

# SEISMIC DESIGN OF MULTISTOREYED RC BUILDING USING VARIOUS CODES

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## Abstract

Earthquake is a major phenomenon which cause failure to the Reinforced Concrete(RC) structure. The necessity of designing the structure as per codal provision is must for all kind of structure. In this research, a building of regular plan of G+10 was taken for study. The Linear static analysis was done using American, European and Indian Codes. The building is modeled and analysed using ETABS software. All the required parameters for analysis was taken as per respective codes. Various response like storey deflection, storey drift and base shear were compared. The displacement, storey shear and storey displacement obtained from ACI code design is more when compared with other code's analysis result.

**Keywords:** Displacement, Shear, Drift, Seismic Analysis

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## 1. HEADING 1

### 1.1. INTRODUCTION

Earthquake resistant structures are capable of resisting lateral and vertical forces acting on the structures. But no structures can entirely survive during earthquake without any damages. According to codes, earthquake resistant structures are designed to withstand expected earthquake atleast to occur once during the design life of the structure. Reinforced concrete buildings are analysed and designed to meet the requirements of relevant codes of practice. Such buildings designed as per codal provision will survive during earthquake with minor damages of structural elements

The following codes are used for analysis purpose;

1. Indian Standard Code  
IS 1893(Part 1):2002 and IS13920:1993.

2. European code  
EUROCODE 8: 1998

3. American code  
ASCE 7-05

Linear Static analysis is applying load in linear pattern.

### 2. MODELLING AND ANALYSIS

A multi-storey building of G+10 with 3x3 bays is considered for this study as shown in fig 1. The base dimension of the plan is 9m x 9m. the typical storey height is 3m for all storeys. The structural elements are considered

as square for all storeys. The building is designed for all three codal provisions as mentioned above. A Linear Static analysis is done using ETABS 2015. The model is studied for all three code for severe zone with medium soil condition.

