Analysis of a High Rise Building with Viscous Dampers using ETABS

G.Karthik[#1], P.Lakshmaiah Chowdary[*2]
[#]*Department of civil engineering, JNTUA University*
Bheema Institute Of Technology, Adoni AP India
[1]*karthik.gandla@gmail.com*

Abstract : **The basic principles of design for vertical and lateral loads (wind & seismic) are the same for low, medium or high rise building. But a building gets high both vertical & lateral loads become controlling factors. The vertical loads increase in direct proportion to the floor area and number of floors. In contrast to this, the effect of lateral loads on a building is not linear and increase rapidly with increase in height. Due to these lateral loads, moments on steel components will be very high. By providing viscous dampers these moments can be reduced.**
In the present analysis, a residential building with 20 floors is analyzed with columns, columns with viscous dampers at different locations were for all the 2 cases. The building is analyzed in Zone 3 & Zone 5 with three soils in both static & Dynamic Analysis. Moments, Shear, Displacement were compared for all the cases. It is observed that the deflection was reduced by providing the Viscous dampers .

*Keywords***— ETABS, Highrise Building, Seismic loads.**

Introduction

Natural disasters are inevitable and it is not possible to get full control over them. The history of human civilization reveals that man has been combating with natural disasters from its origin but natural disasters like floods, cyclones, earthquakes, volcanic eruptions have various times not only disturbed the normal life pattern but also caused huge losses to life and property and interrupted the process of development. With the technological advancement man tried to combat with these natural disasters through various ways like developing early warning systems for disasters, adopting new prevention measures, proper relief and rescue measures. But unfortunately it is not true for all natural disasters. Earthquakes are one of such disaster that is related with ongoing tectonic process; it suddenly comes for seconds and causes great loss of life and property. So earthquake disaster prevention and reduction strategy is a global concern today.

Scope and Objectives of the present study

- To develop a methodology for retrofitting of existing buildings with viscoelastic dampers.
- To estimate the base shear demand of typical low rise (three storey) and high rise (twenty storey) buildings with and without infill for change in zone by seismic coefficient method and time history analysis.
- To perform linear time history analysis of three storey building and twenty storey building to estimate the number of viscoelastic dampers and percentage of damping required to meet additional base shear demand and serviceability limit states.
- To study the effect of infills in framed buildings in terms of difference in time period, base shear demand, amount of damping required for retrofitting.
- To compare the response of the building with and without dampers in terms of base shear, acceleration, axial load, roof displacement and inter-storey drift.

DETAILS OF THE STRUCTURE:

The plan of multistoried building is 24 x 24 m, here 24 is the length of the plan and 24 is the width of the plan and have a lift section design in the building. There are 6 flats in the ground floor and it is similar in the upper most part of the building and in the entry of the building one hall is have and in that hall we have given a lift section from bottom to upper part of the building.

Salient features

Utility of building	Residential complex
No of stories	G+20
Type of construction	R.C.C framed structure
Types of walls	Brick wall
Geometry Details	
Width of the building	24m
Height of building	60m
Height of the floor	3m
Materials	
Concrete grade	M30
All steel grades	Fe500 grade

Size of Structural Members

Column Size:

