COMPARITIVE STUDY OF RESPONSE OF MULTI STOREY BUILDINGS SUBJECTED TO EARTHQUAKE FORCES WITH AND WITHOUT DAMPERS

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Abstract

Dampers helps in reducing the vibrations caused by wind and earthquake. By using dampers we can improve the resistance of building towards the forces which are caused by earthquakes .In this study an attempt has been made to compare the results of equivalent static method and response spectrum method of seismic analysis for various models with different combination of dampers providing in different directions and at different story levels. Results shows that usage of dampers increase in base shear.. As base shear increases the resistance of building increases towards earthquake forces. When compared to Response Spectrum method Equivalent static method shows best results.

Keywords: *Equivalent Static Analysis1, Response Spectrum Analysis 2,Base Shear 3,, Dampers4.*

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1. INTRODUCTION

Now a day's population is increasing day by day. To meet main requirement of shelter, there should be need of multi-story building as land is being limited. After construction, another major task is the performance under different loading. Out of which earthquakes are among the major natural hazards impacting multi storey buildings. The Paper includes comparative study of comparative study of response of multi-story building subjected to earthquake forces with and without dampers. For carrying out the study we will adopt linear analysis i.e equivalent static analysis and response spectrum analysis for G+9 building. We will provide the dampers at right position and we will reduce the vibrations caused due to earthquake which reduce the effects caused due to earthquake.

1.1 Equivalent Static Analysis

It is one of the method for calculating the seismic loads. Generally Equivalent static analysis is not adopted for high rise buildings. Practically it does not take into account all the factors that are importance of foundation condition. The equivalent static analysis is used to design small structures. In this method only one mode is considered for each direction. Earthquake resistant designing for low rise structures the equivalent static method is enough. Tall structures are needed more than two modes and mass weight of each story to design earthquake resistant loads. Equivalent static method is not suitable to design high rise structures and dynamic analysis method to be used for high rise structures.

1.2 Response Spectrum Analysis

Response spectrum is defined as plot of maximum values of response quantities i.e. displacement, velocity and acceleration as a function of natural vibration period or frequency and damping ratio of single degree of freedom system (SDOF)**.As** the seismic forces strikes the foundation of structure it will move with the ground motion. It shows that movement of structure is generally more than the ground motion. The movement of structure depends on the natural frequency of vibration,. The revised IS 1893-2002 uses the dynamic analysis by response spectrum. In this method the most five important engineering properties of the structures i.e, the fundamental natural period of vibration of the building (T in seconds), damping properties of the structure ,Type of foundation provided for the building , Importance factor of the building ,the ductility of the structure represented by response reduction factor are considered .

Many new techniques are found out for resisting earthquakes. One of the technique is Dampers. Dampers are used for vibration control of structure which are caused due to earthquakes and winds. Depending on type of material dampers are classified into different types and they are classified as Tuned Mass Dampers, Friction Dampers, Viscous Dampers, Metallic damper, Visco elastic dampers , Elasto plastic damper .Other techniques like base isolation are used for decrease of damage caused due to earthquake.

2. MODEL GEOMETRY

The details of model are 10stories,3 bays along X-direction and 2 bays along Y-direction.

Table 1: Preliminary assumed data for G+9 RCC framed building

S.NO	CONTENT	DESCRIPTION
1	Type Of Structure	Multi story High Rised Frame (Moment Resisting Frame)
2	Seismic Zone	5
3	Zone Factor	0.36
4	Number of Storey	G+9
5	Floor Height	3.00m
6	Base Floor Height	3.00m
7	Wall Thickness	External-230mm Internal-115mm
8	Materials	Concrete (M25) and reinforcement Fe415
9	Size of Column	500*500
10	Size of the Beam in all Floors and Roof	300*400
11	Depth of Slab	150mm
12	Specific Weight of RCC	25KN/m3
13	Specific Weight of Soil	20KN/m3
14	Type of Soil	Medium
15	Response Spectra	As per IS 1893(Part-1):2002 for 5% damping
16	Importance Factor	1

Table 2: Earthquake Load Parameters

PARAMETERS	VALUES
Seismic zone factor,Z	0.36
Importance factorr	1.00
Response reduction factor	5.00
Percentage damping	5%
Soil type	Medium Soil
Average response acc.coeff (Sa/g)	2.20

