

# Seismic Analysis of Multistory R.C. Building by using Indian Code and United State Code

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**Abstract** – This study involve seismic parameters required for seismic analysis of building by using international codes. For study selected international codes are Indian Code (IS 1893:2002) and ASCE 7-10 (American Society of Civil Engineers). This study helps to understand seismic parameter which helps to improve the behaviour of structures so that they may withstand the earthquake effects without significant loss of life and property. The model consist of G+10 RC building and modeling of structure is done by using ETABS 2016 software. Time period for analysis of structure is taken as per software calculated for both Indian code and US code. In this study base shear, maximum story displacement, maximum story drift, Maximum story moments is calculated in X direction and Y direction for Indian code and US code, also differentiation in graphical representation of maximum base shear, maximum story displacement, maximum story drift, mode vs period for Indian code and US code.

**Key Words:** IS 1893:2002 (Indian Code), ASCE 7-10 (American Society of Civil Engineers), Response spectrum method, ETAB-2016.

## 1. INTRODUCTION

Earthquake is caused due to suddenly release of stored energy in earth crust which creates seismic waves. However, earthquake results in ground shaking, ground rupture, landslides, tsunamis, and liquefaction etc. which results in collapsing structures, unwanted death, transportation abrupt etc. we cannot hold back such a natural disaster problem but we can minimized effects by providing safer building structure. Civil engineers plays an important roll to Identify seismic parameters which are used to reduce dangerous effects of earthquake and also provide education on earthquake safety majors.

The purpose of this paper is to study and understand the seismic parameters which are leads to contributing in seismic analysis of RC building, for Indian code and US code.

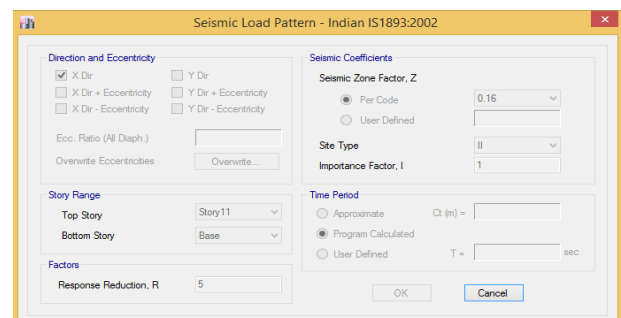
## 2. OBJECTIVE OF STUDY

- To study and understand seismic parameters which are usually used in seismic analysis of RC building in international code, IS 1893:2000 and ASCE 7-10, (American Society of Civil Engineers)
- To allocate seismic parameters to the structure as per code with respect to their country
- Seismic Analysis of structure by using response spectrum method or linear dynamic analysis.
- To generate the graph response of building on the subject of Storey V/S i) Base shear, ii) Storey displacement, iii) storey drift, iii) Overturning moments, iv) Mode vs periods of the building
- To compare the results of seismic response of building on the subject of Storey V/S i) Base shear, ii) Storey displacement, iii) storey drift, iii) Overturning moments, iv) Mode vs periods of the building

## 3. METHODOLOGY

The method carried out to reach objective mention above are as follows:

- To create model for selected G+10 RC building in ETAB 2016 software.
- The models as per Indian code (IS 1893:2002) and United state code (ASCE 7-10).
- Apply gravity loading and load combination to the model with respect to IS code and US code
- Add seismic parameters to the Indian model as follows.



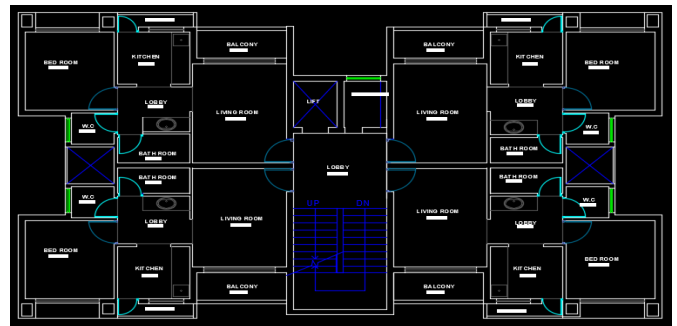
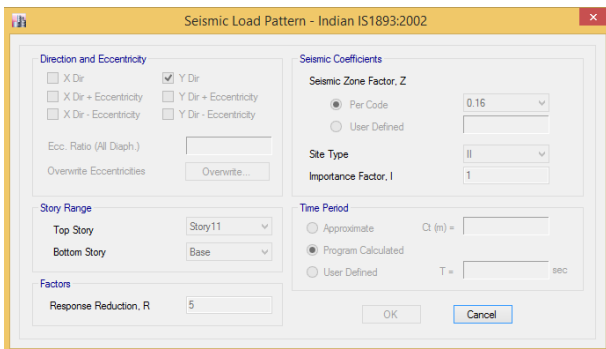


