JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Design and Analysis of Multi-Story Building with Different Country Code and Use Seismic Devices

Akash V Patel, Nirmal S. Mahta, Vikki K. Shah

[1] Post Graduate Student,[2] Assistant Professor ,[3] Assistant Professor
[1] Civil Engineering Department,
[1] U.V.PATEL College of Engineering, Ahmadabad, India

Abstract : These paper discuss about how to prevent multistory building by major earthquake. In this paper, G+ 14 storey building with and without damper in ETABS software with different material property based on the different countries. This modal analysis by time history analysis method and for this method earthquake load applies by three countries code IS CODE, ASCE CODE, and EURO CODE. For time history analysis method applying past earthquake history and compare the result of displacement, story drift and story shear. The paper presents an overview of numerous multistory building research projects that took into account multiple criteria. The frequency response strategy is beneficial for determining structure reaction in unique contexts of ground vibrations, according to all prior studies, observations, and conclusions. The findings of a study on the dynamic performance of a structure (G+14) with and without damper are presented in this paper.

***IndexTerms* – Time history method, ETABS software, Fluid Viscous Damper, Past Earthquake History.**

I. INTRODUCTION

As a result of the increased spending on building in today's world as a result of the development of developing countries, the design of earthquake and wind loads has become more challenging, and the role of civil engineering has become a pressing issue. This study provided insight into the need for earthquake-resistant measures to be installed on multistory buildings in these countries. The structural engineer will be able to get understanding about earthquakes based on the size, height, and shape of the building.

Different types of seismic protection, such as passive control devices, active control devices, and hybrid control systems, are used to prevent damage from earthquakes. Bridges, buildings, and industrial plants all use passive control devices. Active control devices are installed directly on buildings that have a dynamic nature during earthquake ground motion. Hybrid control devices use a combination of active and passive control devices to achieve their goals.

There are numerous research papers on damper and structural parameter checking. The ETABS software is used to design and analyze the modal design in this work. In the software, G+14 story structure and apply Fluid Viscous Damper. These Models are based on diverse areas, such as their country's crucial seismic zone. The time history approach is employed to analyze these models, and time history data from several earthquakes is used in this research. Compare the results of with damper building and without damper building.

II Objective of work

1. To investigate the behavior of buildings during a major earthquake, both with and without seismic equipment.
2. A comparison of structures with various earthquakes and varied nation conditions.
3. To use earthquake devices such as dampers.
4. To compare story shear, storey drift, and displacement results.

III Methodology

Method

The finite element ETABS SOFTWARE used for making 3D modal as well as analysis the structure. These models are design and analyzed by this software. Time history method utilized analyzed seismic behavior of multi-story building with damper and without damper. In time history method applied earthquake load in X direction and Y direction based on their different country code (earthquake load).

Time History Method

Time History Method is known as non-linear dynamic Analysis. It is define by the sequence of value of any time-varying quantity (such as a ground motion measurement) measured at a set of fixed times. It is very important method for seismic analysis.

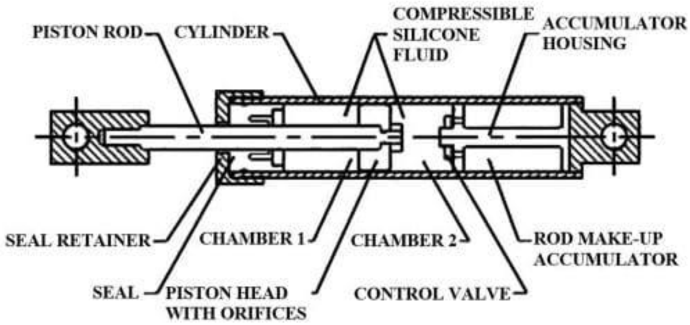
Time history analysis is the study of a building under a past earthquake or wind acceleration but in this paper only considered Earthquake load.

Collect Data

For Concrete and steel material data collected from various code based on the country. For Indian based modal the data took from IS 456:200 and IS 800:2007, European based model the data took from EU 3-2005 and EU 2-2004 and for American modal used to ACI 318-19 and ACI 360-16.

