# Analysis And Design Of G+7 Story Building Using E-tabs Software

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**Abstract -** *One of the most extensively used seismic safety techniques for buildings in earthquake-prone locations is base isolation. The bottom isolation system moves the structure principally in relation to the top structure while separating it from its base. By installing base isolated devices at the inspiration level and using the ETABS 2018v software to match the various concerts between the fixed base condition and base isolated condition, the goal of this study is to reduce the bottom shear, story acceleration, story drift, and column and beam forces caused by earthquake ground excitation applied to the superstructure of the building. The G+6 symmetrical RCC building is used as the test model in this study. As the basic isolation structure for this investigation, lead rubber bearing, and high damping rubber bearing are used. On both permanent and base isolated structures, nonlinear time history analysis is used. There are two parts to comparative research. Fixed and base isolated structures are compared, as are performance studies using two distinct time histories, such as El Centro and Bhuj. The two-time histories analysis between fixed and base isolated conditions is used to compare base shear, displacement, acceleration, narrative drift, column and beam forces, and more. It has been discovered that base separated buildings enhance displacement. Column and beam forces, base shear, story drift, and acceleration are all lower in base separated buildings than in fixed base structures.*

***Key Words***: Time History Analysis, G+7 Storey Building, E-tabs, Modeling.

## 1. INTRODUCTION

When an earthquake strikes, it significantly damages property, especially buildings that were built by humans. Significant progress has been made in the last 20 years in the field of structural seismic protection. But during the past few years, the ductility design idea has been fully embraced in the development of earthquake-resistant building designs. It has been demonstrated that the performances of ductility-design structures during significant earthquakes are inadequate. The most widely used and approved earthquake protection method today is isolation.

Since a rubber isolation system was used at a grade school in Skopje, Yugoslavia to safeguard the building from earthquakes, the idea of isolation has become commonplace. Currently, multilayer isolation bearings produced by vulcanizing rubber sheets to thin steel reinforced plates are in use. These bearing systems are extremely rigid in the vertical direction, carrying the structure's vertical load, and extremely flexible in the horizontal direction, allowing for lateral maneuverability even in the presence of severe ground motion.

The earthquakes are unavoidable and happen. In that regard, we must acknowledge the demand and ensure that the capacity outpaces it.

Building strength and capacity must be improved to counteract inertia forces brought on by the earthquake in order to prevent structural damage. High seismic zones can experience accelerations that are more than one or even two times greater than the acceleration caused by gravity. It is simple to understand the strength required to withstand the magnitude of the load, which implies that the building could withstand gravity applied sideways and be supported horizontally without suffering damage.

## 2. OBJECTIVE

- ETABS software is used to model and analyze fixed base structures before researching the impact of earthquake ground motions.
- To create and research the design of a multi-story structure.
- Using ETAB 2018 Detailer, design reinforcement for columns and beams together with slab and foundation details.
- Gaining knowledge of load determination using IS standards.
- To support a structure for a longer life, use seismic loading and research time history analysis.
- Attempting to find a carrier in the real estate design platform.

## 3. METHODOLOGY

ETABS 2018 software is used to model the fixed base building. Building with G+7 floors and a fixed base is termed RCC. El Centro, Bhuj, and Nagpur area data are used for the design and analysis of building.

