Seismic Performance Analysis of Multistory Symmetrical RC Frame Structure Using Metallic Dampers

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***Abstract:*-This study examines how metallic dampers affect a multistory building's nonlinear seismic performance. These devices work by allowing a significant quantity of energy to be input into the structure, which reduces the structure's displacement. Four distinct frame types are examined for this purpose, each with dampers placed in various places. The nonlinear seismic analysis (Nonlinear Time History) in SAP 2000 was studied using three different forms of natural time histories. The time, base shear, and displacement of the bare frame and the frames with dampers in various locations are compared.**

Keywords: Metallic Dampers, SAP 2000, Time History

I. INTRODUCTION

Earthquakes are natural catastrophes, and under them, damage to or the collapse of buildings and other man-made structures is the primary cause of disasters. Experience has demonstrated that the most effective defiance against earthquake-related damage for new projects is the establishment of earthquake resistant laws and their application. Prior to an earthquake, existing structures must be assessed and strengthened using the evaluation standards. Structures can be damaged by earthquakes and even collapse. In order to resist the imposed loads, the conventional approach to seismic design has relied on offering a combination of strength and flexibility. Because the designing process is incapable of adapting to an unknown earthquake, the degree of structural security cannot be obtained. It has been acknowledged that certain structures have dampening devices,

The ability of buildings to dissipate energy during strong earthquakes is essential for preventing catastrophic instability and failure. In traditional constructions, energy dissipation is mostly caused by the inelastic behaviour of structural materials. Some of the dissipating devices are metallic dampers and ADAS dampers.

II. MODELLING AND ANALYSIS

A) Properties of X Plate Metallic Damper

Height of triangular portion (a)	:	50mm
Breadth of triangular portion (b)	:	70mm
Thickness of plate (t)	:	6mm
Modulus of Elasticity (E)	:	$1.922 \times 10^5 N/mm^2$
Yield Stress ($\square_y$)	:	235 N/mm^2

B) Description of Investigated Structure

Type of Building:	G+8 Residential Building
Plan area:	18(m) ×18(m)
Size of Beam:	300(mm) ×400 (mm)
Size of Column:	500(mm) ×500 (mm)
Thickness of slab:	130mm
Typical story height:	3.2m
Live load, LL:	$3.5 kN/m^2$
External Wall load:	12 kN/m
Partition and floor finishing load, FL:	2 kN/m2
Earthquake Direction:	X and Y
Materials:	M30 and Fe415

