International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 06 Issue: 03 | March - 2022 ISSN: 2582-3930

Non Linear Analysis of High Rise RC Frame Structure using Time History Analysis

Er. Kumar Vanshaj[1], Lokesh Sahu[2], Abhishek Mishra[3]

[1]Asst. Professor CED & Institute of Engineering & Technology, Lucknow

[2]M.Tech. Scholar CED & Institute of Engineering & Technology, Lucknow

[3]Asst. Professor CED & Institute of Engineering & Technology, Lucknow

---

Abstract – The current study aim at understanding realistic behavior of structure under dynamic analysis such as Time History Analysis for non-linear structure by Staad Pro V8i software. Using concrete section for a span of 4mt. and 3mt height columns and G+16 storey considered for a total height of 51 mt. The dynamic analysis such as displacement and modal analysis to find out natural frequency and time period.

Key Words: Staad Pro V8i, Time History Method, Seismic Analysis

Introduction

Earthquakes are one of the most life threatening, environmental hazardous and destructive natural phenomenon that causes shaking of ground. Structures possess less stiffness and strength in case of irregular configured frames; to enhance this, lateral load resisting systems are introduced into the frames. During earthquake motions, deformations take place across the elements of the load-bearing system as a result of the response of buildings to the ground motion. Structure refers to made of non linear members interconnected to each other in space. In analysis we considered structural load like dead load, live load and seismic load and Time History Analysis.

Objective

The aim of this study is defined as follows,:

- Investigate the seismic performance of high rise structures in earthquake zone 4.
- Time History Analysis of the model in terms of Mode, Frequency, Time Period , Story Drift, Story Displacement.

3.Methodology

Dead Load (IS 875 PART -1)

AC Brick Wall load for 230mm wide wall (Density of AC Brick 10KN/m^3)

RCC Slab load for 125mm thick (Density of RCC 25KN/m^3)

Live Load (IS 875 PART-2)

For residential building 2-3 KN/m^2

Seismic Load (IS 1893-2016)

Seismic Zone -4

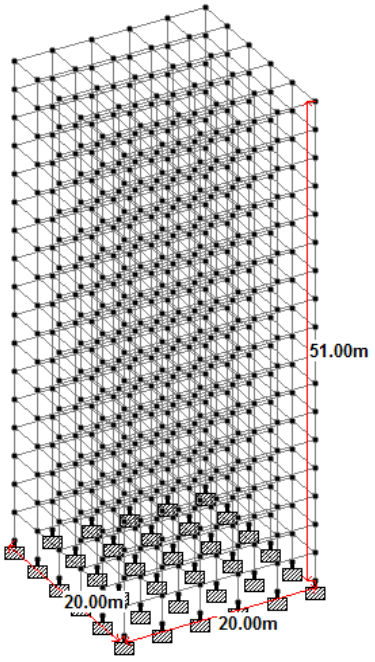
Components	Details
Plan	20mt X 20mt
Grid Spacing	4mt
Storey Height	3mt
No. of Storey	17
Total Height	51mt