From ground floor to tenth floor: 1000 mm X 750 mm

From eleventh floor to twentieth floor: 450 mm X 750 mm

Beam Size: 400 mm X 650 mm

Slab Thickness: 120 mm

Viscous dampers on each elevation

Fig:1 Plan view of high rise building

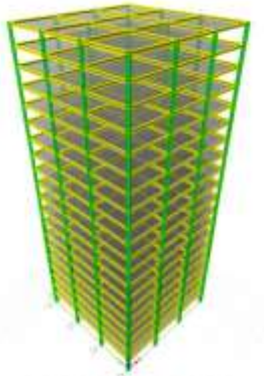
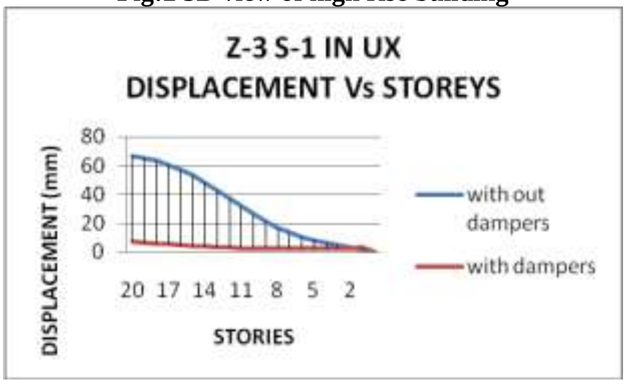
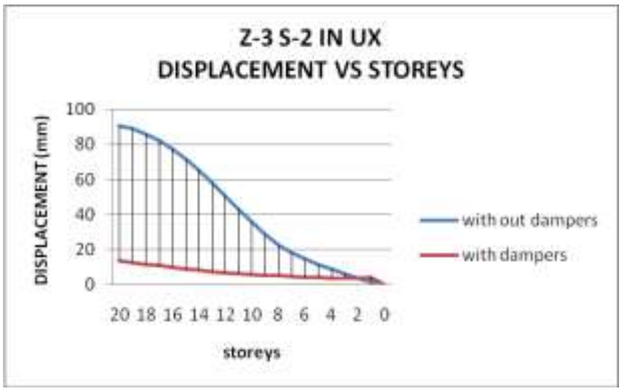


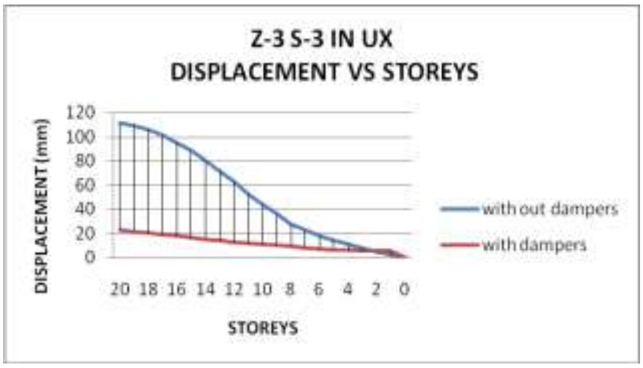
Fig:2 3D view of high rise building



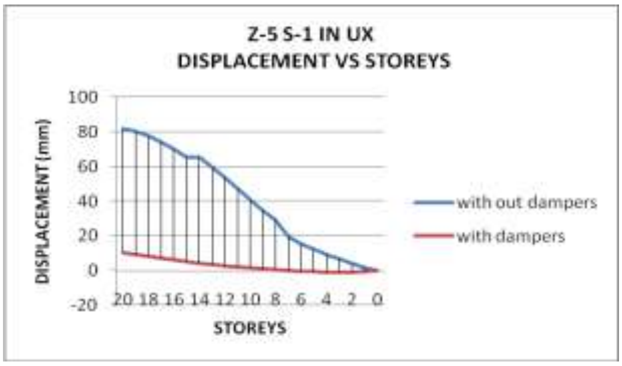
Graph 5.1 Showing displacement variation in z-3 s-1



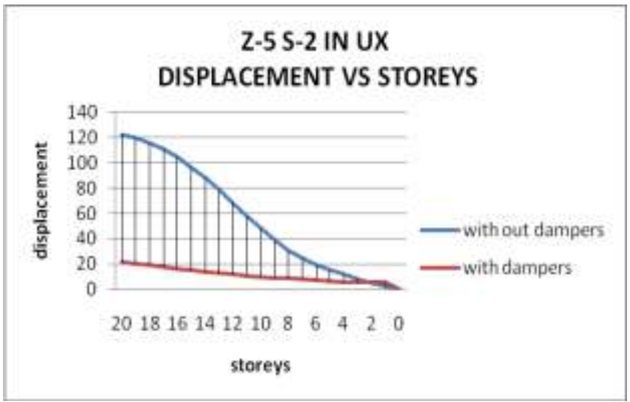
Graph 5.2 Showing displacement variation in z-3 s-2