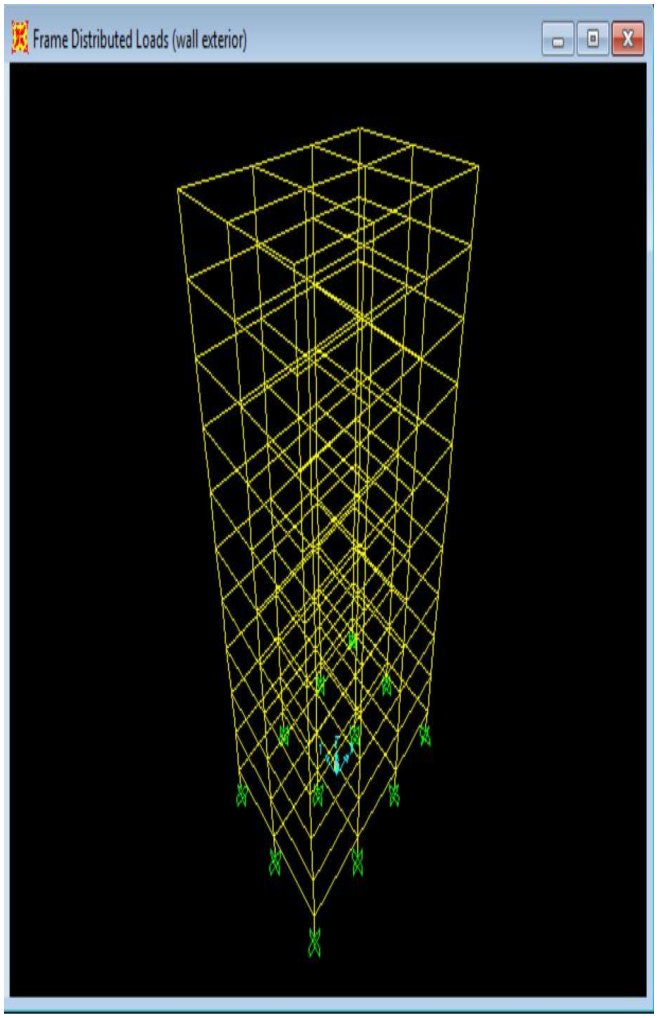


Fig 1: 3D view of the model

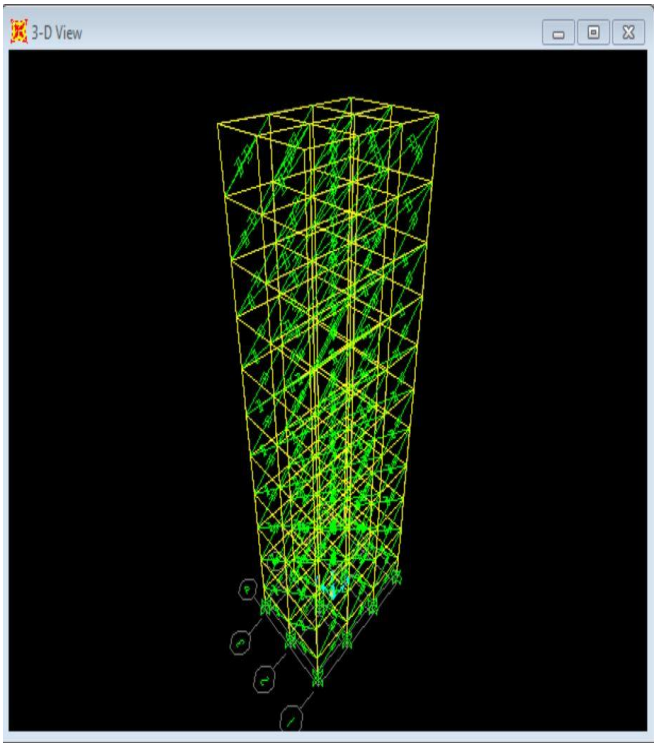


Fig 2: Model with dampers in X-D and Y-D