Apply Earthquake load based on IS 1893:2016, EUROCODE 2004 and ASCE 7-02. For time history analysis consider past earthquake detail and which is collect from peer ground motion data website. Here is the some data graph which is mention is Displacement vs. time and Acceleration vs. time data.

For, with damper building applying fluid viscous damper and this damper data is taken from case study. Fluid Viscous Damper (FVD) is work on principle of fluid flow. This damper is Passive Structural control system.

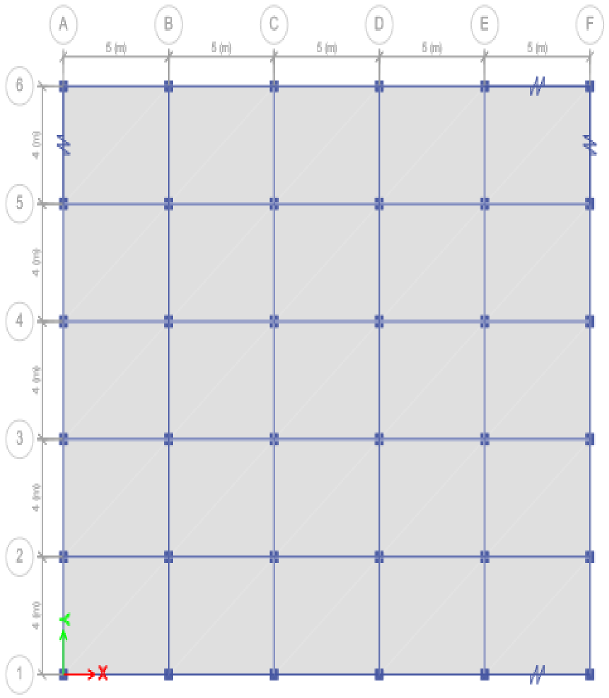


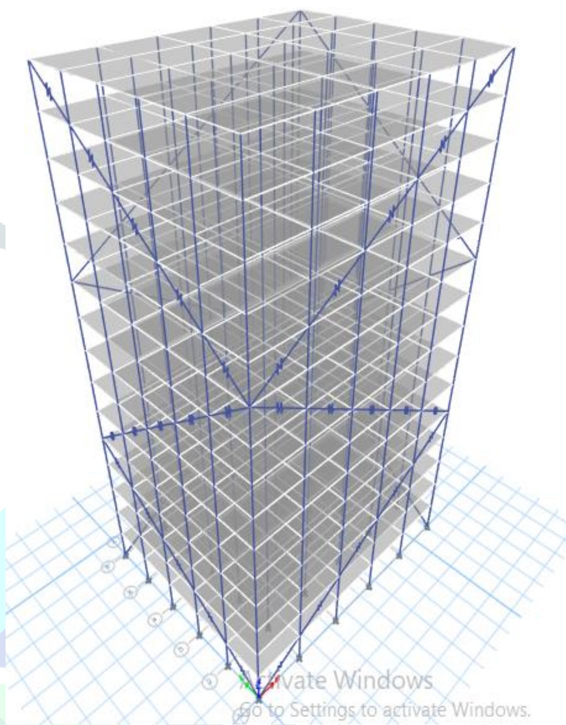
Building Property

Geometric Detail	
Plan Dimension	25×20mm
Type of building	Residential
Each story height	3.1m
Bottom story height	3.1m
Material Properties	
Grade of concrete(IS)	M35
Grade of concrete(EU)	C35/45
Grade of concrete(ACI)	4000psi
Grade of Steel (IS)	Fe 415
Grade of Steel (EU)	S355
Grade of Steel (ACI)	A992Fy50
Grade of Rebar (IS)	HYSD500
Grade of Rebar (EU)	By Default Etabs
Grade of Rebar (ACI)	A615Gr60
Section Property	
Column Size	400×400mm
Beam Size	375×400mm
Slab Thickness	150mm
Primary Load Cases	
Dead Load	1.5kN/m^2

