"Using E-Tab Software & Compare Seismic Analysis of Normal RCC multistoried building with Dampers using"

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Abstract— The earthquake is a natural forced and therefore it is required to study the behavior of the forces generated during an earthquake in multistoried building structures. The vibrating forces are generated at the foundation of the structure, these vibrating forces generate oscillations that can cause significant damage to the building. , In order to avert this type of damages some structural systems like dampers we use in structural system as they able to resist such type of earthquake forces in a very effective manner. Dampers are the devices placed in structure which absorb the forces and vibrations occurring in structure and reduce the deformation and damage of structure. The performance of RCC 10 stories with damper and without damper and 20 stories with damper and without damper under the same plan area and loading conditions and method is used to analyzed the structure and compare the system and buildings in terms of shear force, bending moment, frequency, deflection, different types of stresses in structure and to find he most efficient system and structure used for designing the structure.

Keywords— Viscous damper, Seismic analysis Periods Frequency.

I. INTRODUCTION

An earthquake is a natural event caused by the shifting of tectonic plates, leading to ground shaking due to the imbalance in nature. The forces generated during an earthquake are unpredictable and can directly impact and damage structures. Therefore, it is essential for structural engineers to account for these forces in their designs and implement measures to minimize their effects, ensuring the protection of structures. Several techniques and methods are employed to control these forces and safeguard buildings.

There are many passive energy dissipating devices now a days, devices such as dampers and isolators are commonly used. There are various types of equipment and mechanical systems that can significantly improve their effectiveness when the right ones are selected configuration of these dampers.

Dampers are the devices placed in structure to reduce the earthquake forces and increase the structure strength, they generally absorb the energy released during earthquake and minimize the earthquake effect on structure and prevent structure from deformation and collapse.

II. OBJECTIVE

1. To analyze the seismic performance of a selected G+20 RCC building equipped with a viscous damper using ETABS software.
2. Choosing the most suitable type of damper for the selected building to enhance its earthquake resistance.
3. Compare and analyze various parameters such as shear force, bending moment, and stresses across all models, and evaluate the structural performance of the high-rise building with and without dampers, maintaining the same plan area and loading conditions, using ETABS 2016 software.
4. Compare and study of some different maximum deflection and storey drift, storey force, storey stiffness of all models the structure building with damper or without damper.

III. METHODOLOGY

3.1 Objective of study:

In this project, four models of a standard RCC 10-story and 20-story building are created, one of which is a conventional RCC design & another is with damper system and analyses of shear force, bending moment, frequency, The stress analysis is performed using ETABS software to design the building for earthquake resistance.

3.2 Modelling Parameters

3.2.1 Number of story: G+10, G+20

- Typical story height-3m
- Bottom story height-3m

3.2.2 Properties of Damper:

The damper used in project is viscous damper having following properties:

Stiffness of damper: 200
Damping coefficient: 50
Damping exponent: 0.5

3.2.3 Load Consideration:

Dead load: The structure's self-weight is considered as the dead load.

Live load: The live load used in the design is as follows: A live load of 5.0 kN/m² is considered for all structural models in the project.

Floor finish -1.5 KN/m^2is considered for all structure model of project

Wall load= 3.7KN/m is considered for all structure model of project

Earthquake static values: The static earthquake values for Zone 3, applicable to multistoried buildings, are presented below:

- Earthquake zone factor - III
- Z=0.16
- Soil type: Medium soil (Type II)
- Importance factor-1.0
- Response reduction factor: 5.0
- Total height (30m) of the structure: 10 stories.
- Total height (60m) of the structure: 20 stories.
- .

Wind coefficient ; V_b = 44 m/s

IV. DESIGN ANALYSIS

The modeling procedure for the supplied damper system, walls, and fixed building analysis was based on IS 1893:2000 (Part 1). ETABS software was used for analysis, including the design steps for the dampers and fixed base analysis.

