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Study Response of Fixed Base and Isolation Base

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ABSTRACT:- A natural calamity like an earthquake has taken the tolls of millions of lives through out in past. The nature of induced forces due to earthquake is reckless and last only for short duration of time. The base isolation system separates the structure from its foundation and primarily moves the natural frequency of the structure away from the excitation frequency range through its low stiffness relative to that of the upper structure. Hence base isolation allows a design for smaller seismic forces and higher levels of safety compared with the design of fixed-base structures. Instead, a well-designed isolated building will not suffer any important damages even under strong earthquakes and so no repairing works will be needed. In this study, the response of fixed base and isolated base building is to be studied with different techniques and it is to be studied with the suitable software.
In this paper the (G+25) storied frame structure is taken to compared with the seismic effect of fixed bas structure with respect isolated structure .the (G+25) storied RCC frame structure is design is design with base isolation by using ETAB software by the lead rubber bearing (LRB) is used as an isolator which having efficient result for RCC frame structure over the fixed base structure the report show that the values for lateral loads come very less by using lead rubber bearing .

KEYWORDS:- Base isolation .

I. INTRODUCTION

Earthquake is the sudden release of accumulated energy in the tectonic plates of the earth crust and resulting in propagation of seismic waves. A natural calamity like an earthquake has taken the tolls of millions of lives through out in past. The nature of induced forces due to earthquake is reckless and last only for short duration of time Base isolation system for buildings is introduced to decouple the building structure from potentially damaging induced by earthquake motion, preventing the building superstructures from absorbing the earthquake energy. The mechanism of the base isolator increases the natural period of the overall structure, and decreases its acceleration response to earthquake / seismic motion. Base-isolation relies on the structural bearing, which is the connection element between the superstructure and substructure to dissipate the horizontal displacement, rotation or translation, The bearing that prevents translation is called a fixed bearing or fix point bearing if it is fixed in all directions; it is called a unidirectional movable bearing or a guided bearing. Base shear introduced due to seismic ground acceleration for fixed base building or base-isolated building is investigated throughout this chapter. Also seismic isolation separate the structure from the harmful motion by providing flexible and energy dissipation capability through the inserting of the isolated device so called isolater between the foundation and building structure.

1.1 purpose of base isolation

1. Base isolation is a mechanism that provides earthquake resistance to the new structure.
2. The base isolation system decouple the building from the horizontal ground motion induced by earthquake, and offer a very stiff vertical components to the base level of the superstructure in connection to substructure (foundation).
3. And also It shifts the fundamental lateral period, Ta, dissipates the energy in damping, and reduces the amount of the lateral forces that transferred to the inter-story drift, and the floor acceleration.

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1.2 lead rubber burring

Lead-rubber hysteretic bearings provide in a single unit the combined features of vertical load support, horizontal flexibility and energy absorbing capacity required for the base isolation of structures from earthquake attack and also Lead rubber bearings are elastomeric bearings that contain one or more lead plugs inserted into their preformed holes. The lead provides significant stiffness under service loads and low lateral loads as compare to elastomeric bearings. Advantage of lead rubber bearing Simple o manufacture ,Easy to modal and installation ,Economic design ,The more excellent safety and disadvantage is Need supplemental damping system . Lead rubber bearing is a system that is comprised of rubber and stiffening plate layers with a mechanism at the centre of the isolators made of lead to dissipate energy. the lead rubber elastomeric bearing system performed effectively in reducing acceleration in the horizontal direction. The performance of the lead-rubber bearings were effective in reducing the seismic effect onto equipment under various floor accelerations .

1. MODELING PROCEDURE IN SOFTWARE

The modelling procedure of isolated base and fixed building in ETAB and design stapes of isolated and response spectrum analysis using UBC 97 for isolated building has been carried out and seismic design procedure has been done using IS 1893:2000(part 1)for the following data is used .

- Grade of concrete M20 and steel Grade of steel Fe500
- Floor to floor height is 3.5
- Depth of foundation below GL, parapet height is 1m, slab thickness is 150 mm
- Size of columns 300X700,size of beam 300X450
- Live load of floor = 3kN/m^2 live load of roof = 1kN/m
- Site located in seismic zone 4 and for zone four Z=0.24
- Building is resting on medium soil , for that imported factor as 1
- Density of concrete =25kn/m^3
- Density of masonry wall =20kN/m^3

Using the above in (G+25) RCC frame the building has been analysed and design for fixed base and isolated bas with lead rubber bearing for earthquake forces by ETABS software.

