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Seismic Analysis of Different Shape of RC Building by Using the Viscous Damper

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Abstract - *In this research paper we did comparative study on the different shape of the RC building by using the viscous or fluid viscous damper. There are three model in this paper in which first, second and third model is H, T and L shape respectively. These models are analyzed with the help of the Etabs software by using IS Code 1893 part-1 2016. In this paper we taken some seismic parameter for comparative among the models such as base shear (lateral forces at the storey due to seismic), natural time period, storey stiffness, storey drift, storey overturning moment and storey displacement. The material and geometrical property of all models are same such as dimension of the beam, column and slab. We considered the seismic zone in the fourth zone. All models are analyzed by the dynamic analysis with the help of the time history method and data of the time history is taken from "ELCENTRO" this data represent the graph of the acceleration vs. time of the earthquake e in the Mexico.*

***Key Words*:** Time history, viscous damper, Etabs, RC building, Different shape, horizontal irregularities

1.INTRODUCTION

Nowadays construction of the high rise building is in progress in every country, but high rise building is not safe due to effect of the dynamic force such as seismic force and wind force. The wave which release due to settlement of the tectonic plate inside the earth surface and it create the shaking of the building due to which building can get collapse, to prevent from collapse of the building due to earthquake we provide the different type of the damper which increase the time period of the vibration due to which frequency of the wave decrease. In this paper we choose the viscous damper to decrease the frequency of the earthquake.

1.1 Viscous Damper

Viscous damper is defined as the hydraulic device which dissipates the kinetic energy of the earthquake which acts at the building. The principle of the viscous damper (fluid viscous damper) is based on the hydraulic device which increase the time period of the seismic force which acting at the structure. The figure of the viscous damper is given below:

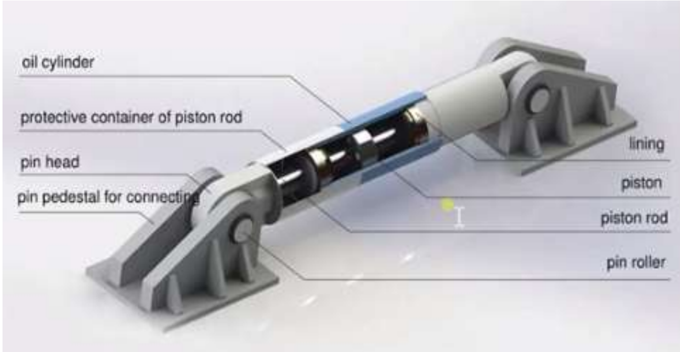

Fig -1: Fluid Viscous Damper

In the following figure, the parameter of the fluid viscous damper is given below and we taken the fluid viscous damper whose force is 500KN and mass is 98Kg in the model:

FVD with Different Capacities Force(kN).

FORCE (kN)	TAYLOR DEVICES MODEL NUMBER	SPHERICAL BEARING BORE DIAMETER (mm)	MID-STROKE LENGTH (mm)	STROKE (mm)	CLEVIS THICKNESS (mm)	MAXIMUM CLEVIS WIDTH (mm)	CLEVIS DEPTH (mm)	BEARING THICKNESS (mm)	MAXIMUM CYLINDER DIAMETER (mm)	WEIGHT (kg)
250	17120	38.10	787	±75	43	100	83	33	114	44
500	17130	50.80	997	±100	55	127	102	44	150	98
750	17140	57.15	1016	±100	59	155	129	50	184	168
1000	17150	69.85	1048	±100	71	185	150	61	210	254
1500	17160	76.20	1105	±100	77	205	162	67	241	306
2000	17170	88.90	1346	±125	91	230	191	78	286	500
3000	17180	101.60	1441	±125	117	290	203	89	350	800
4000	17190	127.00	1645	±125	142	325	273	111	425	1088
6500	17200	152.40	1752	±125	154	350	305	121	515	1930
8000	17210	177.80	1867	±125	178	415	317	135	565	2625

Fig -2: Property of Fluid Viscous Damper

1.2 Horizontal irregularities

According to the IS Code 1893 part-1 2016, from clause 7.1, irregularities configuration is given in different condition such as "Torsional irregularities, and re-entrant corner. All models in this paper are comes under the horizontal (plan) irregularities, where the re-entrant corner are present in every model.