4.1 Maximum Storey Displacement -

Multi Storey	Normal Building	With Damper Building
10th storey	60.943	53.267
20th storey	628.833	163.23

4.2 Avg. Storey Displacements –

Multi Storey	Normal Building	With Damper Building
10th storey	53.267	2.751
20th storey	624.506	160.851

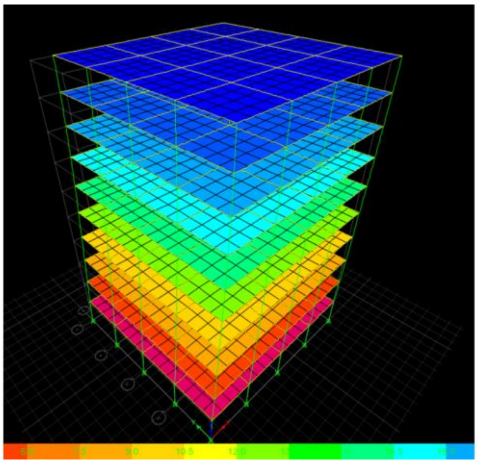

Fig. 4.1 Max. Displacement 10 storey RCC structure

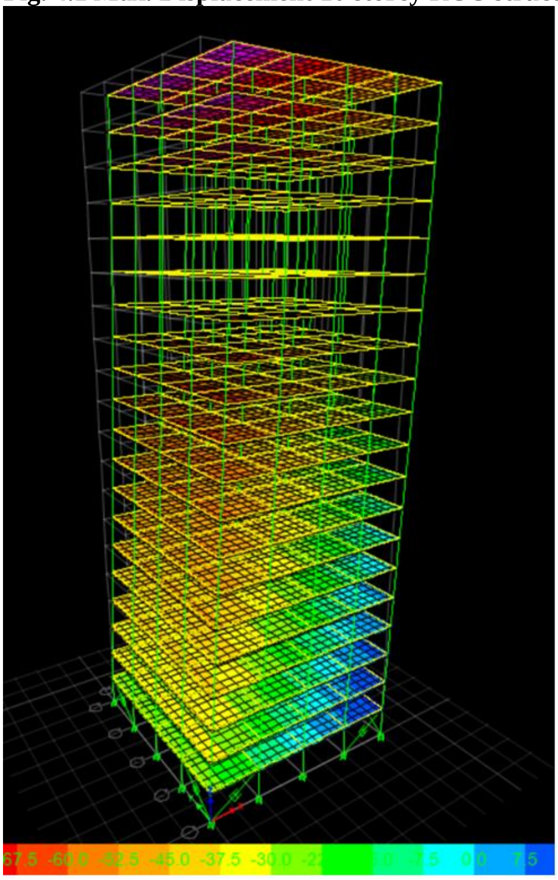

Fig. 4.2 displacement diagram of 20 storey normal rcc structure with damper

V. RESULT

This project involves the analysis of four cases for both 10-story and 20-story buildings. A comparative study is conducted based on displacement and stress results from both static and dynamic analyses, with various load combinations in accordance with IS codes, using ETABS software..

Case 1 Normal RCC structure -10 Storey
Case 2 Normal RCC structure with dampers -10 Storey
Case 3 Normal RCC structure- 20 Storey

Case 4 20 Storey normal RCC structure with damper

Multy	Height	Place	X-Dir	Y-Dir
	M		kN-m	kN-m
M-10	30	Apex	25353.9189	-25353.9189
M-9	27	Apex	53358.6889	-53358.6889
M-8	24	Apex	81363.4589	-81363.4589
M-7	21	Apex	109368.229	-109368.229
M-6	18	Apex	137372.999	-137372.999
M-5	15	Apex	165377.7691	-165377.7691
M-4	12	Apex	193382.5391	-193382.5391
M-3	9	Apex	221387.3091	-221387.3091
M-2	6	Apex	249392.0792	-249392.0792
M-1	3	Apex	277396.8492	-277396.8492
Base	0	Apex	280047.7004	-280047.7004