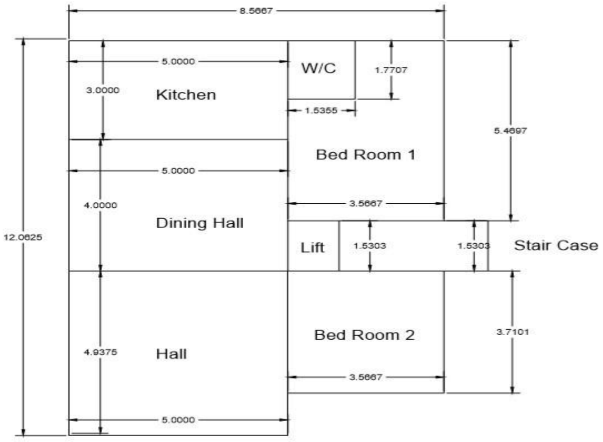



**Fig.1** Plan

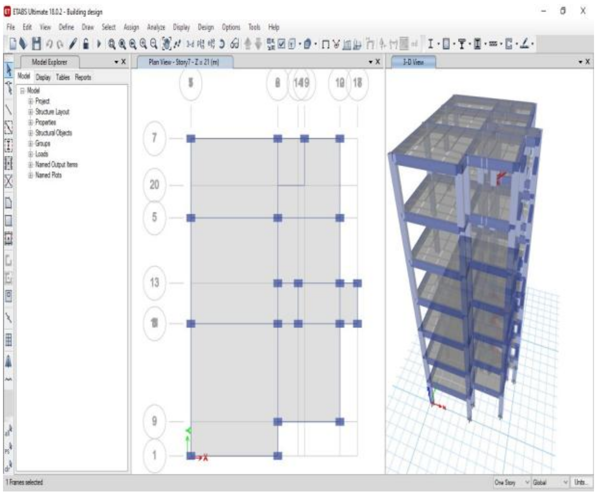


**Fig.2** 3D Plan

### 3.1 Building Details

Number of stories = G+7

Foundation level to ground level = 3m

Floor to floor heigh = 3

Wall thickness = 300mm

Live load on all floors = 4kN/m$^2$

Floor finish = 1kN/m2

Water proofing = 2kN/m2

Self-weight = Soft Calculated

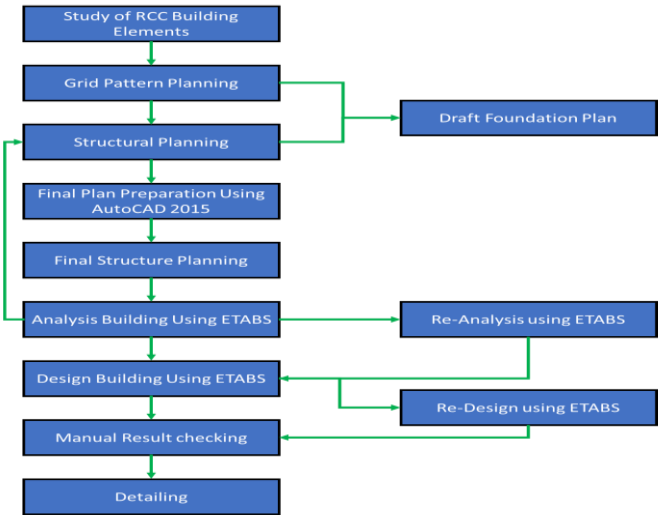
Materials = M30andFe415

Size of column = 300 X 500mm

Size of beam = 300x600mm

Depth of slab = 120mm

Seismic zone = 2




## 4. ANALYSIS REULTS

### 4.1 Shear force results

Model has undergone analysis in accordance with the loading circumstances, and in that regard, it offers the findings of shear force and bending moments.

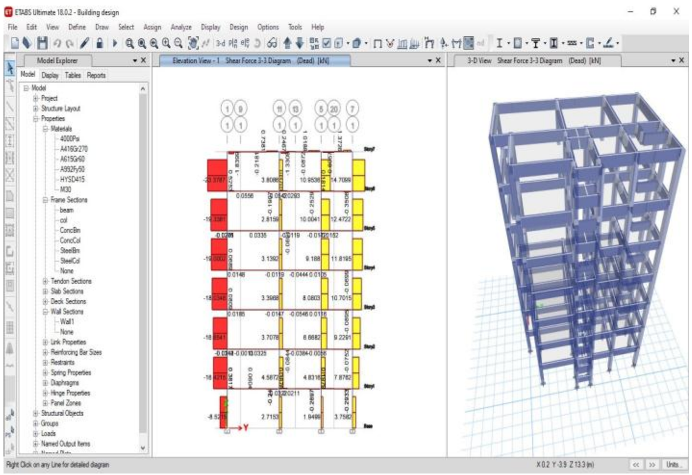


**Fig.3** Shear Force Result

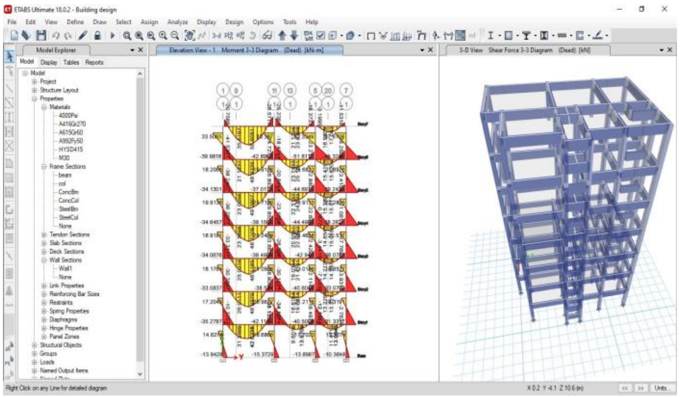


**Fig.4** Bending Moment Result

With the use of the ETAB 2018 Software, shear force and bending moments are identified, and it helps to pinpoint the failure utilizing ETAB during design when it does not reflect the reinforcement.

### 4.2 Design Output

The design technique may be carried out and the design reinforcement as shown below provided based on the findings of the shear force and bending moments.