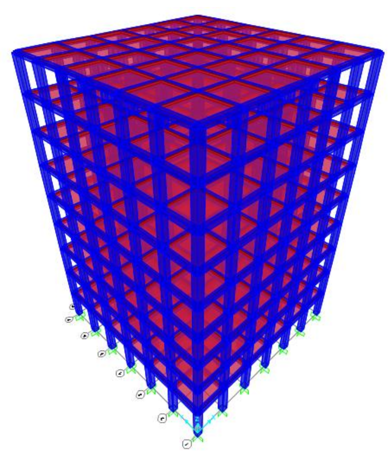


Fig.1 3D Model of Structure

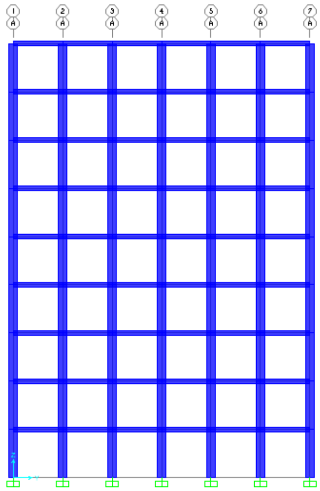


Fig. 2. Bare Frame

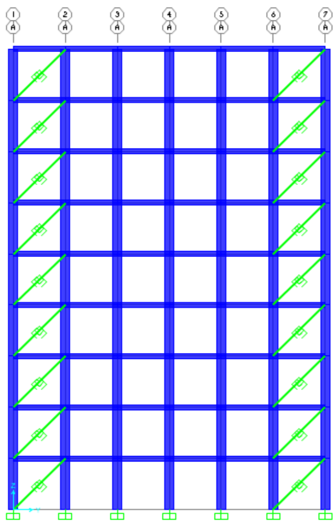


Fig. 3. Dampers at the end bay

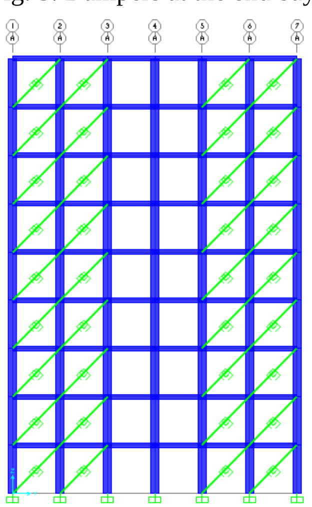


Fig. 4. Dampers at two end Bays

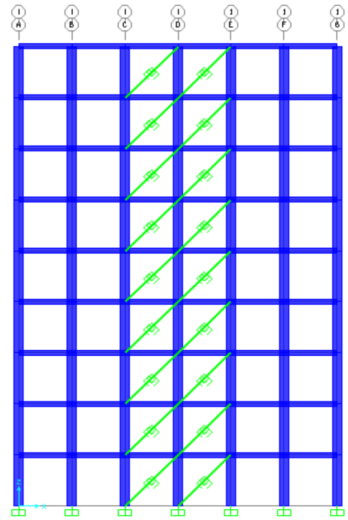


Fig. 5. Dampers at middle bays

III. RESULTS AND DISCUSSION

C) Effect of Metallic Dampers on Base Shear

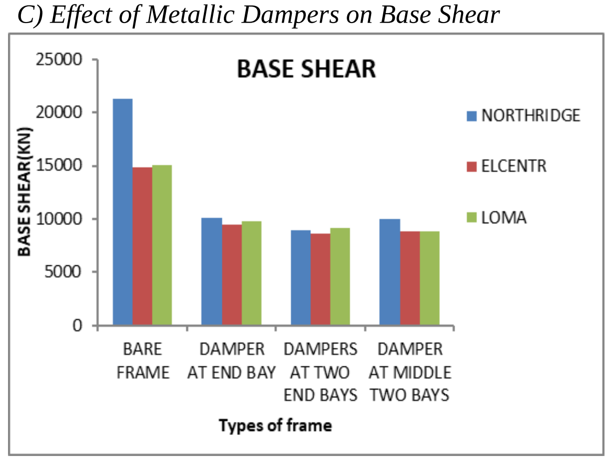
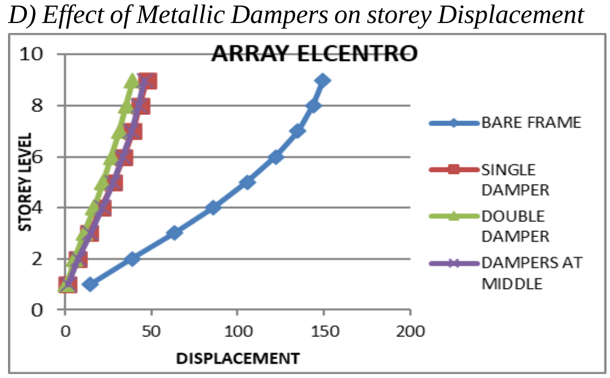
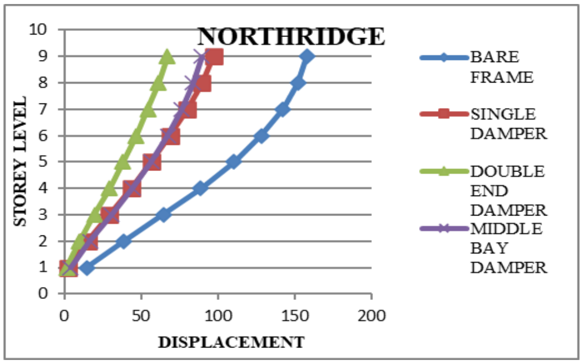


Fig. 6. Base shear comparisons using metallic dampers for various models under various earthquake