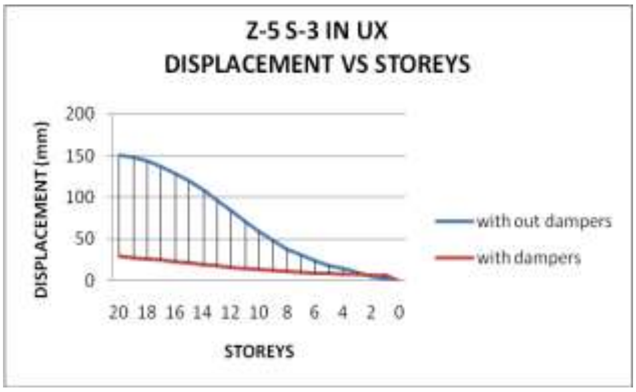
Graph 5.3 Showing displacement variation in z-3 s-3



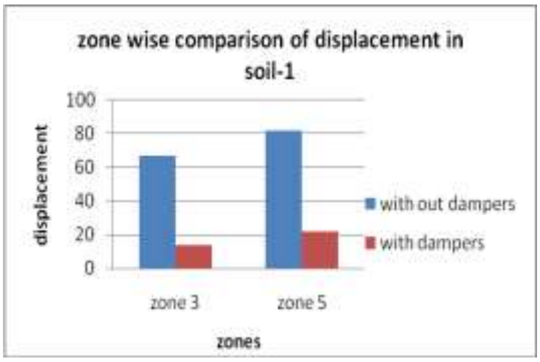
Graph 5.4 Showing displacement variation in z-5 s-1



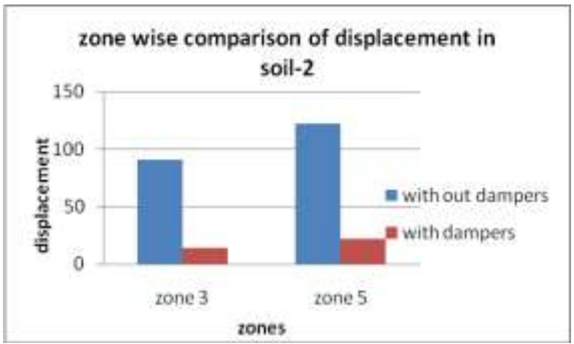
Graph 5.5 Showing displacement variation in z-5 s-2



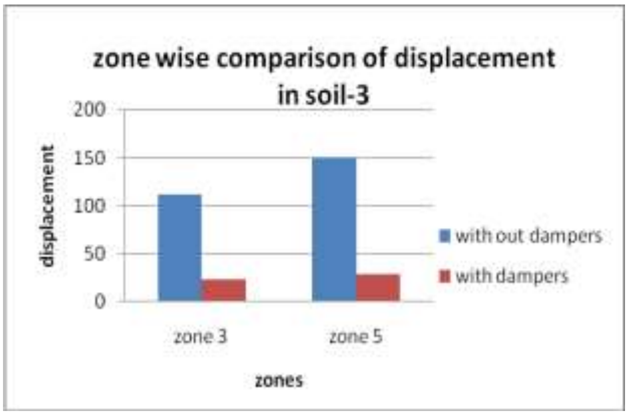
Graph 5.6 Showing displacement variation in z-5 s-3



Graph 5.7 Showing zone wise displacement variation in soil-1



Graph 5.8 Showing zone wise displacement variation in soil-2



Graph 5.9 Showing zone wise displacement variation in soil-3

CONCLUSIONS

1. Displacement is compared for two models i.e,, with out dampers & with dampers at top storey of a high rise building in zone-3 & zone -5 in each soil it is observed that 50% displacement is reduced when the dampers are provided at each elevation.
2. By providing the dampers the stiffness of the structure is increased and storey shear is decreased with increase in height of structure.

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