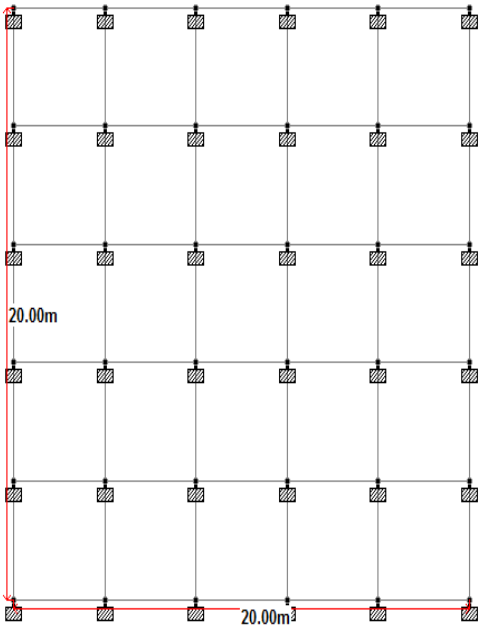
Damping Ratio- 5%

Response Reduction Factor -5

Soil Type – Hard Soil

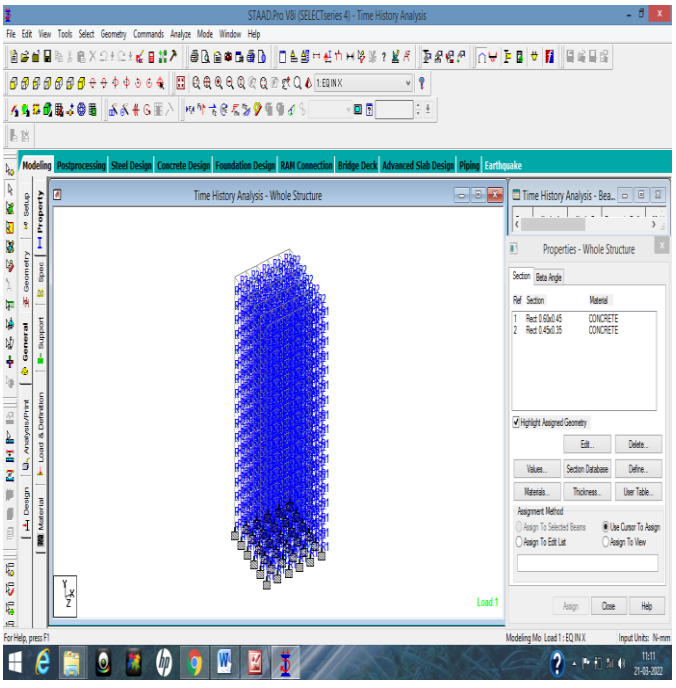
Modelling of Structure in Staad Pro. V8i





Properties of Model

For Column – 600 X 450 mm²
For Beam – 450 X 350 mm²



Time History Analysis

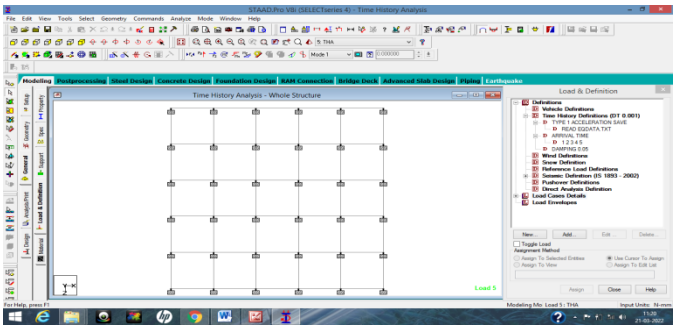
It is one of the method of dynamic analysis for a structure. In this base of the structure is motion in earth quake . for the full period of seismic can evaluate immediate stress throughout the structure at smaller intervals. We can obtained maximum stress by output records.

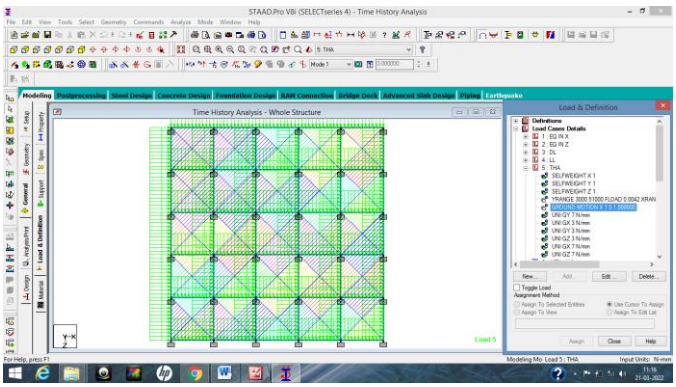
Time History Definition

TYPE	
Data Source	EQDATA.txt

Time History Parameter

Damping- 0.05
Time Step-
Arrival Time- 1 2 3 4 5





Dynamic Analysis of Structure

The dynamic characteristics of structure like horizontal and vertical displacement for the modal. The time History Analysis is done for Bhuj earth quake data and equivalent static method for seismic zone 4.