Fig. I: Basic plan for all model

5) Add seismic parameters to the US model as follows.

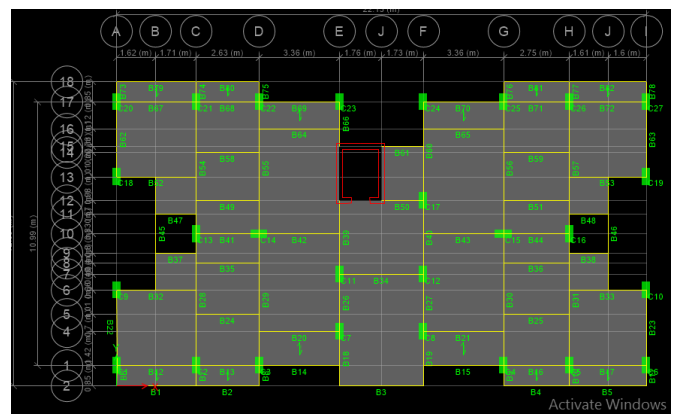
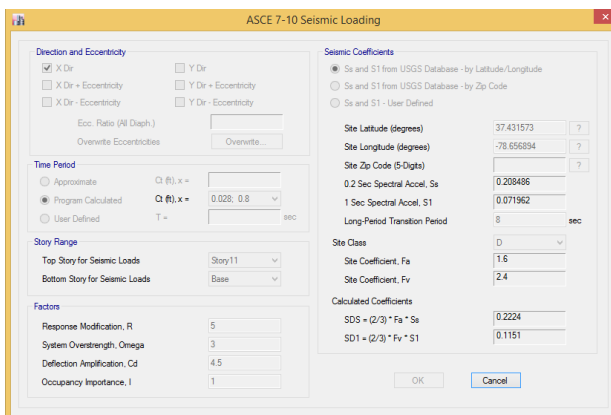


Fig. II: Position of beams and column in plan for all model

6) Then proceed for seismic analysis and compute the results.

### 3. SPECIFICATIONS OF STRUCTURE

#### Specifications of structure:

Structure Type = G+10 storey RCC building

Table- I: Data of the Structures

Sr. No.	Parameters	Dimension/Values
1	Plan Dimension	22.13m x 12.69m
2	No. of Stories	G+10
3	Story Height	3 m
4	Foundation Height	3.5 mm
5	Beam Size	200 x 500 mm
6	Column Size	350 x 700 mm
7	Slab Thickness	150 mm
8	Wall Thickness	230 mm
8	Grade of Concrete	M30
9	Grade of Steel	Fe500
10	Unit Weight of Concrete	25 KN/m3
10	Soil Type	Medium Soil
11	Live Load	2 KN/m2
12	Floor Finish Load	1.5 KN/m2

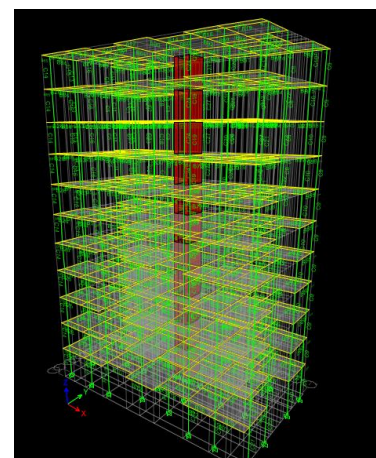


Fig. IV: 3D model in ETAB 2016

### 4. ANALYSIS RESULTS AND DISCUSSION

The G+10 RC building is analyzed by Indian code and United State Code. The seismic parameters like base shear, story drift, story moments, story displacement is calculated and all these data is display in table with respect to their country, also graphical representation of Storey V/S i) Base shear, ii) Storey displacement, iii) storey drift, iii) Overturning moments of Indian code and United State code and compare with each other.

