SEISMIC EXCITATION USING LEAD RUBBER BEARING IN LOW RISE TO HIGH RISE BUILDING

Kiran jyoti Chhetri[1], Prof. D.L Budhlani [2]

[1]*Student, Department of civil engineering, Guru Nanak Institute of Technology, Nagpur*
[2]*Professor, Department of civil engineering, Guru Nanak Institute of Technology, Nagpur*

Abstract-The main aim of this project is to carry out modelling and analysis of fixed base and base isolated building by using E-tab 2016 software and study the effect of earthquake on this model. The model which have been adopted for study are symmetric five storey (G+5), ten storeys (G+10) Fifteen storeys (G+15), twenty storeys(G+20) separately for fixed base and base isolation.

Keywords-To carry out comparison between fixed base and base isolated building on the basis of their dynamic properties like maximum shear force, maximum bending moment, base shear, story drift and story's acceleration.

1.Introduction

Conventional seismic design attempts to make buildings that do not collapse under strong earthquake shaking, but may sustain damage to non-structural elements and to some structural members in the building. Non-structural components may consist of furniture, equipment, partitions, curtain wall systems, piping, electrical equipment and many other items. There are mainly three main categories: architectural components, mechanical and electrical equipment's and building contents. This may render the building non-functional after the earthquake, which may be problematic in some structures, like hospitals, which need to remain functional during the earthquake. Non-structural components are sensitive to large floor accelerations, velocities, and displacements. When a building is subjected to an earthquake ground motion, the building induces motion, resulting in floor accelerations higher than the ground acceleration. Hence, it is present need and also a duty of civil engineers to innovate earthquake resisting design approach to reduce such type of structural damages. Special techniques are required to design buildings such that they remain practically undamaged even in a severe earthquake. There are two basic technologies used to protect buildings from damaging earthquake effects. These are base isolation devices and seismic dampers. The idea behind base isolations to detach (isolate) the building from the ground in such a way that earthquake motions are not transmitted up through the building, or at least greatly reduced. Seismic dampers are special devices introduced in the building to absorb the energy provided by the ground motion to the building (much like the way shock absorbers in motor vehicles absorb the impacts due to undulations of the road).

1.1 Advantageous of E-tab

1.Easy and quick model creation for any type of structure.
2.Creation of 3D model with utilization of plan and view.
3.Automatic consideration of self-weight of material.
4.Automatic creation of seismic load and wind load.
5.Load combination as per your defined building code is also automated.
6.Easy report and documentation.

1.2 Loads and load combination

Loads considered: Dead load: the load due to its self-weight.
Live load: for residential building live load is taken as KN/m2
Seismic load: the load due to acceleration response of the ground to the super structure

II. CALCULATION OF LOADS

According to IS code: For dead load calculations,
Unit weight of brickwall = 20 kN/m3,
Unit weight of RCC= 25 kN/m3,

Floor finish =1kN/m2 on each floor 3 and (1.5kN/m2) on roof.
Seismic load calculation: As per IS-1893 (PART1)

III. DETAILS OF THE STRUCTURE

Multi-storey plane frame with fixed base and base isolation is considered for the present study

- Utility of building: Residential building
- No of stories: G+5, G+10, G+15, G+20
- Floor to floor height: 3.0M
- Shape of the building: SQUARE
- Type of construction: R.C.C framed structure
- Seismic zone IV is considered

CALCULATION OF BASE SHEAR

- Grade of concrete considered is M30 and grade of steel considered is Fe 415

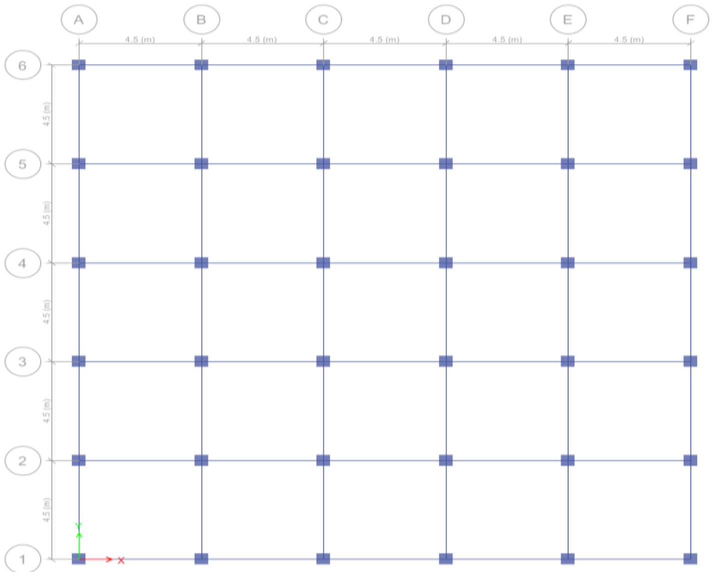

Fig 1- Typical floor building.