### 2.1 PLAN AND ELEVATION OF THE BUILDING

MODEL: Plan and Elevation of the building

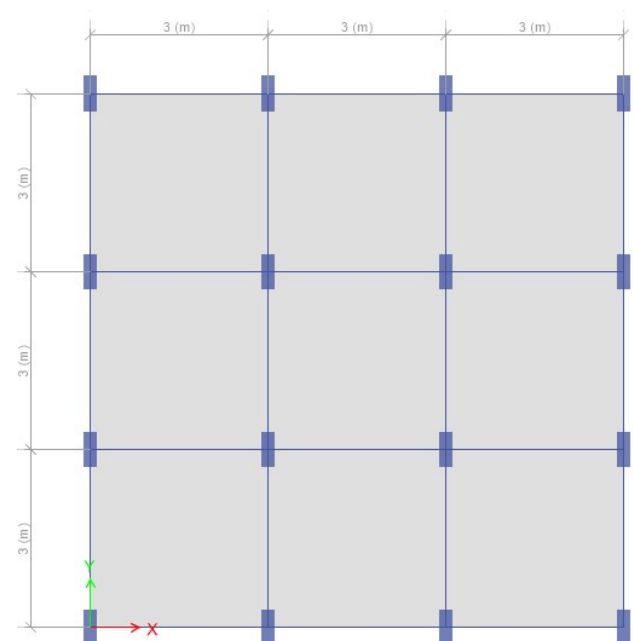


Fig (1). Plan of frame

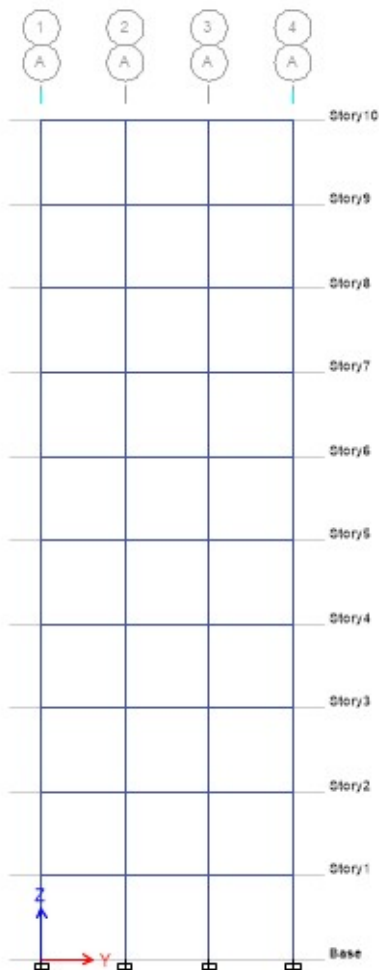


Fig (2). Elevation of frame

Table 1- Preliminary Data

DETAILS OF BUILDING	FOR ALL STORIES
Number of storey	G+10
Storey Height	3m
Beam size	230m* 600m
Column size	230m* 600m
Slab Thickness	125m
Wall Thickness	230mm
Grade of Concrete	M25
Grade of Steel	Fe415

2.2 METHODOLOGY OF THE PROJECT

In this study, linear static analysis is done to find out the response of the building. The storey displacement, shear and drift is determined using ETABS software. The building is designed and detailed as per the codes and the results were compared and discussed.

3. RESULTS AND DISCUSSIONS

3.1 RESULTS FOR EACH CASES

Case(i). Analysis result obtained using IS Code

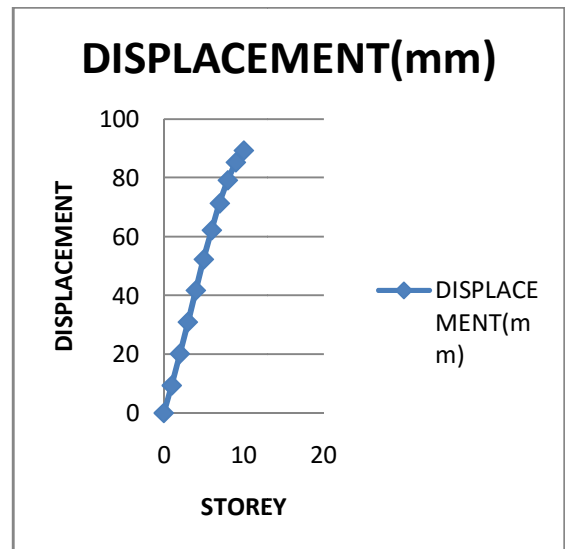


Fig (3)

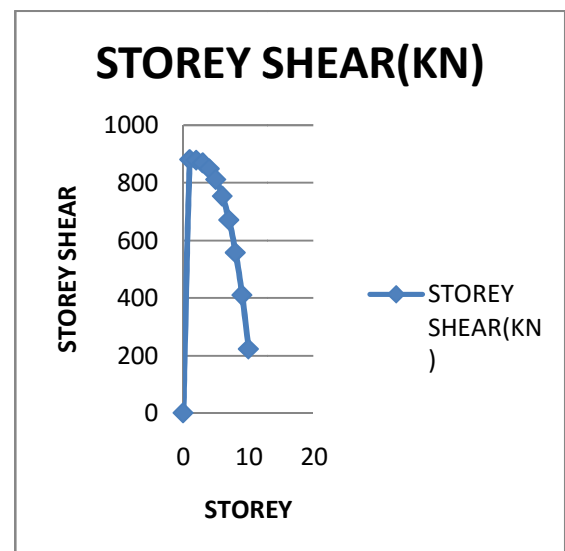


Fig (4)

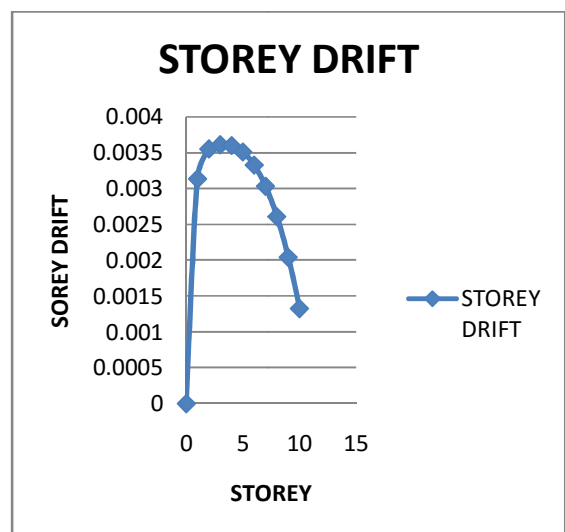


Fig (5)