2. Methodology

In this paper, we used the time history method for the analysis of all model by using the Etabs software, also the vertical load combination according to the IS code 1893 part-1: 2016 from clause number 6.3.4.1.

2.1 Dynamic Analysis Method

This method is also known as the Time history method, and this method is used when the variation of the forces with respect to the time was high .and in this method we provided the data of time history "ELCENTRO", The 1940 "*ELCENTRO"* earthquake Southern California near the international border of the United States and Mexico and the magnitude was 6.9.

2.2 Property of Fluid Viscous Damper

The viscous damper which is used in this model to decrease the storey displacement and some other seismic parameter which act on the structure is given below in the form of the table:

Table -1: Parameter of FVD

Force (KN)	Taylor Device model number	Maximum cylinder Diameter (mm)	Weight (Kg)
500	17120	114	44

3. DETAILS OF MODEL

In the model details, we will give and discussion the parameter of the building, seismic parameter, load and material parameter.

3.1 Material Parameter

In this parameter we give the details about the material which is used in the building and material parameter is given below in table:

Table -2: Material Parameter

S. No	Material	Grade
01.	Concrete	M30
02.	HYSD Steel	Fe415
03.	Mild Steel	Fe250

3.2 Building Parameter

In this parameter, we give the details about building parameter such as size of beam, column and slab is given below in table:

Table -3: Building Parameter

S.No	Building Parameter	Value
01.	Beam	300mm 450mm
02.	Column	350mm 500mm
03.	Slab	150mm
04.	Span of Beam	3.5 m
05.	Height of building	48.5m
06.	Floor height	3m
07.	Ground storey	3.5m

3.3 Seismic Parameter

In this parameter, we given the parameter of the seismic where the model is assumed to construct such as seismic zone factor, Importance factor, etc

Table -4: Seismic Parameter

S.No	Seismic Parameter	Value
01.	Seismic Zone Factor (Z)	0.24 (Forth Zone)
02.	Response Reduction Factor (R)	5
03.	Importance factor (I)	1.2
04.	Soil type	2nd
05.	Eccentric ratio	5%

3.4 Load Parameter

The load which is acting on the structure such as Imposed load, Seismic load, etc is given in table:

Table -5: Load Parameter

S.No	Load Parameter	Value
01.	Live load	$3KN/m^2$
02.	Partition wall	7KN/m
03.	Load distribution wall	14KN/m

3.5 Plan, Elevation and 3D of Model-01

The plan, elevation and three dimensional view of the model-01 are given below:

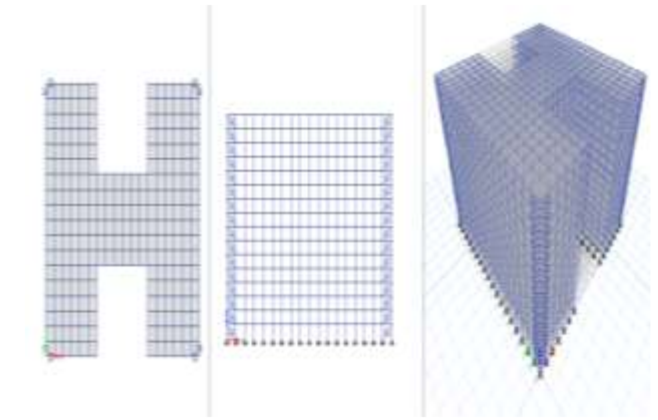

Fig -3: Plan, Elevation and 3D view of Model-01

3.6 Plan, Elevation and 3D of Model-02

The plan, elevation and three dimensional view of the model-02 are given below:

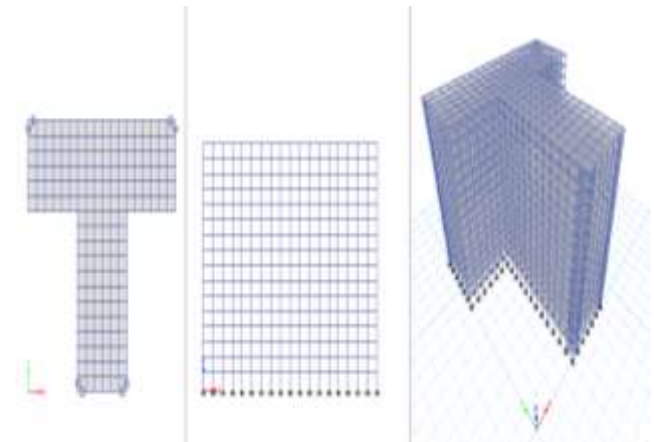

Fig -4: Plan, Elevation and 3D view of Model-02

3.7 Plan, Elevation and 3D of Model-03

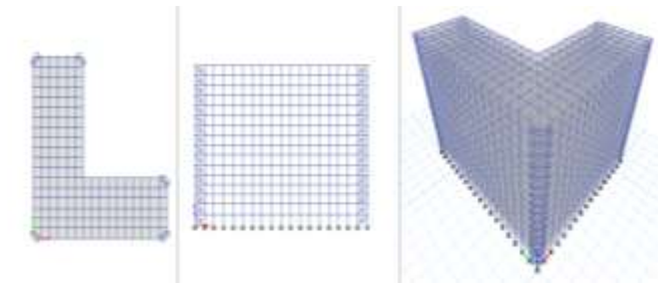

Fig -5: Plan, Elevation and 3D view of Model-03

4. CALCULATION AND RESULT

In this chapter, we analyze the result which came after analysis of this entire model, we taken some parameter of the seismic such as natural time period, base shear, storey displacement, storey stiffness, storey drift, etc. on the basis of this parameter we will check that which shape of the model is more stable as compare to other two models.

4.1 Natural Time Period

From clause 3.18 from Indian Standard Code 1893 part-1:2016, the natural period in mode of oscillation is defined as time (in sec) taken by structure to complete one rotation of the oscillation in its natural mode of wavering. The following graph represents the variation of the natural time period:

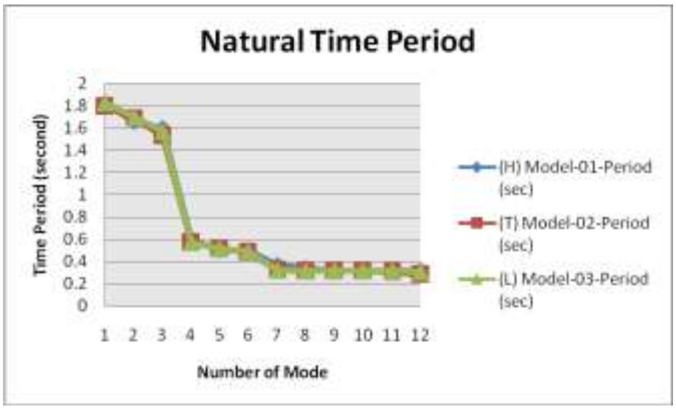

Chart -1: Natural Time Period

With refenrce to the indian Standradrad code 1893 part-1:2016, the natural period of RCC structure should be exist in 0.05 to 2.00 second.

4.2 Base Shear

From the clause 7.2.1, from Indian Standard code 1893 part-1: 2016, the base shear is defined as the lateral forces which act at the every storey due to seismic effect on the structure. The following graph represents the base shear (lateral forces) of all models in X direction due to apply seismic effect in Y direction:

Chart -2: Base Shear Due to EY

From the above graph, we can see that the value of the base shear is maximum in the H shape building.

4.3 Maximum Storey Displacement

It is defined as the displacement of the every storey with respect to the ground which is developed due to the effect of the seismic forces on the structure

The graph of the maximum storey displacement is given below of all models:

Chart -3: Maximum Storey Displacement

From the above graph, we can see that the value of maximum storey displacement in the T shape building.

4.4 Storey Drift

Storey Drift is defined as the relative displacement of the storey with respect to top or below storey. Storey drift do not calculate with respect to the ground surface.

