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Seismic Analysis of RCC Framed Structure Using Different Isolator

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Abstract – *The present study is done on a G+5 storey building considering three models where the first model is framed structure without base isolation and second and third models indicate the base-isolated structure using Friction pendulum bearing and High-density rubber bearing. The main objective is to study the dynamic response of the structure with and without base isolation. Throughout this paper, various structural aspects of the building like storey drift, storey displacement, base shear were studied. The modeling procedure for both buildings has been done using ETABS 2017 software for a regular (G+5) storey. Linear analysis using Time History Analysis (THA) for the records of Elcentro earthquake (1940) and Response spectrum analysis (RSA) has been carried out*

***Key Words*: :** Base Isolation, FPB, HDRB, Time History Analysis (THA) and Response spectrum analysis (RSA)

1.INTRODUCTION

The Indian landmass encompasses a history of devastating earthquakes. The shaking recollection of the high-intensity earthquake of Bhuj and Lathur still linger in the memories. Geographically information on India shows that nearly fifty-nine percent of the land is vulnerable to earthquakes. In recent times many systems have been developed and utilized in many applications all over the world and seismic isolation has become a relevant and important way to improve the seismic response in the design of new buildings and in the retrofitting of existing ones.

1.1 Base isolation

Base isolation, also known as seismic base isolation. It is one of the most popular means of protecting a structure against earthquake forces. It is the design strategy that can reduce the effect of earthquake ground motion by decoupling the superstructure from the foundation. The installation of isolators in a building at a base level significantly increases the time period of the structure which means it reduces the possibility of resonance of the structure giving rise to better seismic performance of the building. Base isolation has become popular in the last couple of decades in its implementations in buildings and bridge.

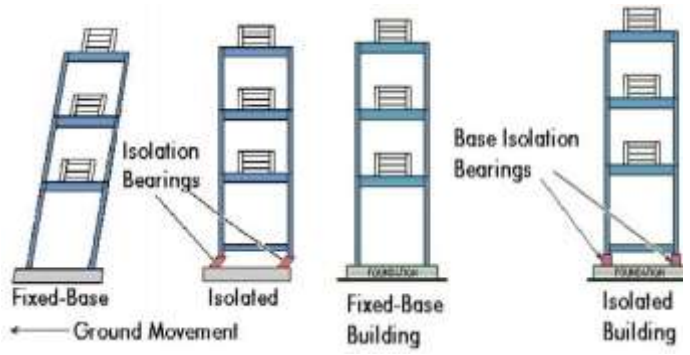
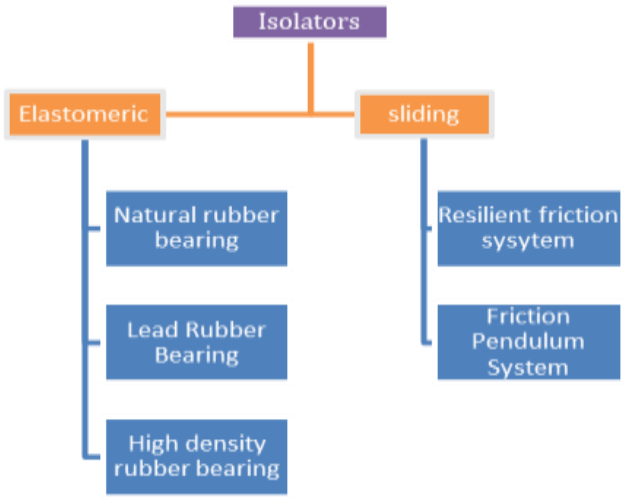


Fig -1: Base Isolation System

2. Types of Bearings

Many types of isolation systems have been proposed and developed to varying stages. There are two families of isolator particularly elastomeric bearing and sliding bearing. In the present study, we considered friction pendulum bearing and high-density rubber bearing.



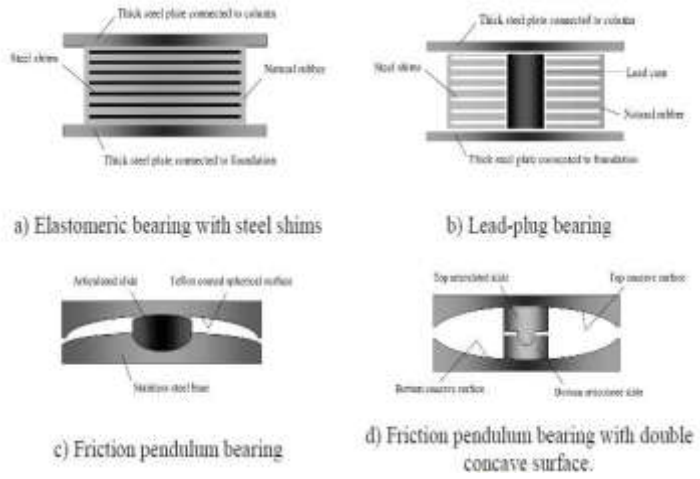


Fig -2: Cross-section of types of Bearing

Friction Pendulum Bearings

The friction pendulum bearing is a widely used bearing based on the principle of sliding system and with a pendulum type isolators to provide a damping function using friction. The FPS has an articulated slider moving on a spherical friction surface. The surface of the articulated slider in coated with a self-lubricating composite material.

