Seismic Analysis of Building using E-Tabs

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Abstract **- The concept of isolator in building at base level reduces the possibility of resonance pf the structure and increases the time period of the structure giving rise to better seismic performance of the building.This study is performed for comparing the effectiveness of fixed base and base isolated multistoreyed RC framed building .For this study G+5 building is designed and analysed. The Lead Rubber Bearing (LRB) is designed according to IS1893-2002 and UBC -97 and the same was used for the analysis of base isolated system. The results obtained from analysis is Time Period. Time period for the base isolated structure is higher than that of the fixed base structure. The commercial building is anlysed in Etabs-2015.**

Keywords—Isolater,time period,base isolation,Etabs,Lead Rubber bearing.

I. INTRODUCTION

Base isolation of structures is one of the most desired means to protect it against earthquake forces. The term base isolation have two word first is 'base' its meaning is a part that supports from underneath or perform as a foundation of a structure, and second is 'isolation' its meaning of the state of being disparate. During earthquake attacks, the traditional building structures in which the base is fixed to the ground, respond with a gradual increase from ground level to the top of the building, like an amplifier.

This may result in heavy damage or total collapse of structures. To avoid these results, while at the same time satisfying in-service functional requirements, flexibility is introduced at the base of the structure, usually by placing Lead Rubber Bearing isolators between the structure and its foundation. Seismic base isolation is the one of best method among the lateral load resisting systems. The term base isolation uses the word isolation in its meaning of the state of being separated and base as a part that supports from beneath or serves as a foundation for an object or structure. The system namely Lead Rubber Bearing (LRB) selected for this study includes sample of materials such as plate, rubber and central core. It has been selected to establish an innovative simplified design procedure for isolators incorporated in multi-storey building structures. Recent studies have shown that most isolated buildings is important to use multi-layer Laminated Rubber Bearings with steel reinforcement layers. Ease of Use

Objective

To analyse a commercial building in Etabs 2015 software to find out and compare the values of Time period in fixred and base isolated building.

II. MODELLING AND DESIGNING OF BUILDING.

Time period of proposed structures is estimated in the application software i.e. ETABS. The model of prototype structure of given geometry and sizes of elements is prepared in the ETABS. Analysis provids the time period of the structure[1].

The ETABS building is idealized as an assemblage of area, line and point objects.[6] Those objects are used to represent wall, floor, column, beam, and brace and link/spring physical members. The basic frame geometry is defined with reference to a simple three-dimensional grid system. Material properties such as concrete, rebar and section properties such as beam, column are defined as frame element and slab element defined as area element. Modal analysis is done.

Building Configuration.

SLNO	PROPERTIES	BUILDING DATA
1.	No of storeys	G+5
2.	Height of the building.	15.45
3.	Beam .	
	Dimension	240*500mm
	Grade of concrete	M25
	Torsion Constant	0.01
4.	Column	
	Dimension	240*400mm
	Grade of concrete	M30
	Torsion Constant	0.01
5.	Slab	
	Dimension	140mm
	Grade of concrete	M25
6.	Plinth Beam	300*450mm

7.	Dead Load	1.5Kn/mt^2
8.	Live Load	4Kn/mt^2
9.	Soil Type	3
10.	Damping	5%
11.	Load Combination	
	1. 1.5(DL+LL)	
	2. 1.2(DL+LL±Ex)	
	3. 1.2(DL+LL±Ey)	
	4. 1.5(DL±Ex)	
	5. 1.5(DL±Ey)	

A. Design of building.

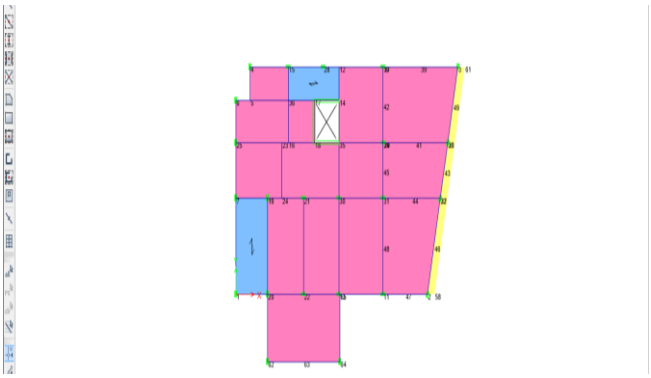

FIG . 1 PLAN OF THE BUILDING.

Grid Dimensions (mt).:

IN X - DIRECTION.