**Table-II:** Storey drifts in X direction and Y direction for Indian model

Storey	X-direction	Y-direction
Base	0	0
Story1	0.00044	0.000311
Story2	0.00085	0.000651
Story3	0.000966	0.000824
Story4	0.001015	0.000922
Story5	0.001019	0.000966
Story6	0.000993	0.000967
Story7	0.000937	0.000934
Story8	0.000853	0.000874
Story9	0.000743	0.000792
Story10	0.000613	0.000702
Story11	0.000506	0.000648

**Table-V:** Storey drifts in X direction and Y direction for United State model

Storey	X-direction	Y-direction
Base	0	0
Story1	0.000511	0.00029
Story2	0.001027	0.000633
Story3	0.001197	0.000814
Story4	0.001267	0.000915
Story5	0.001269	0.000958
Story6	0.001229	0.000957
Story7	0.00115	0.000922
Story8	0.001038	0.00086
Story9	0.000898	0.000779
Story10	0.000741	0.000691
Story11	0.000592	0.000638

**Table- III:** Storey displacement in X direction and Y direction for Indian Model

Storey	X-direction	Y-direction
Base	0	0
Story1	1.6	1.088
Story2	4.151	3.04
Story3	7.048	5.512
Story4	10.094	8.278
Story5	13.151	11.175
Story6	16.13	14.077
Story7	18.94	16.88
Story8	21.499	19.5
Story9	23.727	21.877
Story10	25.565	23.982
Story11	27.028	25.827

**Table- VI:** Storey displacement in X direction and Y direction for United State

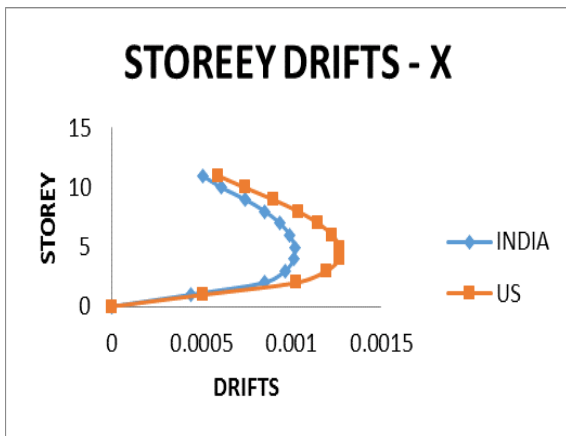
Storey	X-direction	Y-direction
Base	0	0
Story1	1.844	1.016
Story2	4.924	2.916
Story3	8.517	5.358
Story4	12.316	8.101
Story5	16.124	10.975
Story6	19.811	13.848
Story7	23.261	16.614
Story8	26.377	19.192
Story9	29.072	21.528
Story10	31.295	23.601
Story11	33.07	25.431

**Table- IV:** Storey moments in X direction and Y direction for Indian Model

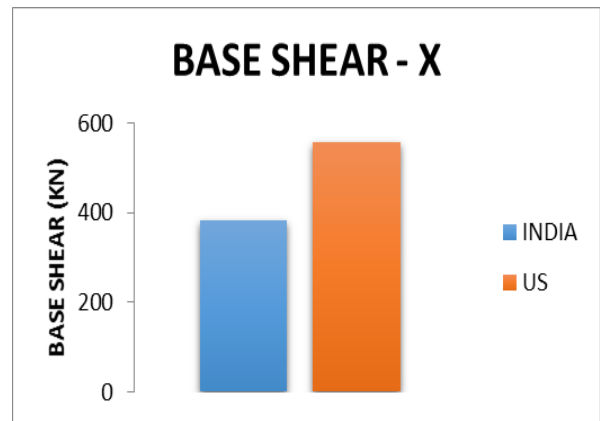
Storey	X-direction	Y-direction
Base	9949.414	13304.56
Story1	8614.183	11519.06
Story2	7472.732	9992.689
Story3	6341.623	8480.147
Story4	5232.602	6997.142
Story5	4161.825	5565.277
Story6	3149.851	4212.045
Story7	2221.645	2970.828
Story8	1406.577	1880.904
Story9	738.4249	987.4368
Story10	255.37	341.4859
Story11	0	0

