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Seismic Analysis of Multi-storeyed Building Supported on Triple Friction Pendulum Bearing and Isolators Using Etab Software

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Abstract - The Triple Contact Pendulum Bearing presented by analysts comprise of four sunken surfaces and free pendulum instruments which are utilized to isolate the base and superstructure at establishment and keep it from Seismic wave's vibration and ground development during tremor.

In late time, zone I of quake district in India is decreased and a portion of the zone 4 locale is changed over into zone 5 and zone 3 area is changed over into zone 4. Thus, the prerequisite of seismic investigation of skyscraper structure is fundamental for these areas according to the new zones proposed by Administration of India. There are not many strategies which are utilized for seismic investigation of designs. Presently utilization of Base Disengagement procedure for Seismic examination of skyscraper structure through rubbing based bearing is embraced by the scientists. In this examination Triple Contact Pendulum Bearing is utilized.

The essential target of the current review is to complete the investigation of G+13 multistoried structure upheld on Triple Contact Pendulum Bearing in Etab 2016 and examination of it with fixed base design on various boundaries

***Key Words*:** Triple Contact Bearing, Seismic Investigation, Base Detachment. Multistory Structure

1. INTRODUCTION

In today's trend of urbanization large number of peoples are working and living in tall buildings. Most of the cities are located in regions of strong earthquake prone areas. So, seismic design of these costly and highly populated tall building is always a critical concern for engineers and general public. As a result minimum requirement for structural safety and seismic design code for general structure is not enough for tall building.

To achieve seismic resiliency in design of these tall buildings, new techniques were studied and implemented. One efficient approach used by researcher to enhance seismic performance is use of seismic/base isolation systems with energy dissipation devices.

2. Objective

- To model a important moment resisting frame RCC Structure (G+13 Storey) with fixed base.
- To model a important moment resisting frame RCC Structure (G+13 Storey), isolating from base using Triple Friction Pendulum Bearing.
- To analyze above both reinforced RCC cement concrete frame structures by using Etab 2016 software.
- To compare the dynamic structural response of fixed base reinforced cement concrete frame structure and isolated base reinforced cement concrete frame structure on various parameters.
- To check the re-centering capacity of isolated base reinforced cement concrete frame structure.

Table -1:

TABLE: TIME HISTORY			
Time	Base FX	Time	Base FX
sec	kN	sec	kN
0.1	-39.5214	0.9	-349.5524
0.2	-78.287	1	-3888.199
0.3	-116.9286	1.1	-389.688
0.4	-155.4796	1.2	-389.688
0.5	-194.1218	1.3	-389.115
0.6	-233.438	1.4	-389.426
0.7	-272.9771	1.5	-389.905
0.8	-311.7304	1.6	-388.616