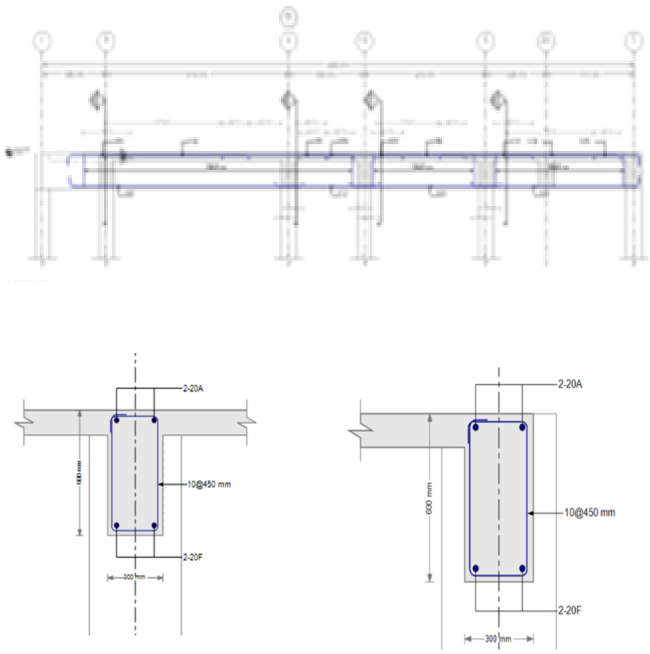



**Fig.5** Beam Design

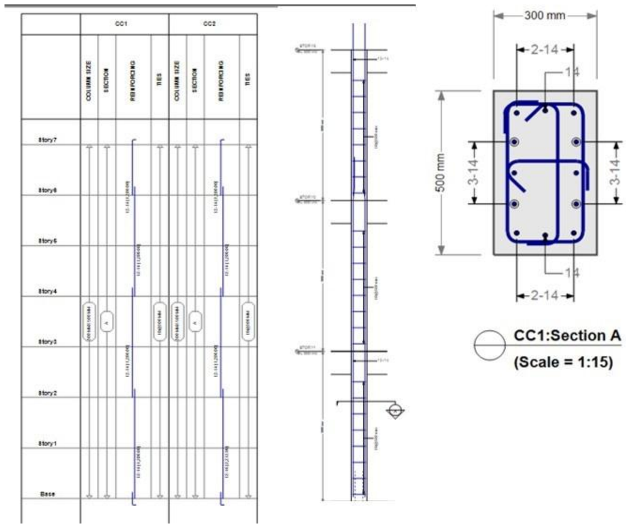



**Fig.6** Column Design

### 4.3 Time History Analysis

A multistory RC structure is subjected to a seismic non-linear time history analysis for the Landers, Kobe, and Chi-Chi earthquakes. The following findings may be taken from the current investigation.

For the structure, the seismic responses known as base shear and story displacements in both directions (x, y) are discovered.

The use of seismic procedures like foundation isolation and seismic dampers is made possible by time history analysis, which provides building acceleration and drift based on historical earthquake data. This study will assist designers create and execute seismic reprofiling's or base isolations for the sustainability of the building by identifying the behavior in terms of building acceleration and drift that would result from an earthquake.

We added the magnitude of the Latur earthquake to the Degn model and obtained the following findings in terms of acceleration in the X direction. This value must match 90% of the EQX+ load in order to be considered safe.

Base Reactions

File Edit Format-Filter-Sort Select Options

Units: As Noted

Filter:

| Output Case | Case Type | Step Type | Step Number | FX kN | FY kN | FZ kN | MX kN-m | MY kN-m | MZ kN-m |
|---|---|---|---|---|---|---|---|---|---|
| Modal | LinModEigen | Mode | 10 | -38.0918 | -1.6757 | 0 | 4.3823 | -86.7289 | 222.4873 |
| Modal | LinModEigen | Mode | 11 | 0.0279 | -16.5702 | 0 | 23.5409 | -0.6403 | -25.6816 |
| Modal | LinModEigen | Mode | 12 | 1.068 | -22.5872 | 0 | -4.4503 | -1.8916 | -146.1498 |
| Dead | LinStatic | | | 0 | 0 | 16897.1509 | 109959.7509 | -83200.2228 | 0 |
| Live | LinStatic | | | 0 | 0 | 0 | 0 | 0 | 0 |
| EQX+ | LinStatic | Step By Step | 1 | -526.6288 | 0 | 0 | 0 | -8734.9898 | 3410.1897 |
| EQX+ | LinStatic | Step By Step | 2 | -526.6288 | 0 | 0 | 0 | -8734.9898 | 3410.1897 |
| EQX+ | LinStatic | Step By Step | 3 | -526.6288 | 0 | 0 | 0 | -8734.9898 | 3410.1897 |
| timehistory | NonModHist | Max | | 374.1191 | 3.1598 | 0 | 40.758 | 5231.9285 | 2755.4813 |
| timehistory | NonModHist | Min | | -424.0116 | -2.7562 | 0 | -44.2176 | -6317.6339 | -2428.3804 |
| DCon9 | Combination | | | 0 | 0 | 25345.7263 | 164939.6264 | -124800.3342 | 0 |
| DCon10 | Combination | | | 0 | 0 | 25345.7263 | 164939.6264 | -124800.3342 | 0 |
| DCon11 | Combination | Max | | -631.9545 | 0 | 20276.581 | 131951.7011 | -110322.2551 | 4092.2277 |
| DCon11 | Combination | Min | | -631.9545 | 0 | 20276.581 | 131951.7011 | -110322.2551 | 4092.2277 |