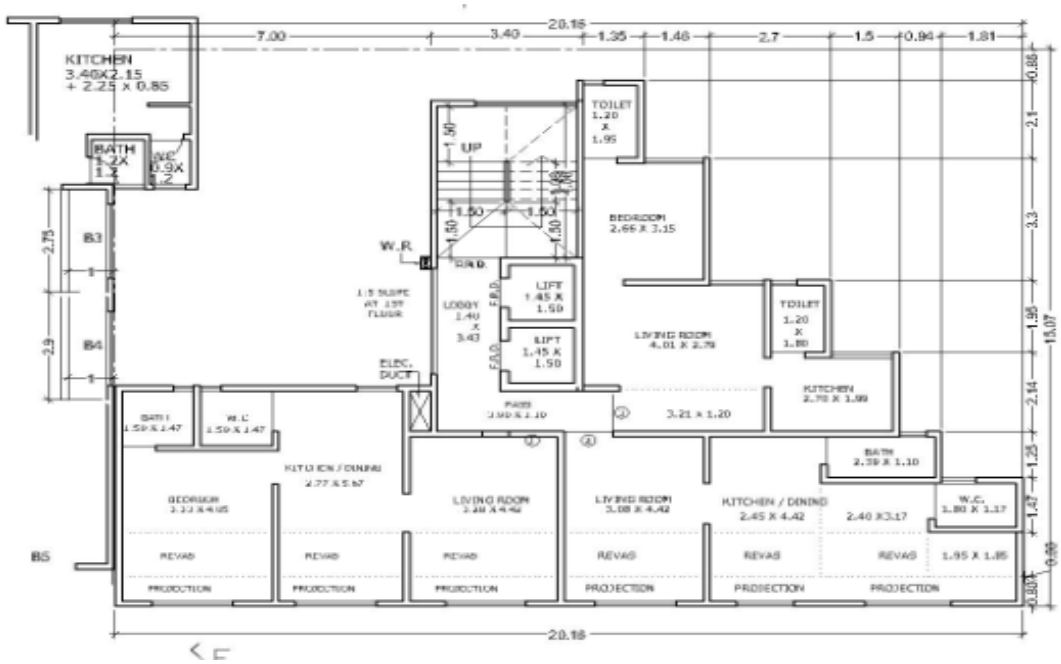

Figure 1: plan for design

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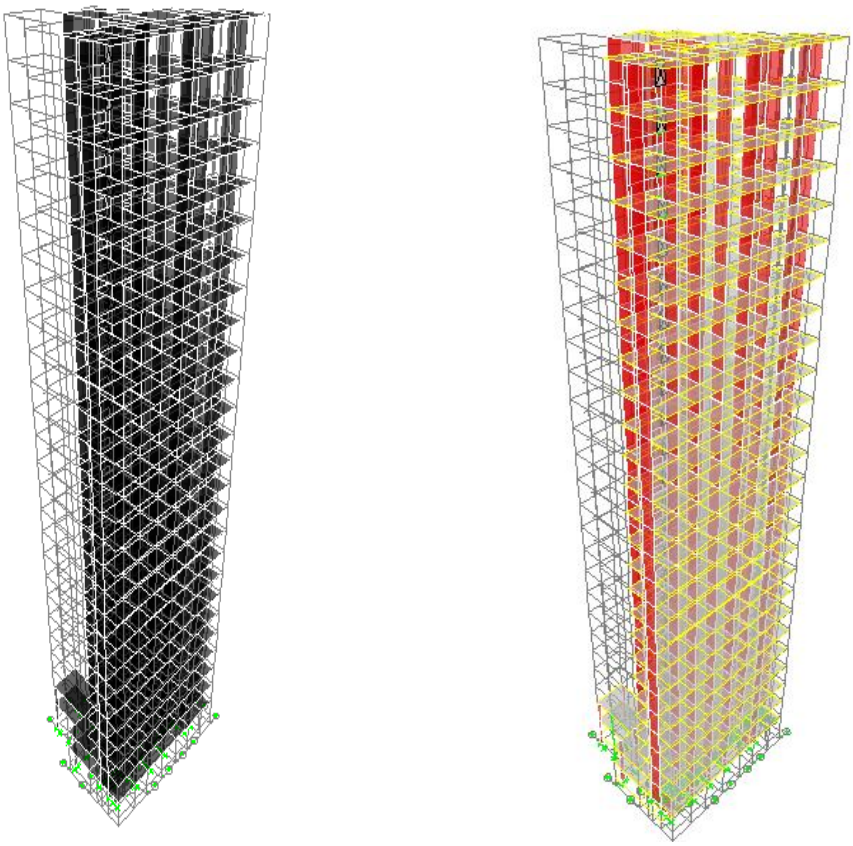

