

Energy Dissipation System in Multistorey Building

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ABSTRACT: In the present paper vibration parameter of the multi-storey reinforced concrete building are analyzed, which has mass irregularity and their seismic behavior is compared with reference to the proposed building in which damper is incorporated at different locations such as (at middle, at corner). The aim of the analysis is to obtain the difference in structural response of the Fixed RC building, with the Building utilizes with the Viscous damper at different locations.

The seismic event of LACC NORTH is considered in the analysis and Time history analysis is performed in ETABS. Under the dynamic loading several parameters of RC building have been studied such as Base Shear, Story Drift, Story Displacement etc.

KEYWORDS: Time history, Viscous damper, ETABS.

I. INTRODUCTION

To minimize the damages which occurs due to ground motions is possible by the introduction of energy dissipation devices which provides damping in to structural elements. In recent years considerable amount of care is taken to mitigate the seismic response of the structure and decrease the loss of human being due to structural collapse and severe damages to the structure. As regards of existing structures, it is very obligatory to evaluate the current strength of structure and strengthen them based on evaluation criteria before an earthquake. Earthquake damage highly depends on this parameters including intensity, duration and frequency, geologic and soil condition, quality of construction.

Passive energy dissipation systems exploit a wide range of materials and technologies as a means to improve the damping, stiffness and strength characteristics of structures. Dissipation may be achieved either by the conversion of kinetic energy to heat or by the transferring of energy along with vibrating modes. The first mechanism incorporates both hysteretic devices that dissipate energy with no considerable rate dependence, and viscoelastic devices that display considerable rate dependence.

Recently many investigation has been conducted to evaluate the seismic response of building equipped with dampers. In present paper the viscous damper is incorporated in the building at different locations. Viscous damper are known as effective energy dissipation device to control the seismic response, the damping force developed by viscous damper depends on the physical property of the fluid used in this device (Constantinou & Symans 1992).

Viscous dampers (VD) have been used in the last 30 years in major civil structures to moderate the effects of earthquakes. Their use in high-rise buildings built in seismic areas is a dispute for the designers, since they should reduce the vibrations induced by both strong winds and earthquakes, and the optimal behaviour in these two situations

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is not usually the same. Consequently, the design requirement for VD to be used in high-rise buildings is often that they should have two different behaviours in the different range of velocities corresponding to wind and earthquake.

II. RELATED WORK

A) Regular and Irregular Structures:

According to the Indian standard, the structure is structurally specified in regular or irregular form. In a regular structure there is no significant imbalance in planning, vertical configurations, or lateral force resistance systems. In irregular structure, according to IS-1893 (Part 1) 2002 has such important constraints like plan irregularities and vertical irregularities. To perform well in the earthquake, there are few main features in a building, i.e simple and regular configuration, and sufficient lateral strength, stiffness and ductility.

The failure of the structure mainly depends on the discontinuity in the mass of the structure, stiffness and geometry of the building. Mostly due to vertical irregularity structure possesses failure. To overcome this failure we use isolation system in the building which decouples the superstructure from substructure by which the structure resist the lateral force and gain adequate stability.

III. STRUCTURAL PROPERTIES AND MODELING

A G+10 multi storey building with the plan dimensions of 30m x 30m have been adapted in the present work with 5 bays in both longitudinal and transverse directions respectively. The storey height of building up to 1st storey is 3m and above all storey is 3.5m.

A) Material properties –

Grade of concrete (f_{ck})	M-25
Grade of steel (f_y)	Fe-415

B) Section properties -

Beam	350mm x 500mm
Coloumn	550mm x 550mm
Slab	150mm

C) Loading data -

Live load (1st floor)	10 kn/m ²
Live load (up to 11th floor)	4 kn/m ²
Floor finish	1.5 kn/m ²

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D) There are 4 models is taken in the analysis -

- 1) Building with Fixed base
- 2) Building with Viscous Damper
- 3) Building with Viscous Damper at middle
- 4) Building with Viscous Damper at corner