Fig (3),(4),(5). Shows the displacement , shear and drift for the building

Case (ii) Analysis Result obtained using EURO code

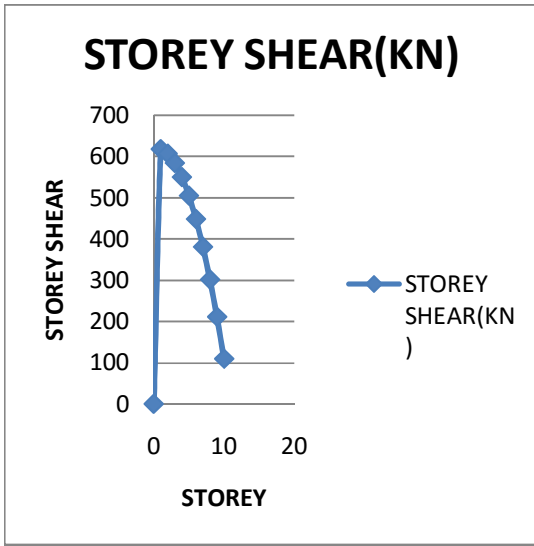
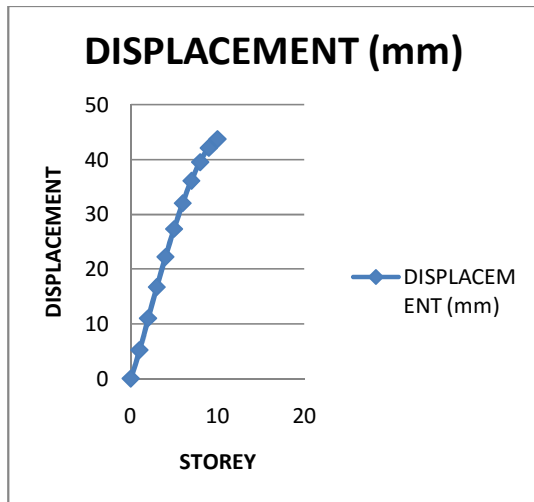


Fig (6)



Fig(7)

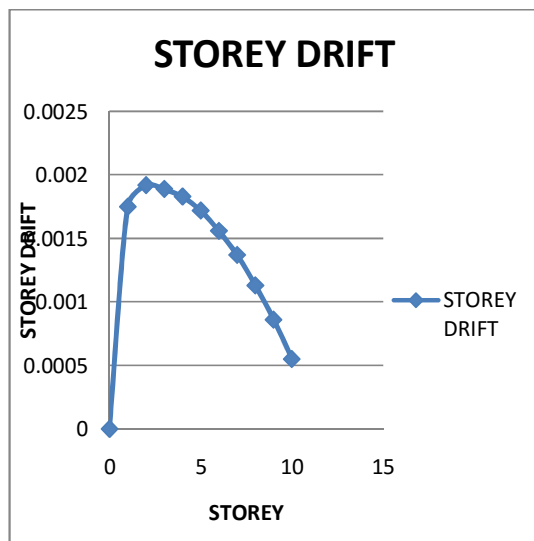


Fig (8)