Live load	3 kN/m^2
Earthquake Load	AS per IS CODE, EU CODE, ACI CODE
Seismic Property	
Response Reduction Factor	IS 1893(R)=5 ASCE 7-02(R)=8
Behavior Factor, q	Eurocode8_2004= 2
Acceleration parameter for ASCE 7-02	Ss=1.4 S1=0.4

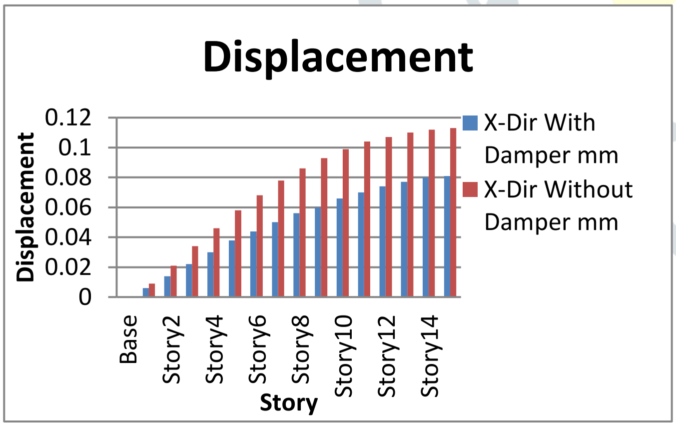
To make different modal by this property and all structure analyzed by time history analysis method.

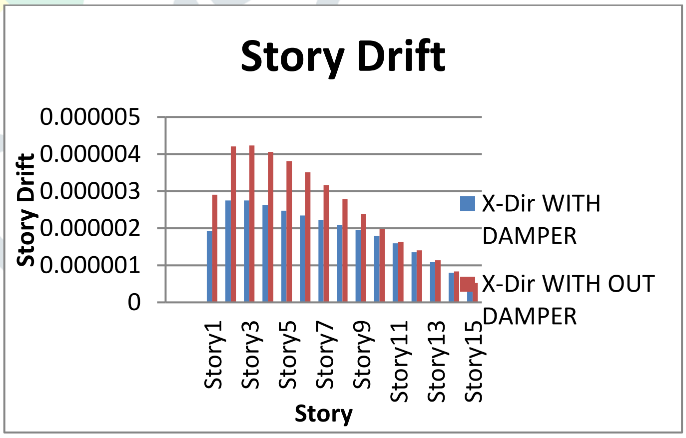




IV Results

These Result based on time history analysis





.

Fig 1- Displacement of as per IS code (Bhuj Earthquake)

Fig 2 – Story Drift as per IS code (Bhuj Earthquake)

Story	X-Dir With Damper	X-Dir Without Damper
	mm	mm
Base	0	0
Story1	0.006	0.009
Story2	0.014	0.021
Story3	0.022	0.034
Story4	0.03	0.046
Story5	0.038	0.058
Story6	0.044	0.068
Story7	0.05	0.078
Story8	0.056	0.086
Story9	0.06	0.093
Story10	0.066	0.099
Story11	0.07	0.104
Story12	0.074	0.107
Story13	0.077	0.11
Story14	0.08	0.112
Story15	0.081	0.113

Table- Value of Displacement of as per IS code (Bhuj Earthquake)

Story	X-Dir WITH DAMPER	X-Dir WITH OUT DAMPER
Base	0	0
Story1	0.000001925	0.000002902
Story2	0.000002752	0.000004204
Story3	0.000002748	0.000004232
Story4	0.00000263	0.000004061
Story5	0.00000247	0.00000381
Story6	0.000002347	0.000003506
Story7	0.00000222	0.00000316
Story8	0.000002083	0.000002782
Story9	0.000001943	0.000002381
Story10	0.00000179	0.000001972
Story11	0.000001593	0.000001626
Story12	0.000001349	0.000001401
Story13	0.000001086	0.000001136
Story14	0.000000801	0.000000835
Story15	0.000000518	0.000000524

Table- Value of Story Drift of as per IS code (Bhuj Earthquake)

