY(KN)	THX(KN)	THY(KN)
1	3145.88	3281.2	3132.04	3261.36
2	4131.09	4274.39	4105.01	4259.28
3	4453.18	4646.52	4373.68	4281.67
4	3951.52	4118.06	3953.5	4098.74
5	4278.4	4462.43	4269.6	4443.01
6	5618.37	5813.25	5589.75	5801.98
7	6055.1	6317.99	6017.91	6313.49
8	5374.61	5600.48	5359.313	5581.26
9	5253.63	5479.6	5242.13	5459.23
10	7023.06	7266.34	6991.02	7243.02
11	7436.81	7759.69	7423.02	7693.14
12	6599.71	6877.07	6597.02	6860.35



TIME PERIOD	
MODEL NO.	TIME
MODEL 1	2.633
MODEL 2	2.038
MODEL 3	2.167
MODEL 4	2.424
MODEL 5	2.633
MODEL 6	2.038
MODEL 7	2.167
MODEL 8	2.424
MODEL 9	2.633
MODEL 10	2.069
MODEL 11	2.167
MODEL 12	2.424

NATURAL FREQUENCY	
MODEL NO.	TIME
MODEL 1	0.38
MODEL 2	0.491
MODEL 3	0.462
MODEL 4	0.412
MODEL 5	0.38
MODEL 6	0.491
MODEL 7	0.462
MODEL 8	0.412
MODEL 9	0.38
MODEL 10	0.483
MODEL 11	0.462
MODEL 12	0.412





5.CONCLUSIONS

a. The displacement values can rely on the frequency of earthquake and therefore the natural frequency of the structure and the building with the short period of time tends to suffer higher accelerations however smaller displacement.
b. As Time History is realistic technique, used for seismic analysis, it provides a much better check to the protection of structures analyzed and planned by a manner outlined by IS code.
c. It is ended, that displacement will increase from light to medium to hard variety of soils for Building without shear wall and dampers.
d. It is ended, that drift will increase from light to medium to hard variety of soils for Building without shear wall and dampers.
e. The value of base shear comparatively more in hard soil, compare with soft and medium soil type.
f. As the building height increases Lateral displacements and drift increases.
g. By Comparing to other case model 1 (Bare Frame) gives much more lateral drifts displacements and.
h. The drift & Lateral displacements are considerably scaled down after using shear wall.
i. One of the important conclusions that can be drawn from the above study is that as the soil changes from heavy to soft there is massive growth in base shear, lateral displacements and lateral movements. Utmost caution should be carried in soft ground.
j. Time Period increases as the height of the building increases because the intensity of the overall building increases as the time point is immediately proportional to the book.
k. Base Shear is decreased as the time period increases.
l. The time period is significantly brought down after placing shear walls.

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