The graph of the storey drift of all models is given in the form of the table as well as table:

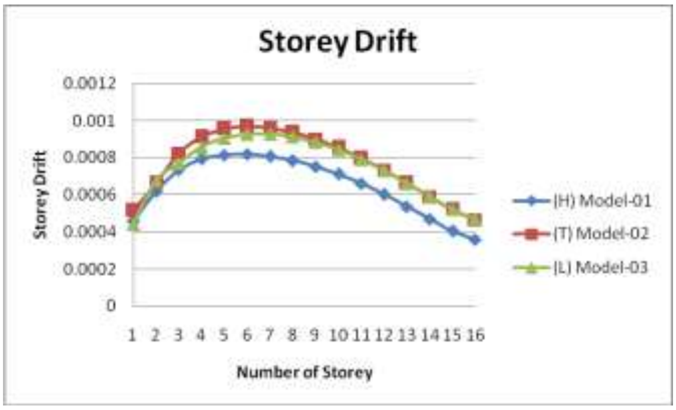

Chart -4: Storey Drift

Withn reference to Indian Standsard code, the ca;ue of the storey drift should not be exceed than 0.004 height of floor.

4.5 Storey Stiffness

Storey stiffness is defined as by Indian standard code 1893 part-1:2016, it is ratio of the storey shear to the storey drift.

The graph of the storey stiffness of all models is given below:

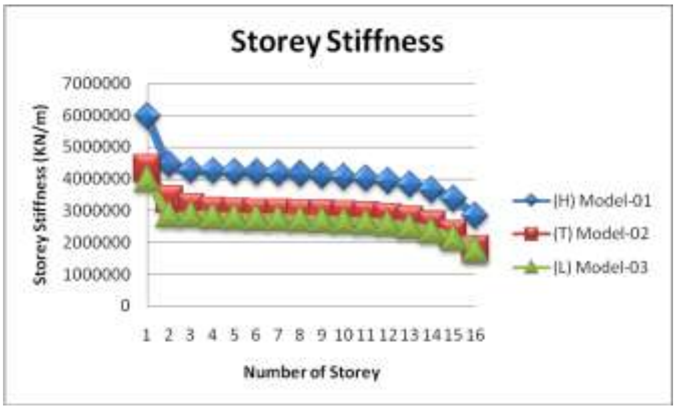

Chart -5: Storey Stiffness

From the above graph, we can see that the value of the story stiffness is high in the H shape building.

5. CONCLUSIONS

There are three models in this paper (H,T and L) and these models are links with the fluid viscous damper, and analysis there models we found some conclusion which is given below:

i. From the graph of the base shear due to EY, we can see that the value of the base shear is minimum in the model-03 because the dead load is low in the model-03 as compared to other two models (H and T) and imposed load is constant in these three models.
ii. From the graph of the maximum storey displacement, we can see that the storey displacement of the model-01(H) is low as compared to the another two models (T and L), because H shape is supported from everywhere, and it can easily transfer the lateral load in the all direction, where in the another two models it is difficult to transfer.
iii. According to the Indian Standard Code, if an RCC Building having floor one to 20 then natural time period should be exist from 0.005 to 2.00second, with these reference our all model is in the safe. The value of the natural time of model-02 is 1.86 % less as compared to the model-01 and 1.54% less as compared to the model-02.
iv. The value of the storey stiffness of the model-03(L) is low as compared to the two models. The value of the storey stiffness of model-03 is 32.82% less than model-01 and 7.18% less than as compared to model-02.

REFERENCES

[1] A. Ras and N. Boumechra "Seismic energy dissipation study of linear fluid viscous dampers in steel structure design" Elsevier -2016.

[2] Laura Gioiella "Analysis and comparison of two different configurations of external dissipative systems" ScienceDirect-2017.

[3] Giuseppe Marcantonio Del Gobbo "Improving total-building seismic performance using linear fluid viscous dampers" https://doi.org/10.1007/s10518-018-0338-4,2018

[4] F. Hejazi, J. Noorzae "Earthquake Analysis of Reinforce Concrete Framed Structures with Added Viscous Dampers" https://www.researchgate.net/publication/242782634, 2109.

[5] IS: 456-2000 "Code practice for plane and reinforced concrete".

[6] IS:875(Part 2)-1987 "Code of Practice for design loads for buildings and structures"

[7] IS: 1893-2016, Criteria for earthquake resistant design of structures, Bureau of Indian Standard, New Delhi.