**Table- VII:** Storey moments in X direction and Y direction for United State

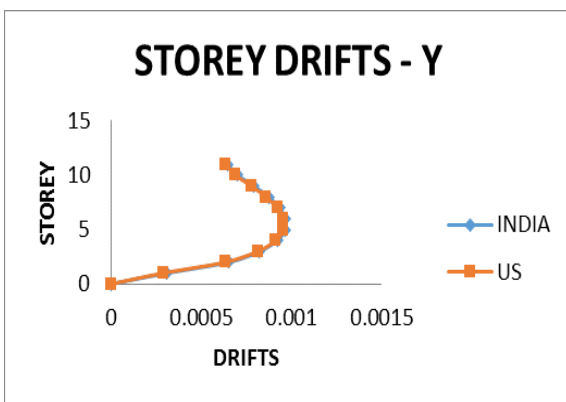
Storey	X-direction	Y-direction
Base	9949.414	14228.2
Story1	8614.183	12276.36
Story2	7472.732	10610.52
Story3	6341.623	8965.651
Story4	5232.602	7361.591
Story5	4161.825	5823.56
Story6	3149.851	4381.817
Story7	2221.645	3071.392
Story8	1406.577	1931.881
Story9	738.4249	1007.283
Story10	255.37	345.8562
Story11	0	0