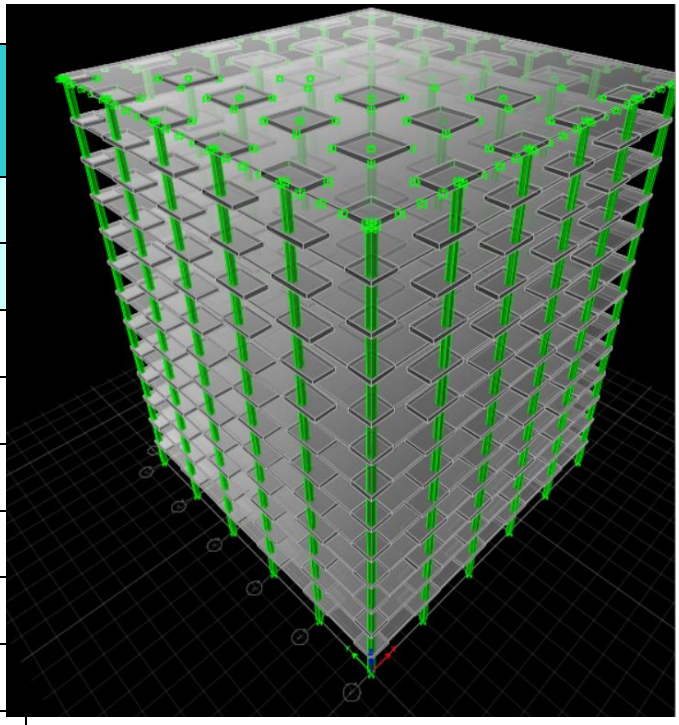


Fig -2: 1 3-D view of structure designed in Etab 2016

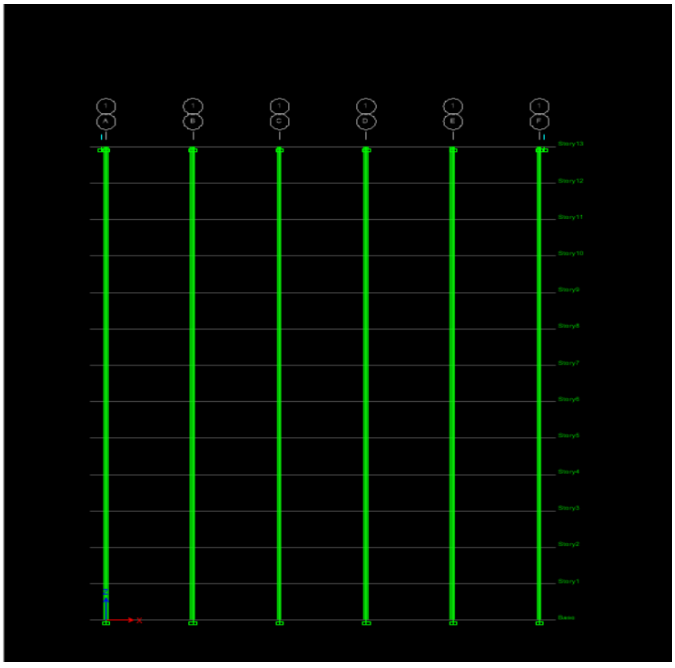
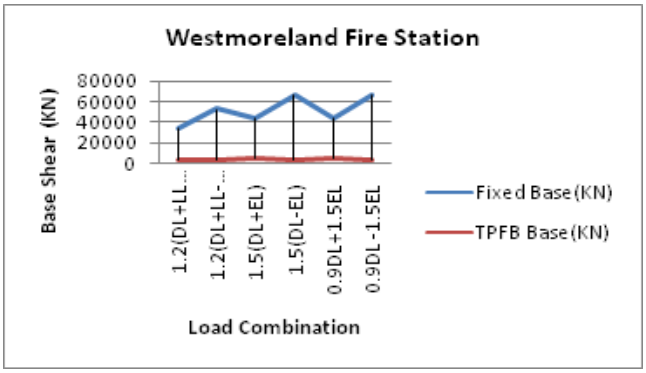
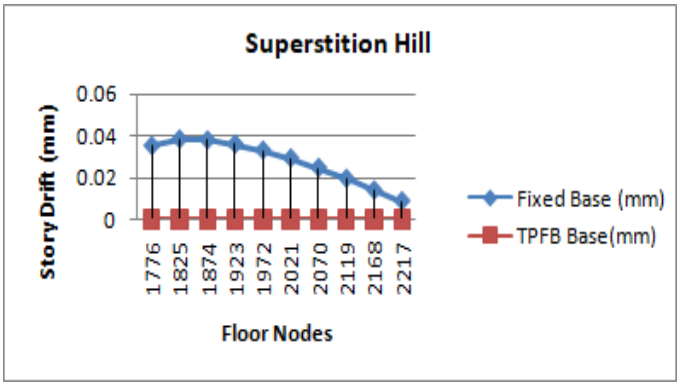
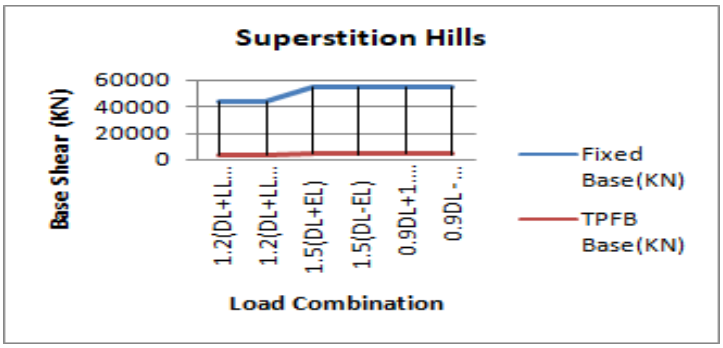


Fig -1: X-Z Plane View of structure designed in Etab 2016

Charts







3. RESULTS

The Results of seismic analysis of both the structures are discussed here, with a fixed base support and with Triple friction pendulum bearing support and comparison is made.

The following parameters are discussed here –

1. Base Shear- It is the maximum lateral force that will occur due to seismic ground motion at the base of a structure.
2. Storey Drift- It is the displacement of one story with respect to the other storey.
3. Time Period - It is the fundamental time period of the structure.

4. CONCLUSIONS

1. Due to the use of triple friction pendulum bearing, there is 30% increase in the fundamental time period of the structure and it has been also observed that time period of fixed base structure is same in all the three cases as it depends upon the mass and stiffness of the structure.

In case of isolated structure it varies because it depends upon the parameters of triple friction pendulum bearing rather than mass and stiffness of the structure but in our study it is same for all 3 cases as we haven't changed the parameters of triple friction pendulum bearing.

2. There is also a great reduction in the base shear of the building of about 90-95 % which reduces the stiffness of structure leads to resist the lateral movement of structure during seismic activity due to the use of triple friction pendulum isolator at the base. It is observed that with increase in Coefficient of friction, it will increase the stiffness of structure which leads to increase in base shear.

I .CASE	Fixed	Isolated %	Reduction
II. Superstition Hill 92.8	54874.951 KN	3927.476 KN	
III. Westmoreland 95.1	65979.077 KN	3190.824 KN	
WAHO, Loma prieta 93.8	57728.193 KN	3531.303 KN	

3. There is also a drastic reduction of about 90% in the story drift of the structure of every floor from ground to the top which makes the structure stable and structure behaves as two separate Sub structure and Superstructure.

4. All the movement of the structure during seismic activity is absorbed by the Isolator and prevents the structure from demolishing.

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