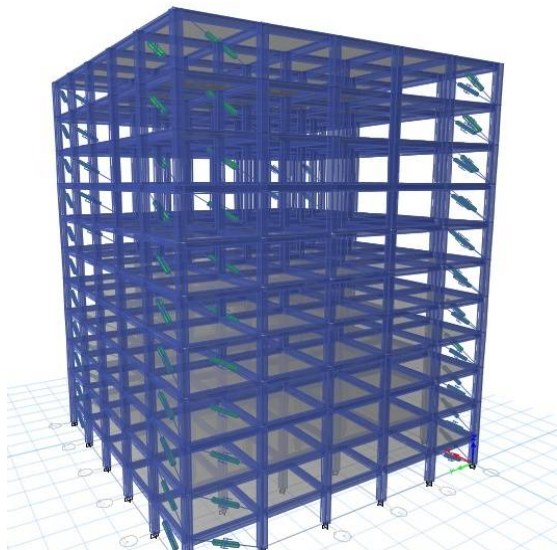


Fig-1 Building with Viscous Damper at corner

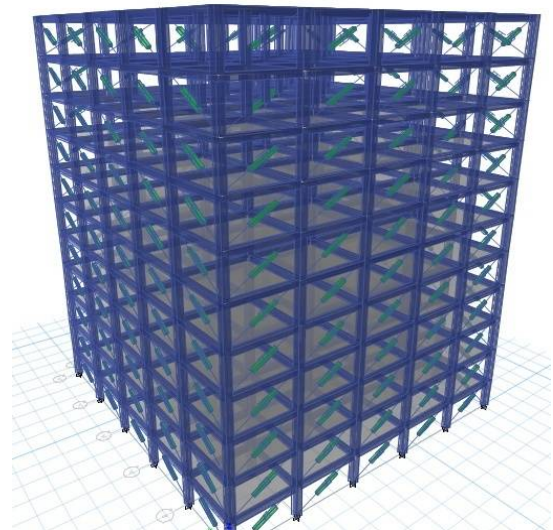


Fig-2 Building with Viscous Damper

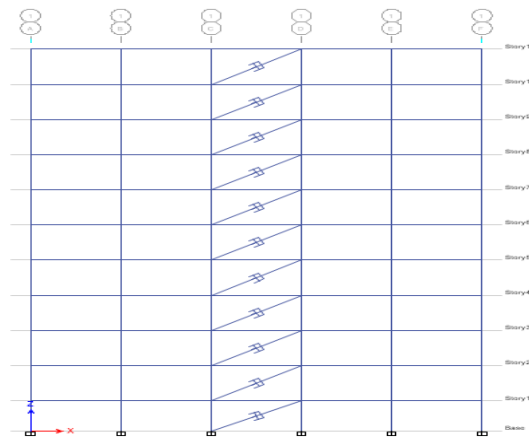


Fig-3 Building with Viscous Damper at middle

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III. RESULTS AND DISCUSSION

All Figures Show The Response Of The Building Such As (Time Period, Base Shear, Story Drift, Story Displacement) Incorporated With The Damper Such Damper At Middle ,Damper At Corner And With Damper At Different Locations Under Seismic Event Of LACCNORTH.

A) Storey Displacement:

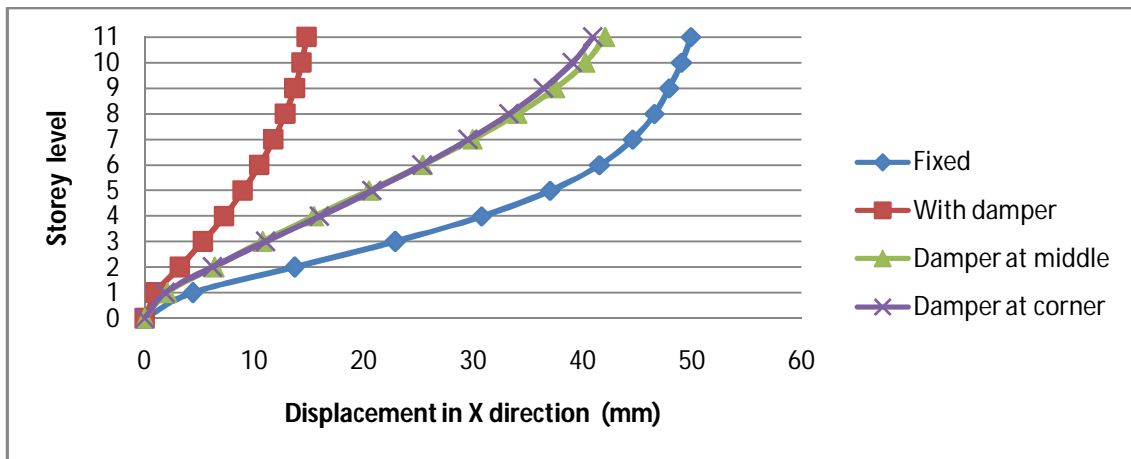


Fig - 4 Story Displacement in X-direction

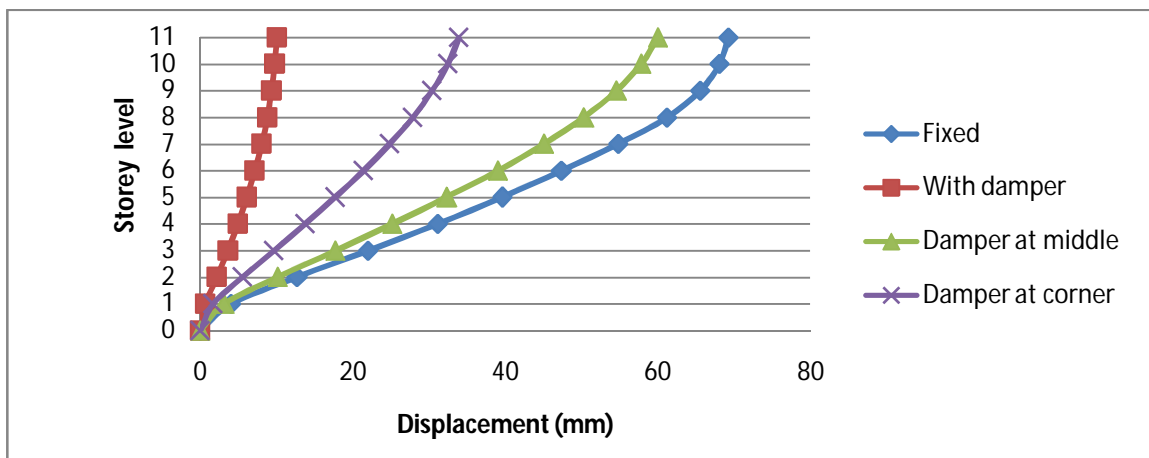


Fig - 5 Story Displacement in Y-direction

Figure 4 and 5 shows the displacement of all stories, In all models at top level displacement goes decreasing very fairly.