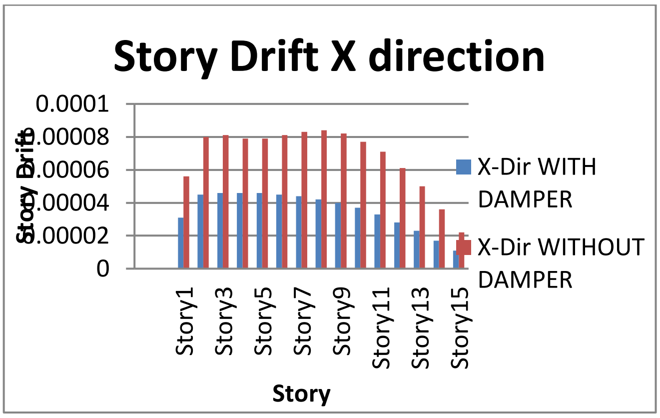


Fig – as per ASCE code (Greece EQ)

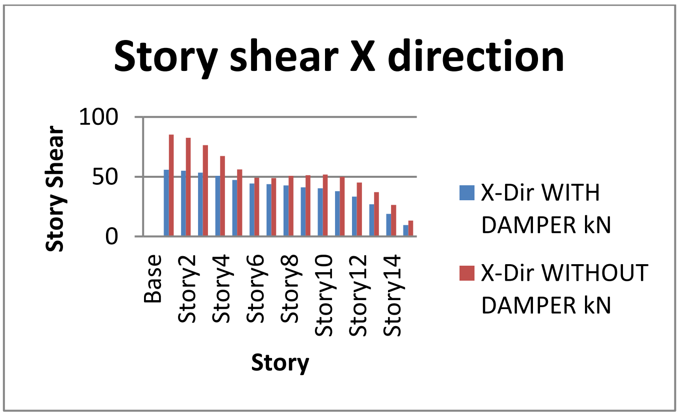


Fig – as per IS code (Greece EQ)

Story	X-Dir WITH DAMPER	X-Dir WITHOUT DAMPER
Base	0	0
Story1	0.000031	0.000056
Story2	0.000045	0.00008
Story3	0.000046	0.000081
Story4	0.000046	0.000079
Story5	0.000046	0.000079
Story6	0.000045	0.000081
Story7	0.000044	0.000083
Story8	0.000042	0.000084
Story9	0.00004	0.000082
Story10	0.000037	0.000077
Story11	0.000033	0.000071
Story12	0.000028	0.000061
Story13	0.000023	0.00005
Story14	0.000017	0.000036
Story15	0.000011	0.000022

Table – As per ASCE code (Greece EQ)

Story	X-Dir WITH DAMPER	X-Dir WITHOUT DAMPER
	kN	kN
Base	0	0
Story1	55.6829	85.1349
Story2	54.9687	82.5073
Story3	53.2826	76.3502
Story4	50.7071	67.2013
Story5	47.377	56.086
Story6	44.3393	49.0673
Story7	43.893	48.8591
Story8	42.632	50.6707
Story9	41.0534	51.3987
Story10	40.2622	51.6936
Story11	37.761	49.9414
Story12	33.3559	45.0699
Story13	27.0252	37.0883
Story14	18.9446	26.2997
Story15	9.4997	13.3306

Table – As per ASCE code (Greece EQ)

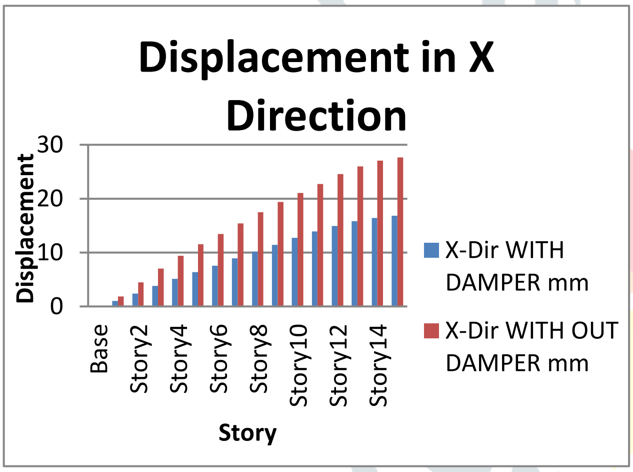


Fig –As per ASCE code (Imperial valley EQ)

