IJREAT International Journal of Research in Engineering & Advanced Technology, Volume 3, Issue 2, April-May, 2015
ISSN: 2320 – 8791 (Impact Factor: 2.317)
www.ijreat.org

Time History Analysis of High Rise Structure Using Different Accelerogram

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Abstract

Time history analysis is an important technique for structural seismic analysis especially when the evaluated structural response is nonlinear. To perform such an analysis, a representative earthquake time history is required for a structure being evaluated. This research paper describes the results of an extensive study on the seismic behavior of structure under different earthquake accelerograph like El centro, Bhuj, Killari In this work an attempt is made to analyze high rise structure with the help of E-tab software. This work has selected Time History Analysis method. For analysis purpose high rise structure with G+25 stories has been selected. Time History of earthquake at various places like El Centro, Bhuj, Killari are used for analysis of selected high rise structure. After that comparative study is made between all selected places. At first study of all places without damper is made. In this work constant loading parameters are used, also same plan is used for various models of time history. Load combinations are taken from IS code.

Key Words:Time History Analysis, High Rise Building.

1. Introduction

Earthquake resistant design of engineering structures is one of the most important methods of mitigating risk of damage from future earthquakes. Such designs are based on the specification of ground motion which can be expected in the event of an earthquake. However, for earthquake-resistant design of some important structures like dams and nuclear power plants, located in seismically active areas, it is desirable to have a reliable site-specific design accelerogram. Available records of strong ground motion, after suitable modifications, have been used in the past for detailed dynamic analysis of engineering structures. However, synthetic accelerograms are now increasingly being used in earthquake engineering. Knowledge of regional and local seismicity and seismotectonics, a suitable earth model and source characteristics of the design earthquake are required for this purpose.

The Time History Response of a structure is simply the response (motion or force) of the structure evaluated as a function of time including inertial effects. The time history analysis in the advanced level of visual analysis allows four main loading types. These include base accelerations, base displacements, factored forcing functions, and harmonically varying force input. Analysis of a structure, applying data over increment time steps as a function of:

– Acceleration – Force – Moment, or – Displacement.

Time history analysis is considered to be more realistic compared to response spectrum analysis. It is most useful for very long or very tall structures (flexible structures).

2. Methodology

For analysis purpose high rise building of G + 25 floors has been selected. The building is RCC framed structure. Overall height of the building is 77.6 M. First 4 floors are for Parking.

A. Model Description

A G + 25 story building plan is selected for the study. same model is used for analysis of different time history.

Table1: Key features of the structure

Name of parameter	*Value*	*Unit*
Number of stories	25	Nos.

Storey height	2.9	m
Total height of the structure(above GL)	77.6	m
Length in long direction	31.60	m
Length in short direction	15.47	m
Thickness of Deck	150	mm
Dead Load (1) Wall (Siporex)	2.64	kN/m
(2) Floor finish	1	kN/m²
Live load	2	kN/m²

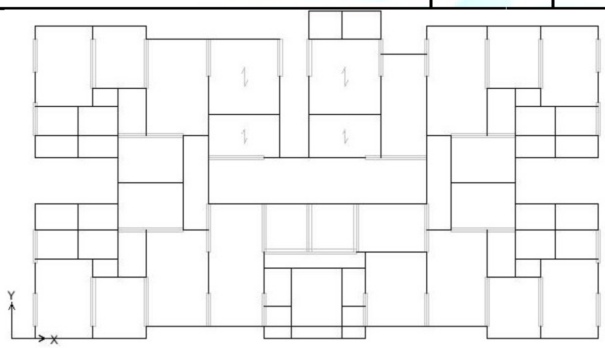

Figure 1: Typical floor plan of building

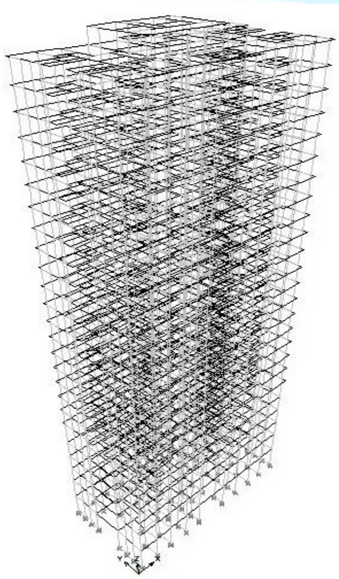

Figure 2: 3-D view of building

3. Model Description

Model 1: Building analyzed with Bhuj Time History.