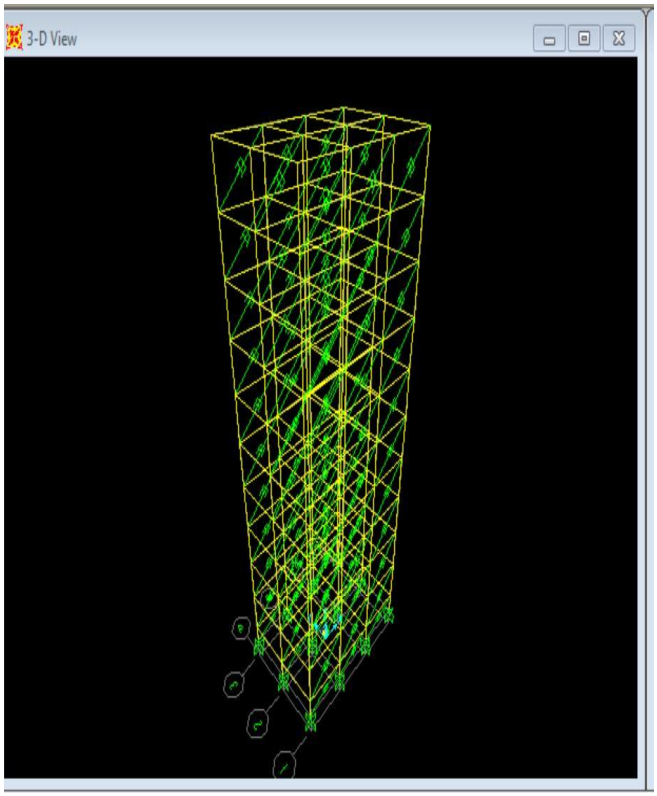


Fig 3: DAMPERS IN X-DIRECTION

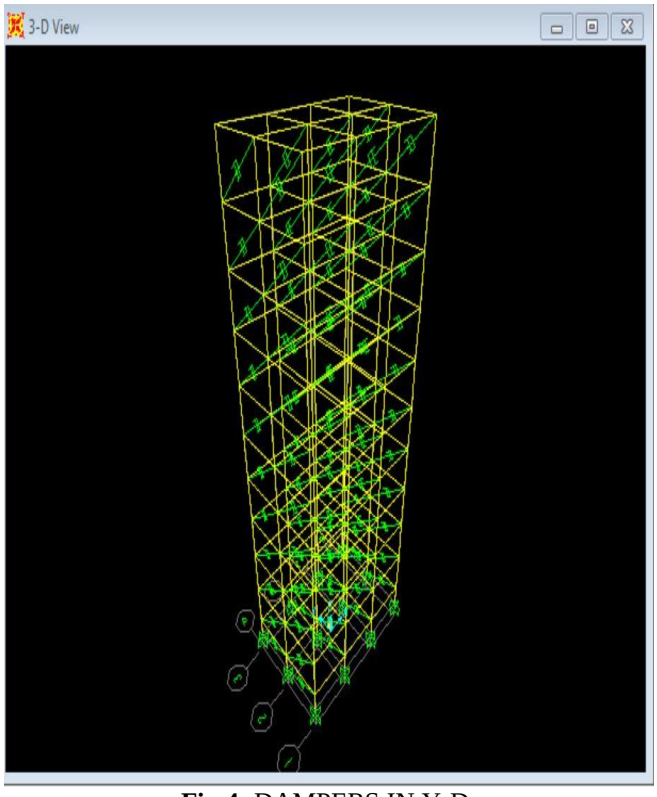
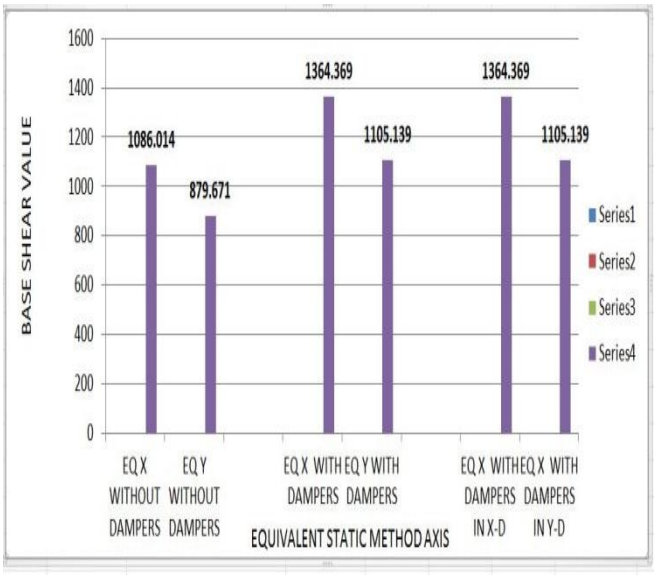