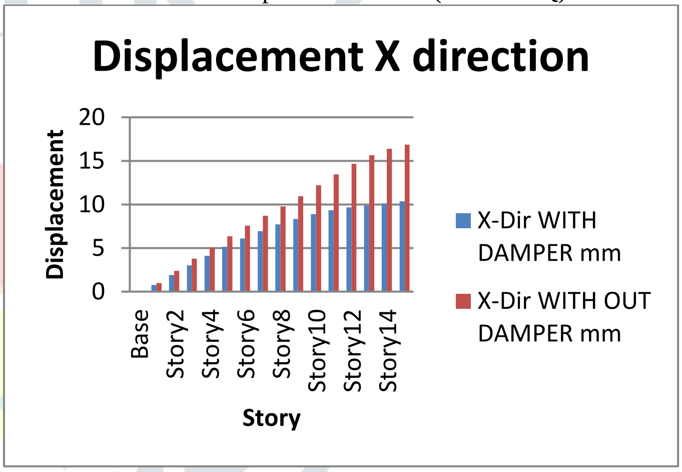


Fig – As per IS code (Imperial valley EQ)

Story	X-Dir WITH DAMPER	X-Dir WITH OUT DAMPER
	mm	mm
Base	0	0
Story1	0.989	1.83
Story2	2.388	4.448
Story3	3.785	7.027
Story4	5.118	9.417
Story5	6.362	11.56
Story6	7.582	13.429
Story7	8.915	15.379
Story8	10.203	17.471
Story9	11.426	19.369
Story10	12.717	21.044
Story11	13.913	22.728
Story12	14.952	24.532
Story13	15.799	25.98
Story14	16.427	27.028
Story15	16.826	27.671

Story	X-Dir WITH DAMPER	X-Dir WITH OUT DAMPER
	mm	mm
Base	0	0
Story1	0.784	0.975
Story2	1.9	2.377
Story3	3.025	3.772
Story4	4.11	5.08
Story5	5.137	6.351
Story6	6.087	7.578
Story7	6.944	8.721
Story8	7.701	9.765
Story9	8.352	10.95
Story10	8.895	12.191
Story11	9.327	13.438
Story12	9.65	14.646
Story13	9.881	15.651
Story14	10.118	16.395
Story15	10.38	16.852

Table - As per ASCE code (Imperial valley EQ)
As per IS code (Imperial valley EQ)

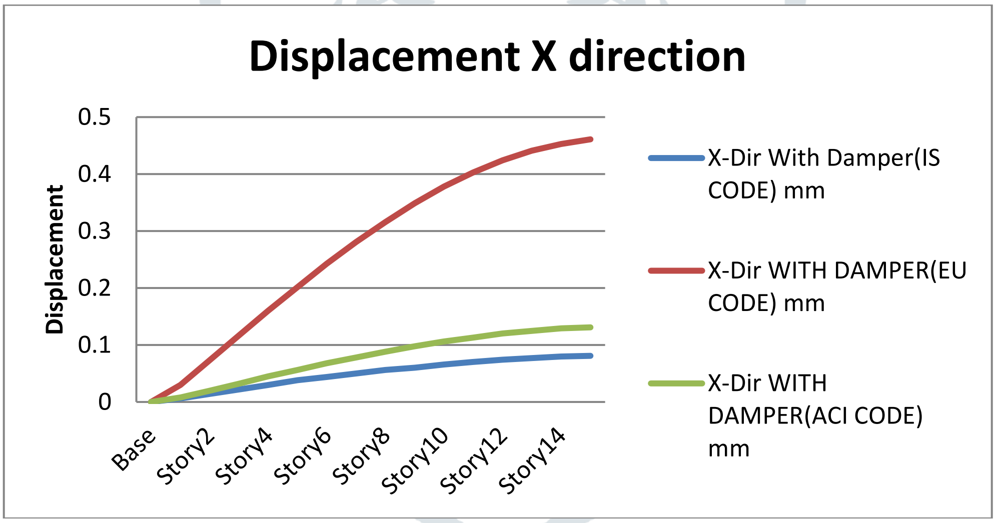


Fig-Displacement Graph (with damper) (IS CODE, EU CODE, ACI CODE) (Bhuj Eq)

V Conclusion

In Bhuj earthquake, as per IS code the displacement, story drift and story shear difference is around 20% to 27% for structure (with damper and without damper). As per EU code the difference is around 25% for the structure and as per ASCE code difference is up to 40% difference in structural element.