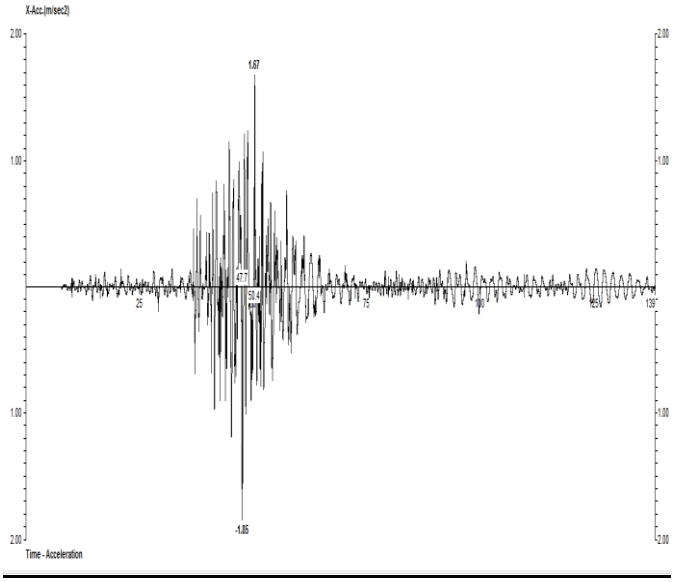
Time History Function

In time history analysis motion of earthquake is applied directly to the base of structure for full duration of the earthquake instantaneous stress throughout the structure are evaluated at small intervals. From the output records we can find a maximum stress in any member. In this study, Bhuj earth quake data is selected for the analysis.

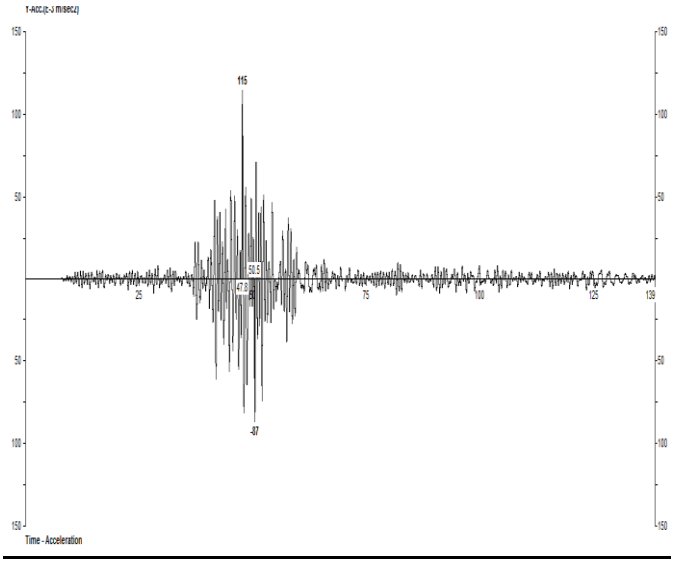
The graph shows below of Time v/s Acceleration, Time v/s Velocity and Time v/s Displacement.