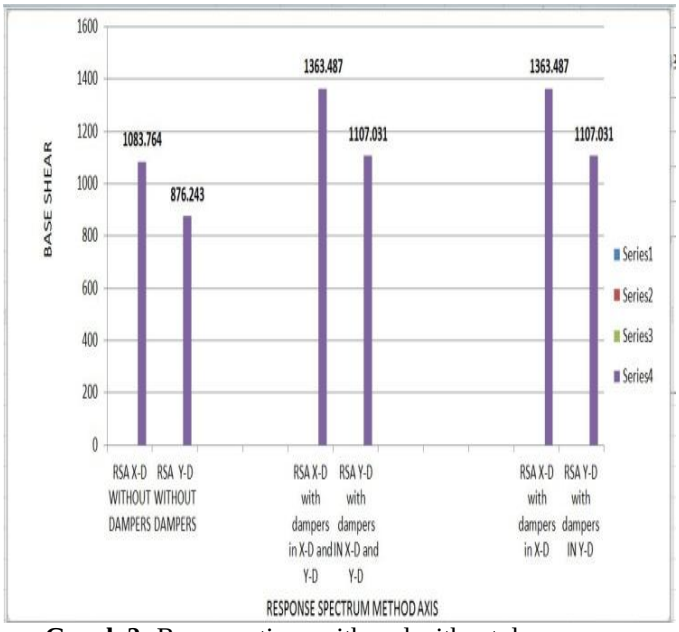
Fig 4: DAMPERS IN Y-D

Fig 1 shows 3-D view of the model which is considered for analysis. Fig 2 shows the placing of dampers in X-D and Y-D. Fig 3 shows the placing of dampers in X-D .Fig 4 shows the placing of dampers in Y-D .

3. RESULTS AND DISCUSSIONS



Graph 1: Base reactions with and without dampers-equivalent static method



Graph 2: Base reactions with and without dampers-response sectrum method

From the graphs it can be observed that response spectrum is less effective when compared to equivalent static method. Base reaction which are obtained from the response spectrum method is low when compared with equivalent static method. From graph 2 it can be observed that by providing dampers in buildings base shear is being increased. From the results obtained we can observe that providing of dampers in the buildings which are designed by equivalent static method. shows considerable effect in reducing the base reactions. There is increase of base shear of equivalent static method when compared to response spectrum method From results obtained it can be observed that there is no difference in value of base reactions when we place the dampers only in x-d. From the results it is

concluded that equivalent static method has more base shear when compare to response spectrum method..This helps in reducing the damage.

4. CONCLUSION

Dampers helps in reducing the vibration with its material properties .Providing dampers helps in reducing the damage caused by the earthquake. By comparing base reactions which are obtained by with and without dampers , usage of dampers shows considerable effect on increase in base shear. As the base shear increases the building will be able to resist the earthquake. When compared to response spectrum method equivalent static method shows increase in base shear. As base shear increases the resistance of the building towards forces increases.

5. REFERENCES

[1]. E. Pavan Kumar et al Int. Journal of Engineering Research and Applications ISSN : 2248-9622, Vol. 4, Issue 11(Version 1), November 2014, pp.59-64

[2].Mario De Stefano· Barbara Pintucchi , A review of research on seismic behaviour of irregular building structures since 2002, Bull Earthquake Eng 6:285–308 , 2007

[3]. B.Samali-Use of viscoelastic dampers in reduce in wind- and earthquake induced motion of building structures ,Engineering Structures, Vol. 17, No. 9, pp. 639 654, 1995.

[4]. L.P.B. Madsen et al Seismic response of building structures with dampers in shear 1 November 2002

[5].DrV.L.Shah,Dr.S.R.karve llustrated design of reinforced concrete buildings,6th edition .

[6]. Earthuake tips http://www.iitk.ac.in/

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