(SI) (FB)

Figure 2: analytical model

II. RESULT

All performance of base isolator is best than fixed based building, it can be used for general purposes or initial cost of structure increases tremendously. But safety it should be providing at such as hospitals, police station, & public places etc. it should be provided. It is observed that in case of fixed base building it is not possible to achieve the Intermediate occupancy and Life Safety performance level but it is possible in base isolated building. It is observed that the story drift at EQ-X direction fixed base building and base isolated building is same & story drift at EQ-Y direction fixed base building is more than base isolated building.

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Table1: Story displacement (m)

STORYNo	Story displacement			
	In -X direction		In- Y direction	
	(Fixed Base)	(Base Isolated)	(Fixed base)	Base Isolated
	Disp	Disp	Disp	Disp
TERRACE	0.0223	0	0.0306	0
STORY25	0.0215	0	0.0295	0
STORY24	0.0207	0	0.0285	0
STORY23	0.0198	0	0.0274	0
STORY22	0.019	0	0.0262	0
STORY21	0.0181	0	0.0251	0
STORY20	0.0172	0	0.0239	0
STORY19	0.0163	0	0.0227	0
STORY18	0.0153	0	0.0214	0
STORY17	0.0144	0	0.0202	0
STORY16	0.0134	0	0.0189	0
STORY15	0.0125	0	0.0176	0
STORY14	0.0115	0	0.0163	0
STORY13	0.0105	0	0.015	0
STORY12	0.0095	0	0.0136	0
STORY11	0.0086	0	0.0123	0
STORY10	0.0076	0	0.011	0
STORY9	0.0066	0	0.0096	0
STORY8	0.0057	0	0.0083	0
STORY7	0.0048	0	0.007	0
STORY6	0.0039	0	0.0057	0
STORY5	0.003	0	0.0045	0
STORY4	0.0022	0	0.0033	0
STORY3	0.0014	0	0.0023	0
STORY2	0.0008	0	0.0013	0
STORY1	0.0003	0	0.0006	0
Base	0.0001	0	0.0001	0

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Table 2: Story Drift in both direction (m)

STORYNo	Story Drift (m)			
	In -X direction		In- Y direction	
	(Fixed Base)	(Base Isolated)	(Fixed base)	Base Isolated
	Drift	Drift	Drift	Drift
TERRACE	0.000275	0	0.00036	0
STORY25	0.000291	0	0.00037	0
STORY24	0.000307	0	0.000382	0
STORY23	0.000323	0	0.000395	0
STORY22	0.000338	0	0.000407	0
STORY21	0.000352	0	0.000418	0
STORY20	0.000366	0	0.000427	0
STORY19	0.000379	0	0.000436	0
STORY18	0.000392	0	0.000443	0
STORY17	0.000404	0	0.000449	0
STORY16	0.000416	0	0.000454	0
STORY15	0.000426	0	0.000458	0
STORY14	0.000436	0	0.00046	0
STORY13	0.000444	0	0.000461	0
STORY12	0.00045	0	0.000461	0
STORY11	0.000455	0	0.00046	0
STORY10	0.000457	0	0.000456	0
STORY9	0.000456	0	0.000451	0
STORY8	0.000451	0	0.000442	0
STORY7	0.000439	0	0.000431	0
STORY6	0.000419	0	0.000415	0
STORY5	0.000387	0	0.000393	0
STORY4	0.000332	0	0.000362	0
STORY3	0.000241	0	0.000318	0
STORY2	0.000144	0	0.000246	0
STORY1	0.000144	0	0.000152	0
Base	0.000000	0	0.000078	0