Time v/s Acceleration

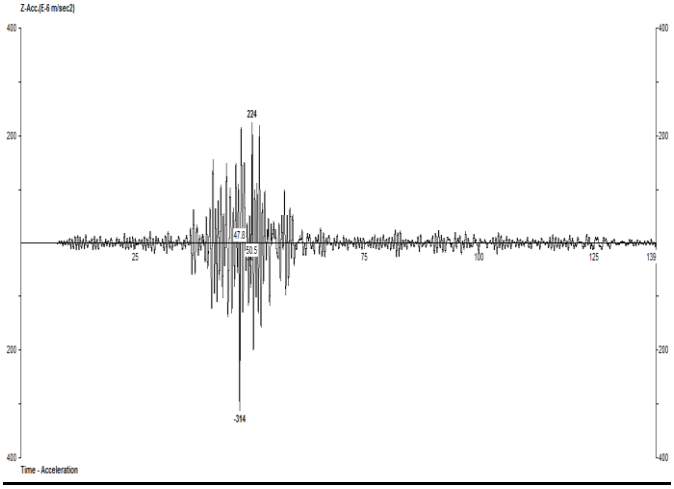
X- Axis



Y-Axis

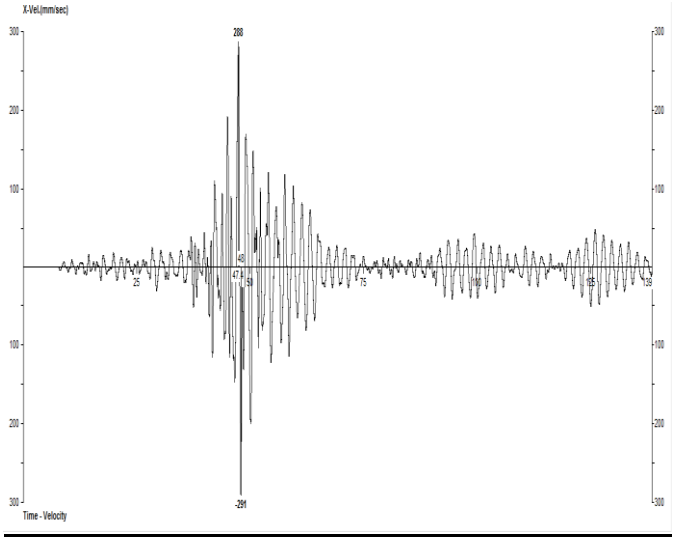


Z-Axis

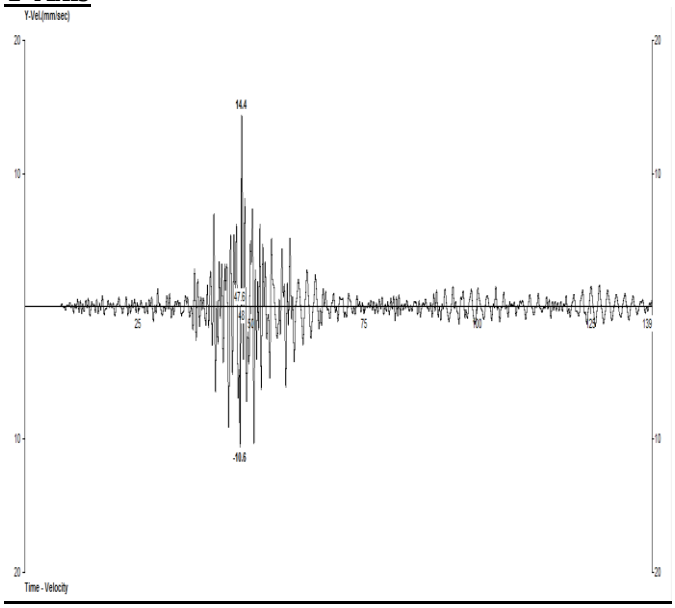


Time v/s Velocity

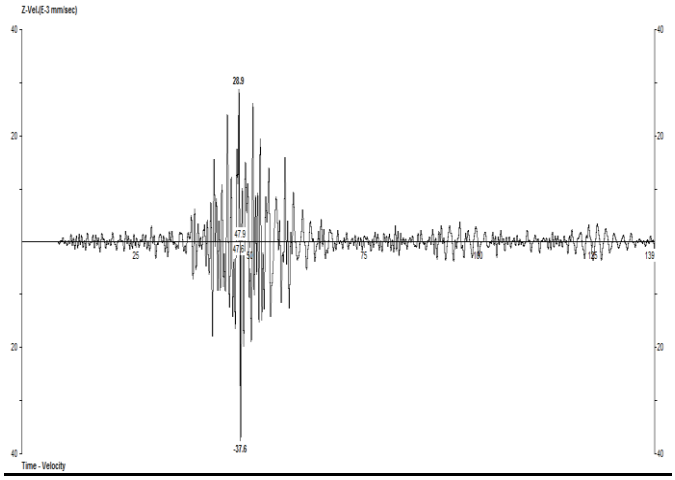
X-Axis



Y-Axis

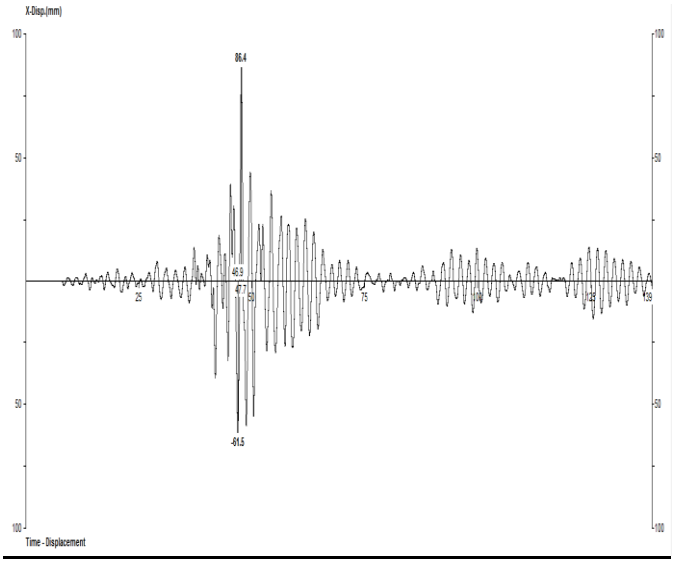


Z-Axis

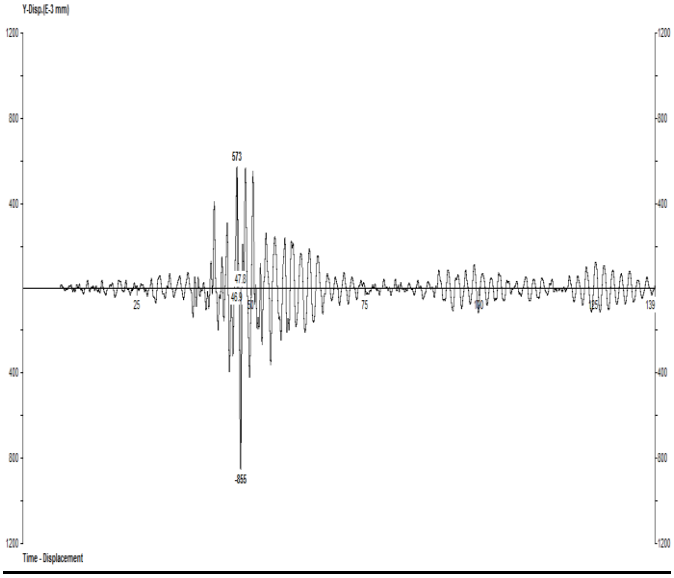


Time v/s Displacement

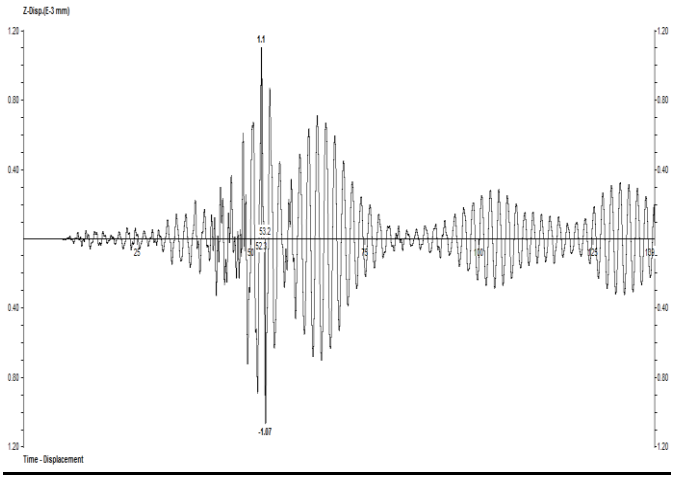
X- Axis



Y-Axis

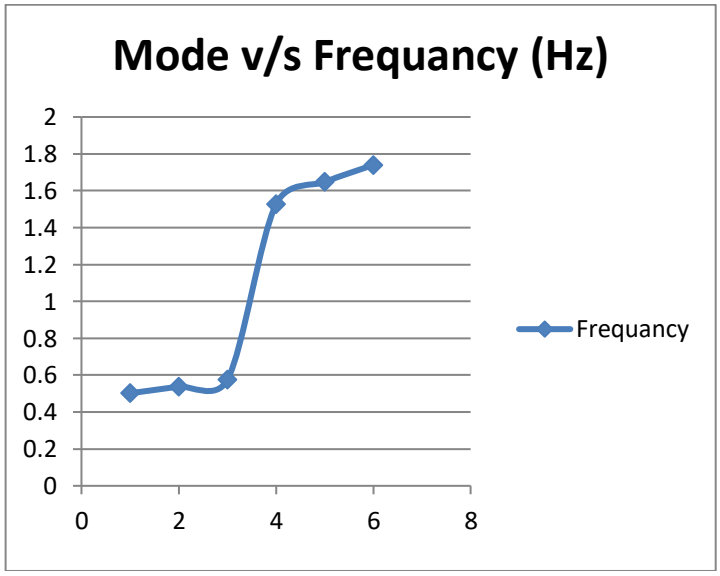


Z-Axis

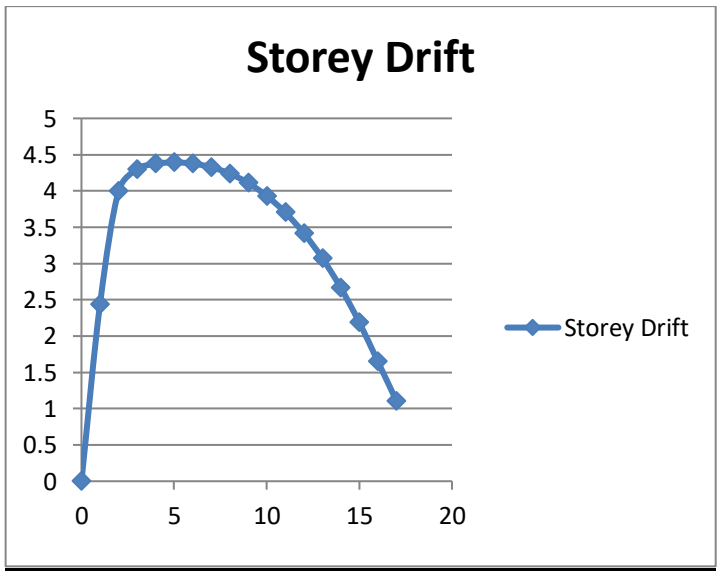


Modal Analysis Result

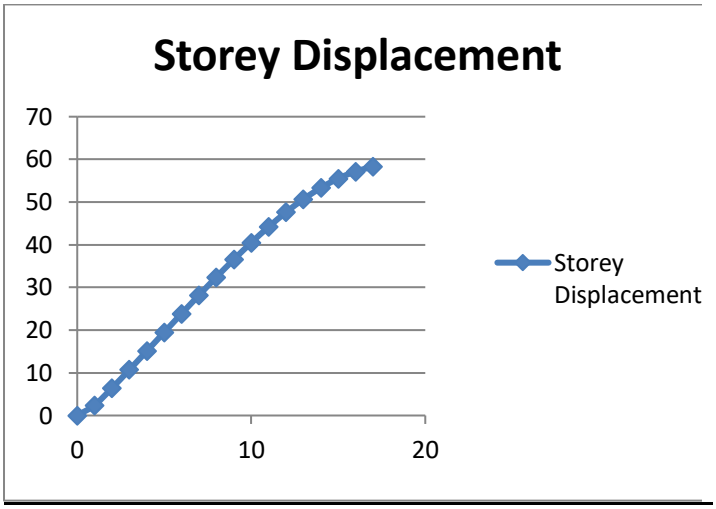