Fig (6),(7)&(8). Shows the shear, displacement and drift of the structure

Case (iii) Analysis Result obtained using ACI code

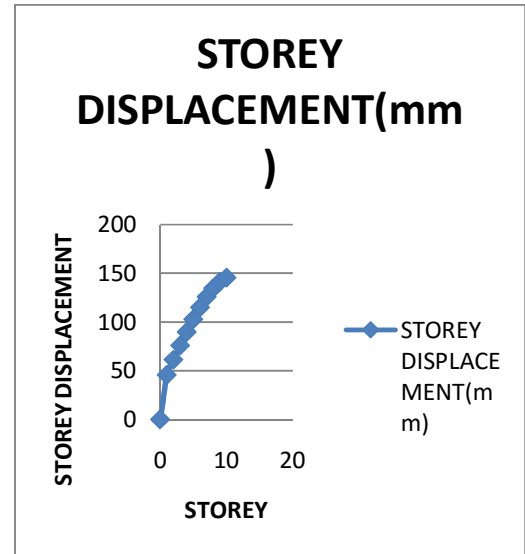


Fig (9)

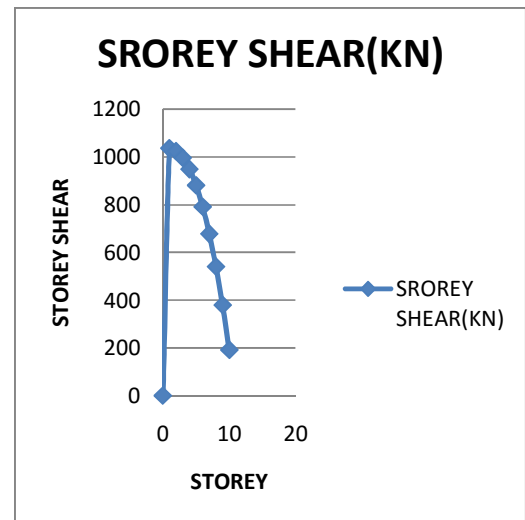
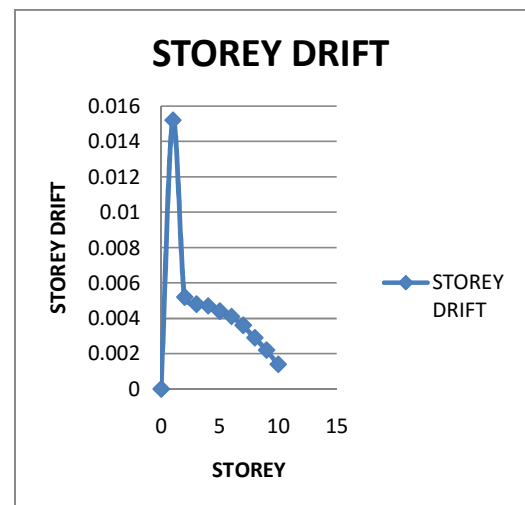


Fig (10)



Fig(11)

Fig (9),(10)&(11) shows the displacement, shear and drift of the structure

3.2 COMPARATIVE ANALYSIS

3.2.1 STOREY DISPLACEMENT:

Table 2. Comparison result of Displacement

Storey	IS CODE	EURO CODE	ACI CODE
Base	0	0	0
1	9.4	5.2	45.7
2	20.1	11	61.4
3	30.9	16.7	75.9
4	41.7	22.2	89.9
5	52.3	27.3	103.1
6	62.2	32	115.3
7	71.3	36.1	126
8	79.2	39.5	134.8
9	85.3	42.1	141.5
10	89.3	43.7	145.7