**Fig.7** Base Reaction

We included the magnitude of the Latur earthquake in the design model, and as a consequence of the data below, we discovered that the drift reflected the drift in terms of E, which is too little, making it SAFE.

Story Accelerations

File Edit Format-Filter-Sort Select Options

Units: As Noted

Filter:

| Story | Output Case | Case Type | Step Type | Step Number | UX mm/sec² | UY mm/sec² | UZ mm/sec² | RX rad/sec² | RY rad/sec² |
|---|---|---|---|---|---|---|---|---|---|
| Base | timehistory | NonModHist | Max | | 246.54 | 0 | 0 | 0 | 0 |
| Base | timehistory | NonModHist | Min | | -297.88 | 0 | 0 | 0 | 0 |
| Story1 | timehistory | NonModHist | Max | | 314.42 | 8.79 | 35.49 | 0.011 | 0.043 |
| Story1 | timehistory | NonModHist | Min | | -297.88 | -12.96 | -31.83 | -0.012 | -0.06 |
| Story2 | timehistory | NonModHist | Max | | 413.62 | 14.99 | 63.01 | 0.011 | 0.054 |
| Story2 | timehistory | NonModHist | Min | | -348.77 | -15.51 | -59.63 | -0.013 | -0.065 |
| Story3 | timehistory | NonModHist | Max | | 528.59 | 14.38 | 84.56 | 0.012 | 0.069 |
| Story3 | timehistory | NonModHist | Min | | -508.41 | -15.61 | -80.75 | -0.013 | -0.061 |
| Story4 | timehistory | NonModHist | Max | | 652.49 | 12.98 | 101.03 | 0.014 | 0.081 |
| Story4 | timehistory | NonModHist | Min | | -687.45 | -14.38 | -93.22 | -0.015 | -0.064 |
| Story5 | timehistory | NonModHist | Max | | 776.68 | 18.24 | 112.23 | 0.015 | 0.072 |
| Story5 | timehistory | NonModHist | Min | | -888.42 | -15.84 | -97.64 | -0.017 | -0.074 |
| Story6 | timehistory | NonModHist | Max | | 891.84 | 22.93 | 117.44 | 0.014 | 0.053 |
| Story6 | timehistory | NonModHist | Min | | -1094.65 | -22.97 | -97.77 | -0.017 | -0.076 |

**Fig.8** Story Drift

We can determine the acceleration will be impacted by the earthquake load with regard to Time in Sec as indicated below based on the results.

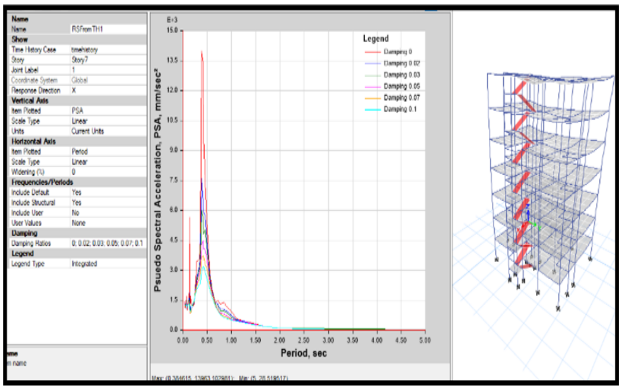



**Fig.9:** Time history analysis results

## 5. CONCLUSION

Multi-model analysis tools for earthquakes are provided by ETAB software.

ETAB assists with model design and in producing reinforcement details in accordance with Standards.

For a better knowledge of building design, the time history analysis tool helps to present the building acceleration and building drift.

Using the ETAB programme, we learnt about building design, which helped us land a job in the real estate industry.

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