A	B	C	D	E	F	G	H	I	J
0	1.2	2.7	3.9	4.5	5.8	6.7	7.6	8.8	12.6

K	L	M	N
16.4	17.49	18.13	19

IN Y - DIRECTION.

1	2	3	4	5
0	5.7	9	11.5	13.5

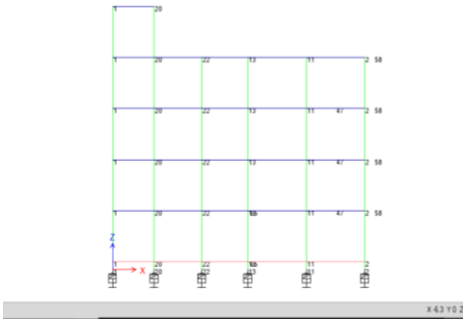

Fig. 2 ELEVATION OF BUILDING.

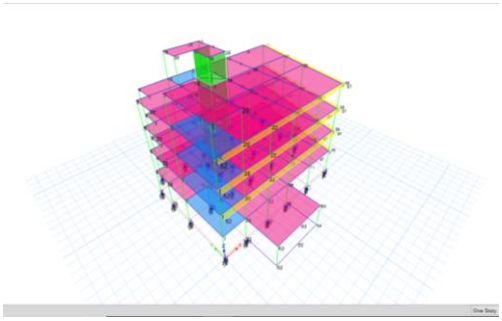

Fig. 33-D VIEW OF THE BUILDING.

III. LEAD RUBBER BEARING.

LRBs are consisting of a standard elastomeric laminated rubber bearing. The rubber compound can be of chloroprene rubber or natural rubber[2]. The shape can be either rectangular or round[3]. For this testing a circle shape is chosen. The LRBs are usually made with low-damping (unfilled) elastomers with shear modules of 0.4 −1.2N /mm2 and lead cores with diameters ranging 15% and 33% of the bonded bearing diameter for circle bearings.[2] The minimum of shear modulus 0.4N /mm2 is taken for the testing performed. The elastomer offers the isolation and recanting, while the lead core provides the damping component or the necessary dissipation of energy[5].

THEORITICALLY CALCULATED VALUES .

SLNO	PROPRTIES	VALUES
1.	Target period	2.5secs
2.	Eff Damping	5%
3.	Design Displacemet(D_d)[5]	0.372mt
4.	Rubber Shear Modulus(G)	1Mpa
5.	Axial load on LRB	1037.71Kn
6.	Eff Stiffness (K_{eff})	836.06KN/mt
7.	Stiffness Ratio	0.1
8.	Post yield Elastic Stiffness (k_1)	7704.1Kn/mt
9.	Post yield Elastic Stiffness (k_2)	770.41kn/mt

Dimensions of LRB.

SLNO	PROPERTIES	VALUES
1.	Total plud diameter (d_{pb})	0.05mt
2.	Single layer rubber thickness	0.01mt
3.	Steel plate thickness	0.003mt
4.	Top and Bottom Plate thickness	25mm
5.	Total height of LRB (H)	0.311mt
6.	Total beraing diameter	0.63mt
7.	No of rubber layers	22
8.	No of steel layers	21

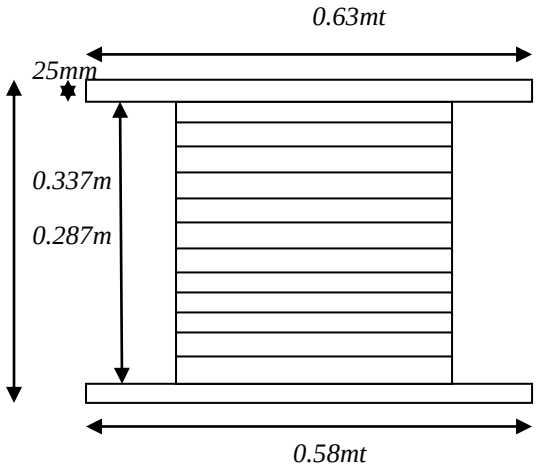

Fig. 4 SECTION OF LEAD RUBBER BEARING

RESULTS

It is observed that tim period of the fixed base structure for different modes is lesser than that of the structure which is base isolated structure .

Mode No	Time period with fixed	Time period with base isolation
1	1.203	1.888
2	1.566	1.703
3	0.491	1.579
4	0.453	0.53
5	0.373	0.455
6	0.284	0.365
7	0.283	0.355
8	0.281	0.283
9	0.279	0.280
10	0.223	0.272
11	0.218	0.271
12	0.206	0.245

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