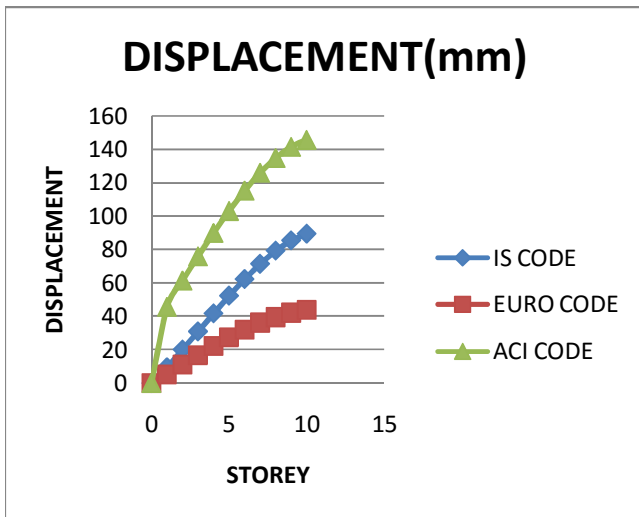


Fig 12. Comparison result of Displacement for all cases

3.2.2 STOREY SHEAR:

Table 3. Comparison result of Storey Shear

Storey	IS CODE	EURO CODE	ACI CODE
Base	0	0	0
1	880.75	618.4	1037.6
2	878.44	607.09	1025.56
3	869.19	584.47	996.93
4	848.39	550.54	949.39
5	811.41	505.3	881.29
6	753.63	448.76	791.28
7	670.42	380.896	678.23
8	557.17	301.73	541.15
9	409.25	211.25	379.17
10	222.03	109.46	191.49

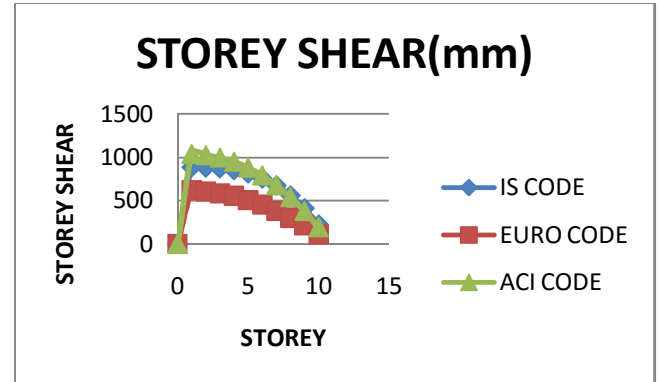


Fig 13. Comparison result of Storey shear for all cases

3.2.3 STOREY DRIFT:

Table 4. Comparison result of Storey Drift

Storey	IS CODE	EURO CODE	ACI CODE
Base	0	0	0
1	0.003136	0.00175	0.0152
2	0.003555	0.00192	0.0052
3	0.003612	0.00189	0.0048
4	0.003602	0.00183	0.0047
5	0.003513	0.00172	0.0044
6	0.003329	0.00156	0.0041
7	0.003033	0.00137	0.0036
8	0.00261	0.00113	0.0029
9	0.002043	0.00086	0.0022
10	0.001327	0.00055	0.0014

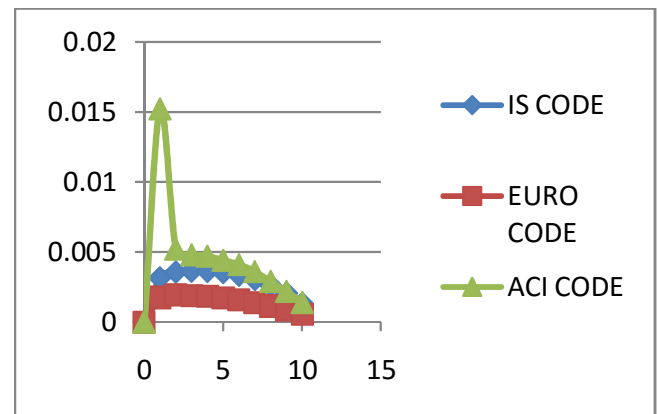


Fig 14. Comparison result of Storey Drift for all cases

4. CONCLUSIONS

- The analysis as per ACI code shows more displacement, storey shear and storey drift when compared with IS standard and Euro code.
- The displacement, shear and drift is maximum for first story for all cases.
- Comparing IS and EURO code, the displacement is increased by 50% for all stories as per IS code than EURO code. For Euro and ACI code, the displacement is varied from 88% to 70% from the base to top storey.

- Comparing the storey shear for EURO and IS code, the value varies from 30% to 50% from base to top floor. For EURO and ACI codes, the shear varies from 40% to 43%.
- Comparing the Storey Drift for EURO and IS code, the value varies from 44% to 59%. For EURO and ACI codes, the drift varies from 88% to 60%.

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