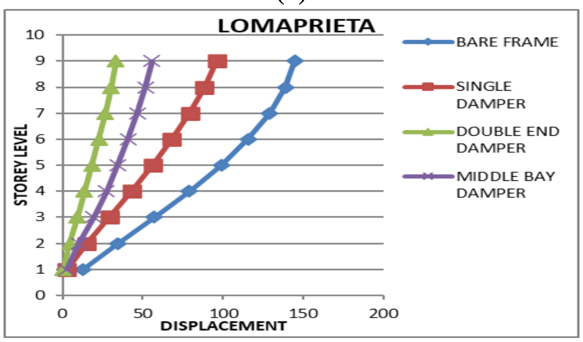
D) Effect of Metallic Dampers on storey Displacement



(a)



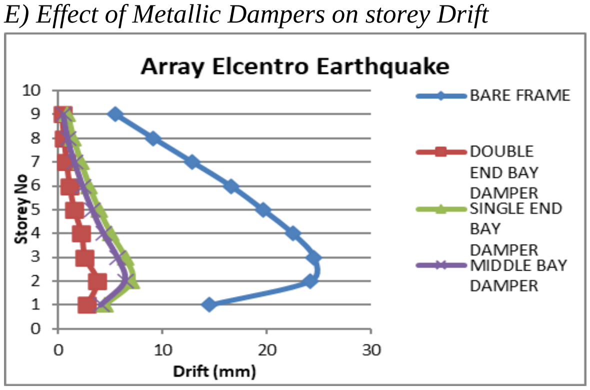
(b)



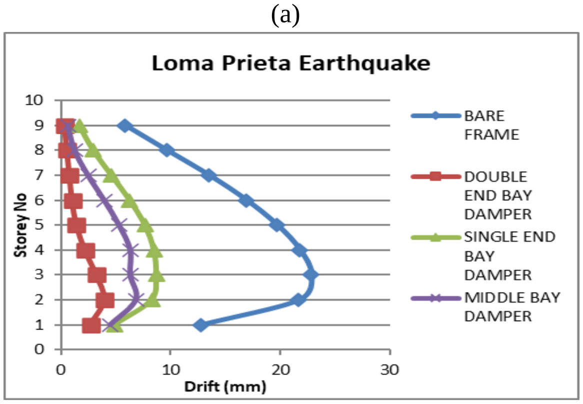
(c)

Fig. 7 a,b and c Displacement comparisons using Metallic dampers for various models under various earthquakes

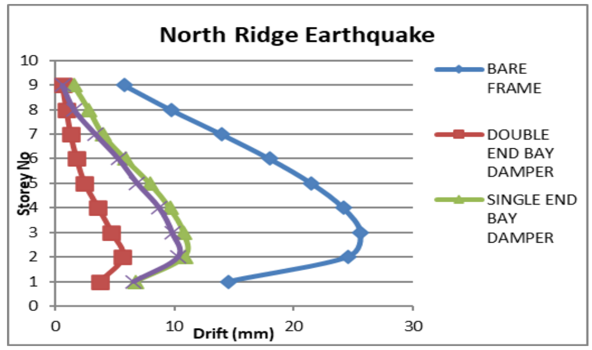
E) Effect of Metallic Dampers on storey Drift



(a)



(b)



(c)

Figure 8 a,b and c Displacement comparisons using Metallic dampers for various models under various earthquakes

IV. CONCLUSION

1. When compared to bare frame, Metallic dampers reduced the top storey displacement by 53.82%, 74.42%, and 60.38% for end bay dampers, double end dampers, and middle bay dampers, respectively.
2. When bare frame for Metallic damper was used as a comparison, it was found that the decrease in storey drift for the top storey was lowered by 63.39%, 79.20%, and 79.52% for end bay for end bay damper, double end damper, and middle bay damper, respectively.
3. It was also noted that the metallic damper reduced the base shear for the end bay damper, double end damper, and middle bay damper by 32.07%, 31.28%, and 42.57%, respectively.
4. The study's key finding relates to the damper's location inside the building structure. The findings indicate that installing metallic dampers in the building's outermost and adjacent bays maximises their effectiveness while installing them in the centre bay reduces their effectiveness. Installing dampers at the outside bays is highly advised, while staying away from installing them at the central bays.

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