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B) Story Drift

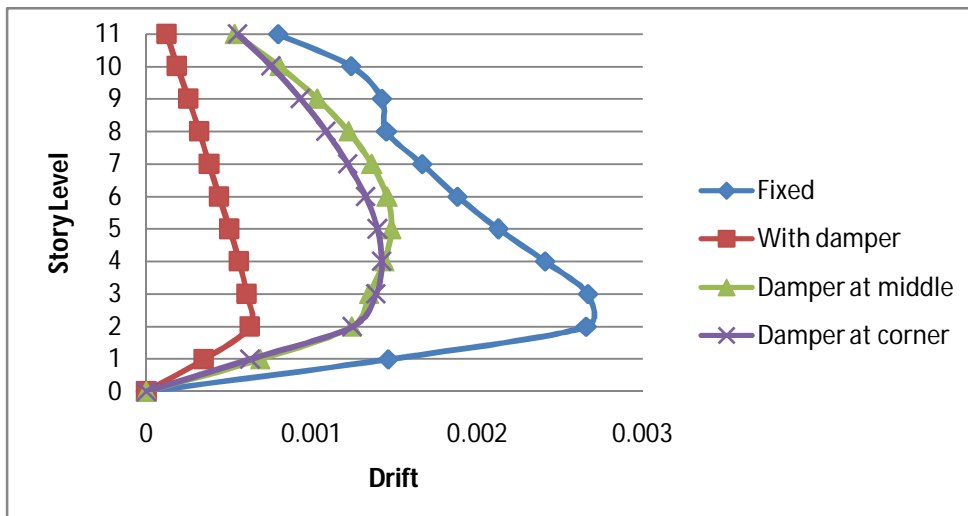


Fig - 6 Story Drift in X-direction

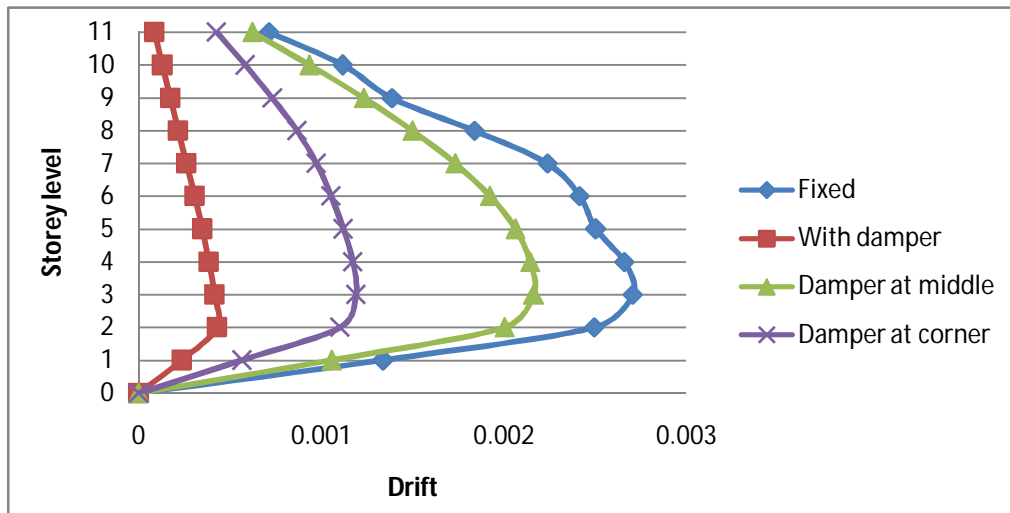


Fig - 7 Story Drift in Y-direction

From figure 6 and 7 it observed that at story level 2 story drift increases in all model because of mass irregularity.

C) Base shear

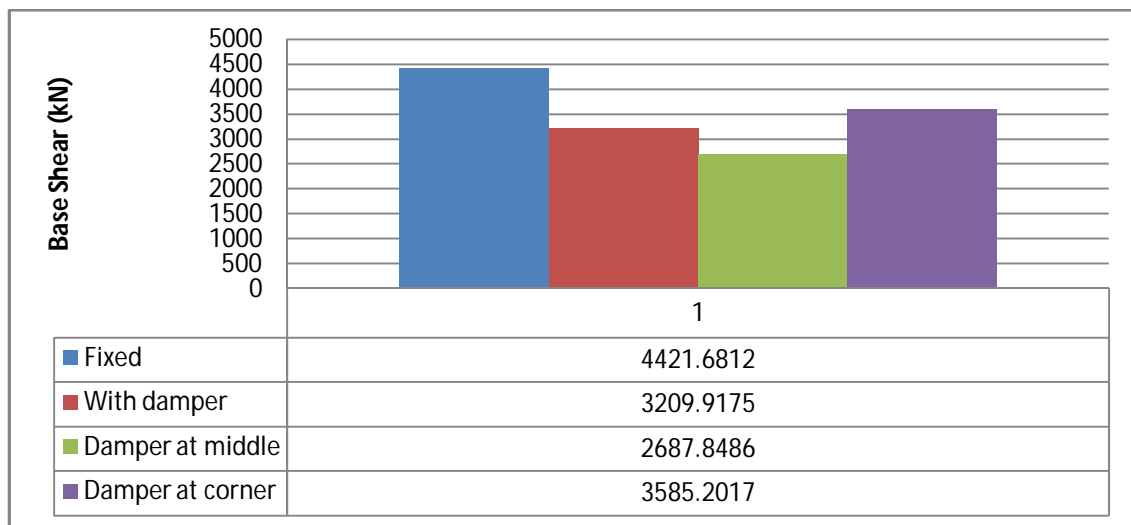


Fig - 8 Base shear

In figure 8 it shows the Base shear reduces 40% in the building when dampers located at middle.

V. CONCLUSION

Under the dynamic analysis of building using LACC NORTH seismic event, it concluded that the viscous dampers proves more relevant in seismic prone areas when we place it at all frames but the damper at corner also gave satisfactory result and provide good rigidity to the structure specially in case of story displacement and drift.

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