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Table 3: Story lateral load (kN)

STORYNo	Story lateral load			
	In -X direction		In- Y direction	
	(Fixed Base)	(Base Isolated)	(Fixed base)	Base Isolated
	FX	FX	FY	FY
TERRACE	95.44	0.47	90.41	0.45
STORY25	106.52	0.21	100.91	0.2
STORY24	98.33	0.4	93.15	0.38
STORY23	90.46	0.37	85.7	0.35
STORY22	82.93	0.34	78.56	0.32
STORY21	75.72	0.31	71.73	0.29
STORY20	68.84	0.28	65.22	0.27
STORY19	62.29	0.26	59.01	0.24
STORY18	56.06	0.23	53.11	0.22
STORY17	50.17	0.21	47.53	0.19
STORY16	44.42	0.18	42.08	0.17
STORY15	39.51	0.16	37.43	0.15
STORY14	34.44	0.14	32.63	0.13
STORY13	29.85	0.12	28.28	0.12
STORY12	25.59	0.1	24.25	0.1
STORY11	21.66	0.09	20.52	0.08
STORY10	18.06	0.07	17.11	0.07
STORY9	14.78	0.06	14.01	0.06
STORY8	11.84	0.05	11.21	0.05
STORY7	9.100	0.04	8.62	0.04
STORY6	7.000	0.03	6.64	0.03
STORY5	4.960	0.02	4.69	0.02
STORY4	3.300	0.01	3.13	0.01
STORY3	2.010	0.01	1.91	0.01
STORY2	1.210	0.003	1.15	0.002
STORY1	0.550	0.001	0.52	0.001
Base	0.000	0.000	0.000	0.00

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Table 4: Story Shear (kN)

STORYNo	Story shear			
	In -X direction		In- Y direction	
	(Fixed Base) shear	(Base Isolated) shear	(Fixed base) shear	Base Isolated Shear
TERRACE	109.79	0.07	103.49	0.1
STORY25	225.18	0.15	211.39	0.2
STORY24	315.8	0.21	295.68	0.29
STORY23	383.46	0.28	357.97	0.37
STORY22	431.68	0.34	401.78	0.45
STORY21	464.99	0.4	431.59	0.51
STORY20	487.8	0.46	451.7	0.57
STORY19	503.6	0.51	465.52	0.61
STORY18	514.94	0.57	475.47	0.65
STORY17	523.82	0.62	483.43	0.68
STORY16	532.17	0.66	491.09	0.7
STORY15	541.88	0.71	500.1	0.72
STORY14	554.53	0.75	511.95	0.74
STORY13	571.22	0.79	527.93	0.76
STORY12	592.44	0.83	548.92	0.79
STORY11	618.16	0.87	575.18	0.82
STORY10	647.76	0.9	606.17	0.85
STORY9	680.34	0.93	640.77	0.89
STORY8	715.27	0.96	677.84	0.93
STORY7	752.75	0.98	716.61	0.96
STORY6	793.31	1	756.57	1
STORY5	836.28	1.02	796.71	1.04
STORY4	878.46	1.03	834.76	1.06
STORY3	914.52	1.04	867.19	1.08
STORY2	944.33	0.88	894.35	1.05
STORY1	962.48	0.81	912.14	1.03
Base	964.38	0.8	913.8	1.02

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III. CONCLUSIONS

1. The Base-isolated structure exhibit less lateral deflection, as the lateral displacement at the base never equals to zero, and less moment values than the fixed base structure.
2. The base isolation decouples the building from the earthquake-induced load, and maintain longer fundamental lateral period than that of the fixed base.
3. Base isolation, also known as seismic base isolation or base isolation system, is one of the most popular means of protecting a structure against earthquake forces.
4. Base isolation is one of the most powerful tools of earthquake engineering pertaining to the passive structural vibration control technologies.
5. Base isolation is a system that protects a building from the damaging erects of a seismic movement. If the structure separates form the ground during an earthquake, the ground is moving but the structure is still dormant.
6. The (G+25) stories frame structure is design with base isolation by using the ETABS software lead Rubber bearing (LRB) is used as isolator which having efficient result for frame structure over the fixed base structure than any other isolation system.

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