In Greece earthquake, as per EU code the displacement, story drift and story shear difference is around4% to 15% for structure (with damper and without damper). As per IS code the difference is around 18% for the structure and as per ASCE code difference is up to 40% difference in structural element.

In Imperial valley earthquake, as per ASCE code the displacement, story drift and story shear differenceis around 30% to 40% for structure (with damper and without damper) . As per EU code the difference is around 25% for the structure and as per IS code difference is around 30% difference in structural element.

All three earthquake, As per IS code base building results such as displacement, story drift and story shear value are lower than other two different country code. However EU code building result is higherthan other country

Based on the results, with damper structure is more effective than the without damper structure. It is clearly seen the structure which is made as per IS code is more sustainable than EU based structure andASCE based structure.

VI References

1. S. Lakshmi Shireen Banu, Kothakonda Ramesh "Seismic Response Study and Evaluation of Vibration Control of Elevated RCC Structure using Friction Damper"
2. U. D. D. Liyanage, T. N. Perera, H. Maneetes "Seismic Analysis of Low and High Rise Building Frames Incorporating Metallic Yielding Dampers"
3. ABHISHEK KUMAR MAURYA, V.K. SINGH "ANALYSIS OF BUILDING USING VISCOUS DAMPERS IN SEISMIC ZONE-V"
4. B.Naresh , J.Omprakash "Seismic Design of Multistorey RCC-Building with Dampers Using ETABS"
5. Luca Septimiu , Pastia Cristian "Case Study of Variable Orifice Damper for Seismic Protection of Structures"
6. M. S. Landge , Prof. P. K. Joshi "Comparative Study of Various Types of Dampers used for Multi-Story R.C.C. Building"
7. Nikos Lagaros ,Chara Ch. Mitropoulou, Papadrakakis Manolis "Time History Seismic Analysis"
8. N. Priyanka, Dr. J. Thivya, J. Vijayaraghavan " SEISMIC STUDY OF MULTI-STOREY STRUCTURE WITH FLUID VISCOUS DAMPERS USING ETABS"
9. Tanzila Tabassum, Khondaker Sakil Ahmed " SEISMIC PERFORMANCE OF DAMPER INSTALLED IN HIGH-RISE STEEL BUILDING IN BANGLADESH"
10. Ankit Jain, Dr. R. S. Talikoti "Performance of High Rise Structure with Dampers at Different Location"
11. Owais Rasool , Dr. Manzoor Ahmad Tantray "Seismic Performances and Evaluation of Structures Equipped with Supplemental Brace Damper System"
12. Pall, A.S. and Marsh, C. "Response of friction damped braced frames," J. Struct. Engrg., ASCE, 108(6), (1982) :1313-1323.
13. A. Filiatrault and S. Cherry, "Performance Evaluation of Friction Damped Braced Steel Frames under Simulated Earthquake Loads," Report of Earthquake Engineering Research Laboratory, University of British Columbia, Vancouver, Canada, 1985.
14. S.Y. Hsu and A. Fafitis, "Seismic Analysis Design of Frames with Viscoelastic Connections," J. Struct. Engrg., ASCE, 118(9), 2459-2474 (1992)
15. P. Sajjan and P. Biradar, "Study On The Effect Of Viscous Damper For Rcc Frame Structure,"
16. IS code 1893 Part 1:2002 "Criteria for Earthquake Resistant Design of Structures"
17. ASCE code 7.2002 "for Earthquake Resistant Design of Structures"
18. EU code 1998 Part 1 2004 "for Earthquake Resistant Design of Structures"
19. Imperial Valley Earthquake." Southern California Earthquake Data Center."
20. Bhuj Earthquake "India Zone V Data center"