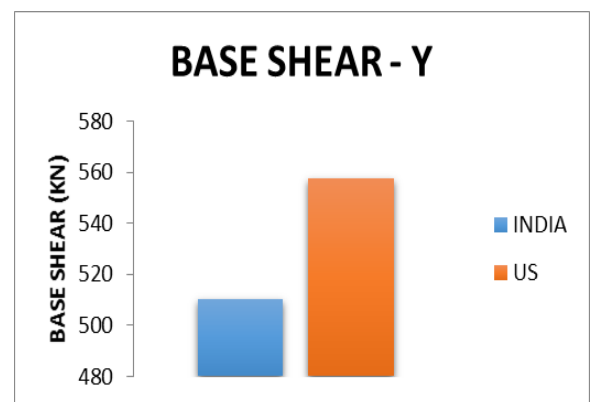
Graph-I: Storey Drift in X direction



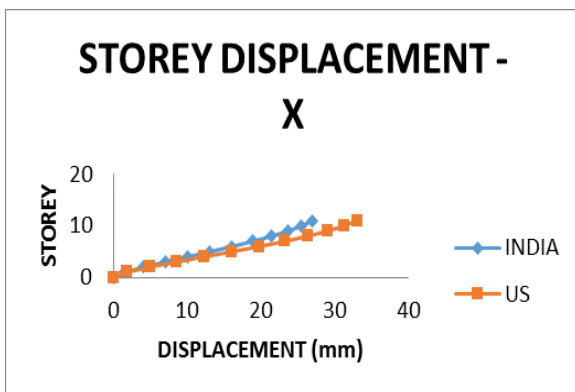
Graph-V: Base Shear in X direction



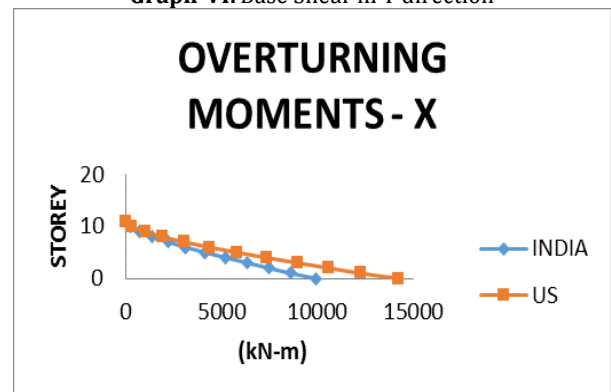
Graph-II: Storey Drift in Y direction



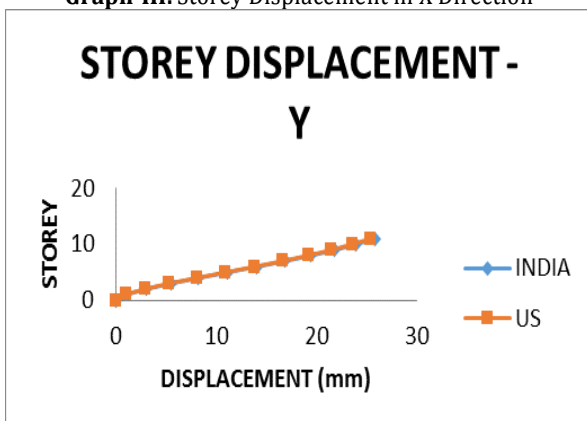
Graph-VI: Base Shear in Y direction



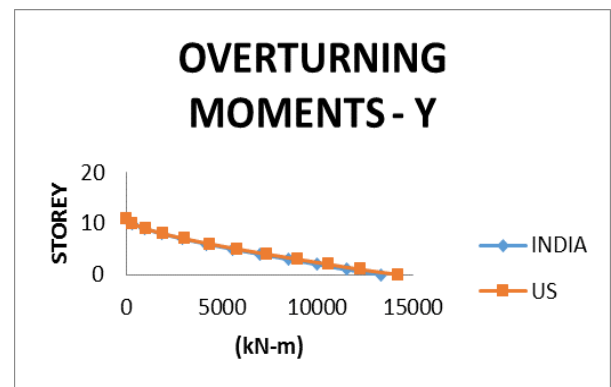
Graph-III: Storey Displacement in X Direction



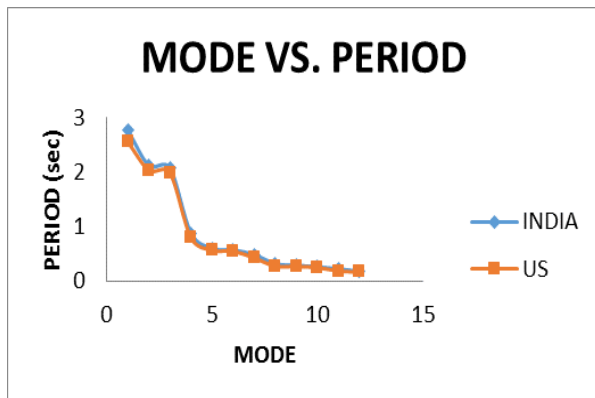
Graph-VII: Overtuning moments in X-direction



Graph-IV: Storey Displacement in Y Direction



Graph-VIII: Overtuning moments in Y-direction



Graph-IX: Mode Vs Period

## 5. CONCLUSIONS

Based on present investigation medium soil type and response reduction are same for both Indian model and United State model, and following conclusions are drawn.

**A)** In this project the study for seismic analysis of G+10 RC building, the seismic parameters used for analysis are differs with respect to their country.

**B)** In the study of seismic analysis of Indian model, the time period calculation is depends on height and dimensions of building, taking it into consideration for rectangular building time period is changes for X-direction and for Y-direction respectively.

**C)** For Indian model, the base shear calculated is differs in X-direction and in Y-direction respectively.

**D)** In the study of seismic analysis of United State model, the time period calculation is depends on height of building, however time period calculation for rectangular building is same for X-direction and for Y-direction.

**E)** For United State model, the base shear calculated is remains same in X-direction and in Y-direction respectively.

**F)** The results and graph are calculated for Seismic analysis of building is for Indian code and United States and are compare with each other as follows;

**a.** The base shear calculated for United State model is 8.52% is more as compare Indian Model.

**b.** The Story displacement calculated for United State model is 18.25% is more as compare Indian Model.

**c.** The Story drift calculated for United State model is 1.56% is more as compare Indian Model.

**d.** The Overturning moment calculated for United State model is 6.5% is more as compare Indian Model.

**e.** The mode VS period calculated for Indian model is 7.8% more as compare United State Model.

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