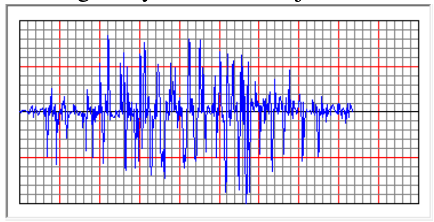

Figure 3: BhujAccelerogram

Model 2: Building analyzed with Koyna Time History.

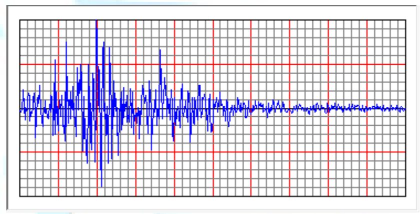

Figure 4: KoynaAccelerogram

4. Results

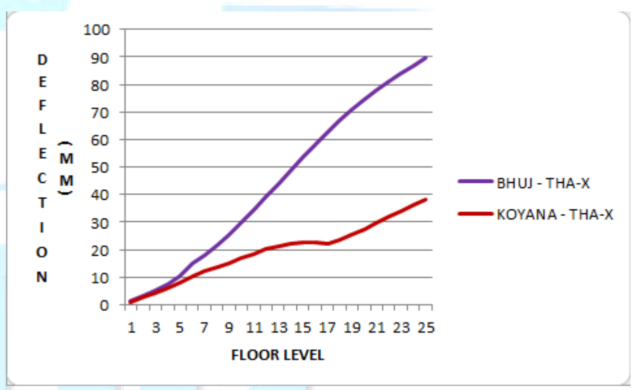

Figure 5: TOP STORY DISPLACEMENT (X-DIRECTION) (THA-X)

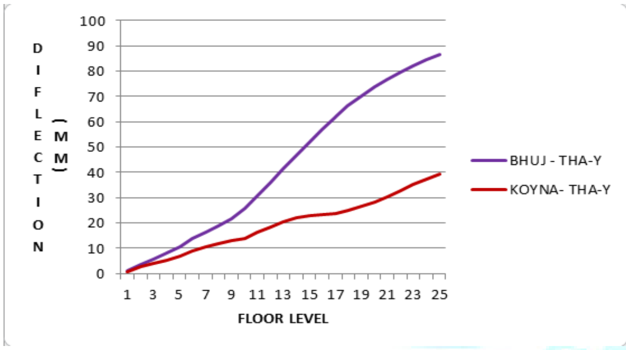

Figure 6: TOP STORY DISPLACEMENT (Y-DIRECTION) (THA-Y)

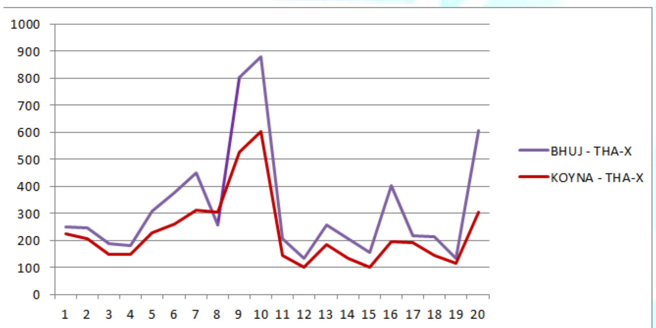

Figure 7: AXIAL FORCES (THA-X)

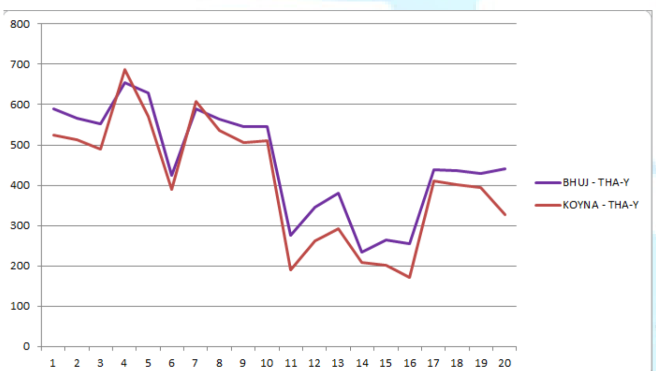

Figure 8: AXIAL FORCES (THA-Y)