Mode	Frequency(cycle/sec)	Time Period(sec)
1	0.502	1.99112
2	0.538	1.85945
3	0.575	1.74008
4	1.527	0.65478
5	1.647	0.60710
6	1.740	0.57482



Story Drift



Storey Displacement



Conclusion

The analytical study on non linear analysis of G+16 storey Building using Time history analysis is carried and from the result following conclusion are drawn.

- From the model analysis maximum time period of 1.991 sec. is obtained. And a maximum frequency of 1.740 Hz is obtained.
- From the dynamic analysis the maximum mass participation factor in X and Z is respectively 89.598% and 90.223%.
- From the dynamic analysis maximum horizontal displacement is getting of 87.404mm .

Reference

- K M Mahanthesh and B O Naveen "Dynamic Analysis of Multi-Layered Grid Space Structures"
- Mohammed Rizwan Sultan & D. Gouse Peera " DYNAMIC ANALYSIS OF MULTI-STOREY BUILDING FOR DIFFERENT SHAPES"
- Mohd. Minhajuddin, Noor Mohammed & Syed Farrukh Anwar "LINEAR DYNAMIC ANALYSIS OF RC FRAMED BUILDINGS"
- IS 456-2000 " Practice for general structural use of Plain and Reinforcement Concrete."
- IS 1893-2016 "Earth quack Resistance Design of Structure