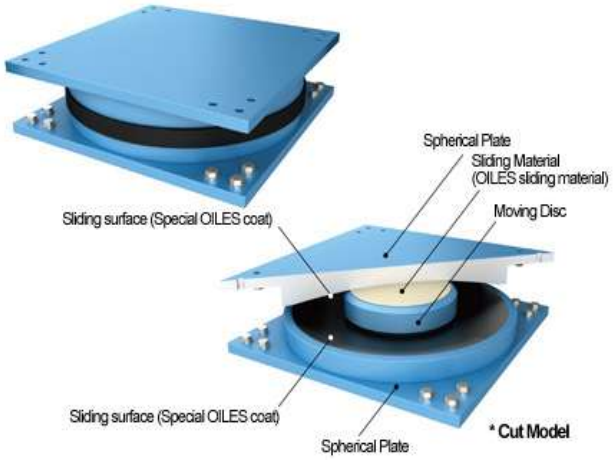


Fig -3: Friction Pendulum Bearing

High-Density Rubber Bearing

High-density rubber bearing is another type of elastomeric bearings which consist of a thin rubber layer of high damping rubber and steel plates in alternate layers.

Fig 4:- High-Density Rubber Bearing

3. MODELING AND ANALYSIS

The modeling of a fixed base and base-isolated building is done by ETABS 2017 software. G+5 stories RCC building is considered with a fixed base and base-isolated with two different isolators they are friction pendulum bearing and High-density rubber bearing. Time history analysis and response spectrum analysis is done by using Elcentro data.

Table -1: Building Description

Type of building	Residential apartment
Height of building	18m
Floor height-	3m
Grade of concrete	M25
Steel grade	Fe415
Slab thickness	150mm
Size of beam	300mmx500mm
Size of column	300mmx500mm
Live load on floor	4kN/ m^2
Floor Finish	1 kN/m^2

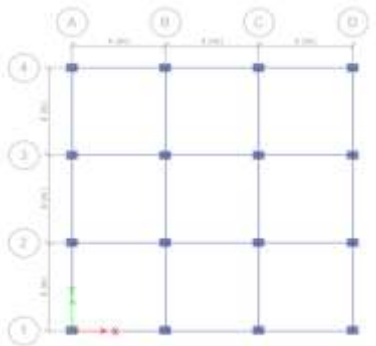


Fig 5: Plan of a proposed building

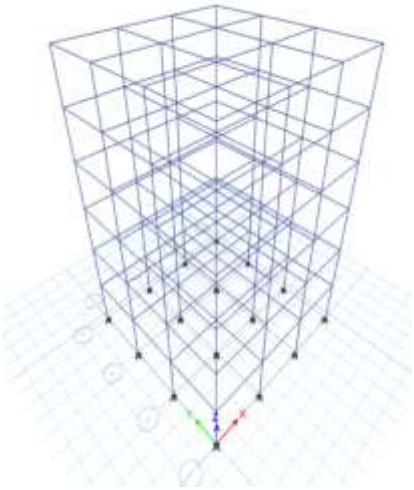


Fig 6: 3D view of the proposed building

4. RESULT

The results shows that the time period and storey displacement are increased in both the isolated building as compared to fixed base and base shear and storey drift is reduced by using the isolator. This suggested that base-isolation is an effective earthquake resistant technique for medium-rise structures.

Storey Displacement

The graph shows the storey displacement for the structure, It is observed that the total maximum displacement is higher in the case of an isolated buildings.

Chart 1: Graph of Storey Displacement

Storey Drift

It is observed that the story drift for the fixed base building is much more than that of base-isolated building.

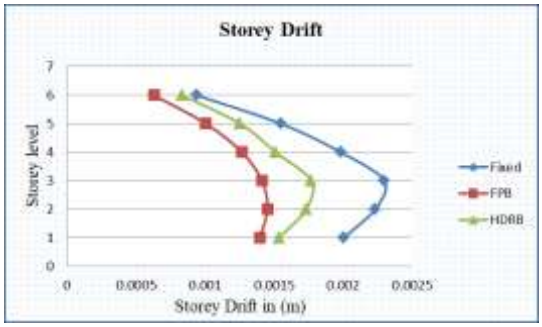


Chart 2: Graph of Storey Drift

Storey Shear

The graph shows the storey shear which is reduced in base-isolated buildings compared to fix based.

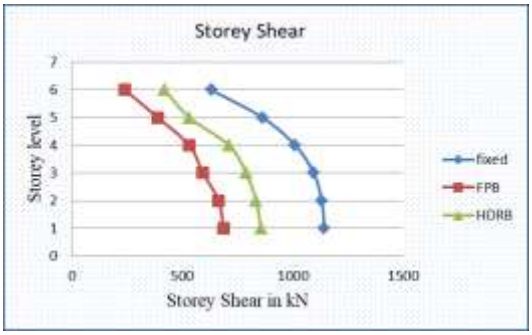
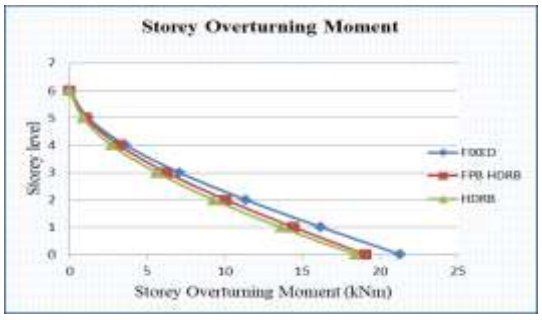


Chart 3: Graph of Storey Shear

Storey Overturning Moment

The graph shows the overturning moment of the structure.



5. CONCLUSIONS

1. Base isolation method has proved as a promising solution of earthquake-resistant design
2. The result shows that the response of the structure can be reduced by using Friction Pendulum bearing and High-Density Rubber Bearing.
3. Time period of both the base-isolated structure increases as compared to the fixed base.

4. The result shows that the storey displacement increases and storey drift reduced in both the isolated building over the conventional structure.

5. The base shear is reduced in both the building by using FPS and HDRB.

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