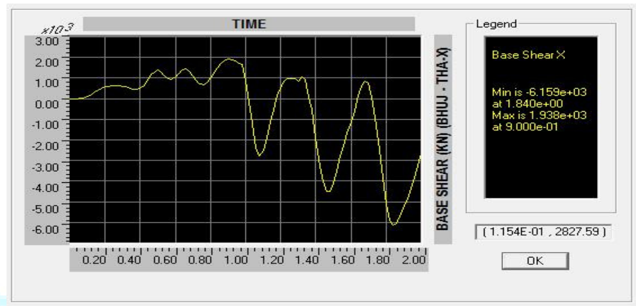

Figure 9: BASE SHEAR-BHUJ (X-DIRECTION)(THA-X)

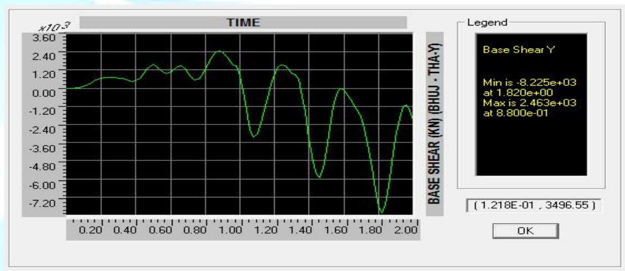

Figure 10: BASE SHEAR- KOYNA (X-DIRECTION)(THA-X)

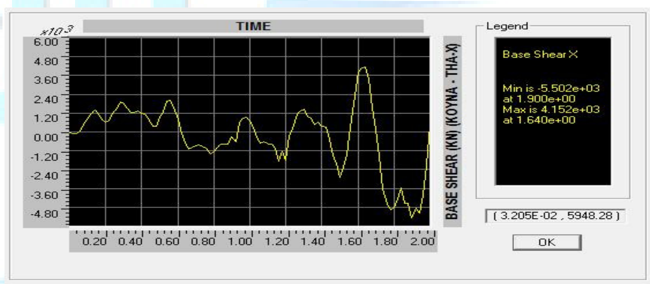

Figure 11: BASE SHEAR- BHUJ (Y-DIRECTION)(THA-Y)

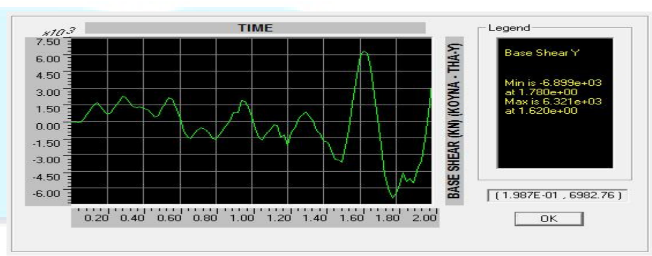

Figure 11: BASE SHEAR-KOYNA (Y-DIRECTION)(THA-Y)

5. Discussion

Lateral Displacement

- ® Displacement of top story in THA-X is 89.72mm & 38.40 mm for case A & B simultaneously.
- ® Avg. displacement in case B is less by 48.25% than in case A.
- ® Displacement of top story in THA-Y is 86.71mm & 39.50 mm for case A & B simultaneously.
- ® Avg. displacement in case B is less by 49.76% than in case A.

Axial Forces

- ® Axial forces induced in case A are greater than case B.
- ® Avg. axial force in case B is less by 21.39% than in case A.

Base Shear

- ® Base shear in case A is greater than in case B.

6. Conclusion

- ® Time history of Bhuj earthquake is more hazardous than time history of Koyna earthquake.
- ® Displacement due to Bhuj Earthquake (case 1) is approximately double as compare to Koyna Earthquake (case 2).
- ® Avg. axial force and base shear in case of Bhuj earthquake is greater than koyna earthquake for selected building plan.

7. Future scope

There are various types of damper which reduces the seismic effects on the structure. In further work behavior of structure can be study after provision of damper.

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