STOREY DRIFT G+5

Number of Storey	Fixed Base	Isolated Base
G+5	3600.9946	1012.894
G+10	6289.1541	3356.4534
G+15	6418.3179	5059.5389
G+20	6465.9956	6723.4584

Story Level	Fixed Base	Isolated Base
0	0	0
1	4.768	5.755
2	8.169	3.682
3	7.974	2.753
4	6.533	2.121
5	4.501	1.574
6	2.399	1.139

STOREY DRIFT G+10

Story Level	Fixed Base	Isolated Base
0	0	0
1	8.567	18.319
2	15.228	11.822
3	16.08	9.547
4	15.389	8.338
5	14.341	7.352
6	13.226	6.409
7	12.013	5.456
8	10.509	4.484
9	8.534	3.499
10	5.982	2.534
11	3.296	1.739

Story Level	Fixed Base	Isolated Base
0	0	0
1	8.987	36.674
2	16.343	24.218
3	17.895	20.649
4	17.878	19.342
5	17.5	18.52
6	17.099	17.801
7	16.701	17.074
8	16.248	16.311
9	15.717	15.508
10	15.143	14.663
11	14.559	13.774
12	13.95	12.841
13	13.27	11.864
14	12.5	10.843
15	11.668	9.781
16	10.801	8.686
17	9.84	7.563
18	8.606	6.378
19	6.981	5.152
20	5.005	3.943
21	3.153	2.949

STOREY DRIFT G+15

Story Level	Fixed Base	Isolated Base
0	0	0
1	8.857	27.598
2	15.978	18.053
3	17.28	15.102
4	17.043	13.82
5	16.485	12.891
6	15.866	12.033
7	15.174	11.165
8	14.398	10.268
9	13.557	9.335
10	12.64	8.367

11	11.628	7.361
12	10.506	6.32
13	9.186	5.243
14	7.472	4.141
15	5.271	3.056
16	3.062	2.161

References:

- IS: 1893 (Part 1) – 2016; "Criteria for Earthquake Resistant Design of Structures – general provisions and buildings"; Bureau of Indian Standards, New Delhi.
- J. Yang, J.B. Li, G. Lin, "A simple approach to integration of acceleration data for dynamic"- Journal of Soil Dynamics and Earthquake Engineering 26 (2006), pp. 725–734
- A. B. M. Saiful Islam1*, M. Jameel1, M. A. Uddin1 and Syed Ishita Ahmad, —Simplified design guidelines for seismic base isolation in multi-storey buildings for Bangladesh National Building Code (BNBC)", International Journal of the Physical Sciences Vol. 6(23), pp. 5467-5486.
- H. Yoshioka; J. C. Romello; and B. F. Spencer Jr, —Smart Base Isolation Strategies Employing Magneto rheological Dampers", ASCE, vol-9399-2002, pp- 128:5-540.
- Salic R. B., Garevski M. A. And Milutinovic Z. V., "Response of Lead-Rubber Bearing isolated Structure," The 14th World Conference on Earthquake Engineering, October 12-17, 2008, Beijing, China
- V.kilaret: four storey R.C.C building is designed according to Euro code 8
- Di sarno: structural analysis of regular multi-storeys R.C frame.
- Masayoshi Nakashima, Praveen Chusilp:The Japanese seismic design code is to be revised towards more performance- based engineering.
- Pradeep Kumar T. V. The most common isolation bearing used was the lead–rubber bearing.

Conclusion:

E-tab contains a number of parameters which are designed as per IS: 456(2000). As we can see by the result that Base shear is maximum for a fixed base and minimum in base isolation likewise storey drift is minimum in base isolation for low to medium rise building but as we go for a higher building base isolation is not properly working so, base isolation is not good for high rise building

AUTHOR PROFILE

1. Kiran jyoti Chhetri received the B.E.

(Civil Engineering) in the year 2013 from Priyadarshini College of Engineering Nagpur (RTM Nagpur University), Maharashtra State, India. Now she is MTech – Student appearing (Structural Engineering) from Gurunanak Institute of Technology, Kalmeshwar road, Nagpur (RTM Nagpur University), Maharashtra State, India.

2. Prof. D.LBudhlani B.ECivil and M.E(Enviromental)

Prof. At Guru Nanak Institutions, Nagpur, Maharashtra State, India.