Table 5.1 Max displacement of 10 storey

Multy	Height	Place	X-Dir	Y-Dir
	m		Mm	Mm
M-10	30	Apex	0.021	0.015
M-9	27	Apex	0.02	0.014
M-8	24	Apex	0.019	0.014
M-7	21	Apex	0.017	0.012
M-6	18	Apex	0.015	0.011
M-5	15	Apex	0.012	0.009
M-4	12	Apex	0.009	0.007
M-3	9	Apex	0.006	0.005
M-2	6	Apex	0.003	0.002
M-1	3	Apex	0.000115	0.00006916
Base	0	Apex	0	0

Table 5.2 Max displacement of 10 storey with damper

Story	Elevation	Location	X-Dir	Y-Dir
	M		mm	Mm
M-20	60	Apex	0.011	0.011
M-19	57	Apex	0.011	0.011
M-18	54	Apex	0.011	0.011
M-17	51	Apex	0.011	0.011
M-16	48	Apex	0.01	0.01
M-15	45	Apex	0.01	0.01
M-14	42	Apex	0.009	0.009
M-13	39	Apex	0.009	0.009
M-12	36	Apex	0.008	0.008
M-11	33	Apex	0.008	0.008
M-10	30	Apex	0.007	0.007
M-9	27	Apex	0.006	0.006
M-8	24	Apex	0.006	0.006
M-7	21	Apex	0.005	0.005
M-6	18	Apex	0.004	0.004
M-5	15	Apex	0.003	0.003
M-4	12	Apex	0.002	0.002
M-3	9	Apex	0.002	0.002
M-2	6	Apex	0.001	0.001
M-1	3	Apex	0.0000389	0.0000389
Base	0	Apex	0	0

Table 5.3 Max displacement of 20 storeys

Multy	Height	Place	X-Dir	Y-Dir
	m		mm	Mm
M-20	60	Apex	0.011	0.011
M-19	57	Apex	0.011	0.011
M-18	54	Apex	0.011	0.011
M-17	51	Apex	0.011	0.011
M-16	48	Apex	0.01	0.01
M-15	45	Apex	0.01	0.01
M-14	42	Apex	0.009	0.009
M-13	39	Apex	0.009	0.009
M-12	36	Apex	0.008	0.008
M-11	33	Apex	0.008	0.008
M-10	30	Apex	0.007	0.007
M-9	27	Apex	0.006	0.006
M-8	24	Apex	0.006	0.006
M-7	21	Apex	0.005	0.005
M-6	18	Apex	0.004	0.004
M-5	15	Apex	0.003	0.003
M-4	12	Apex	0.002	0.002
M-3	9	Apex	0.002	0.002
M-2	6	Apex	0.001	0.001
M-1	3	Apex	0.0000389	0.0000389
Base	0	Apex	0	0

Table 5.4 Max displacement of 20 storeys with Dampers

VI. CONCLUSIONS

The analysis includes models of a multi-story building with identical plan area and height, consisting of two standard RCC structures without a damper system and two models with a damper system. These models were analyzed using ETABS software, and a comparative study was conducted across the four models. The following conclusions were drawn from the analysis:

The max displacement at 10 storey top and bottom are decreased as we provide damper system in multistoried building than normal RCC building.

The min displacement at 10 storey top and bottom are more in multistoried building with damper system and RCC multistoried building.

The max storey drift at 10 storey top and bottom are more in multistoried building with damper system RCC multistoried building.

The min storey drift at 10 storey top and bottom are more in multistoried building with damper system and RCC multistoried building.

The max storey stiffness is decrease in 10 storey with damper system and in RCC than normal RCC building system.

The min storey stiffness at 10 storey top and bottom with damper system and in RCC than normal RCC building system

The storey max force is decrease in 10 storey with damper system and in RCC than normal RCC building system

The min is decrease in 10 storey with damper system and in RCC than normal RCC building system

The period and frequencies is decrease in 10 storey with damper system and in RCC than normal RCC building system

The max storey moment is decrease in 10 storey with damper system and in RCC than normal RCC building system

The max displacement is decrease in 20 storey with damper system and in RCC than normal RCC building system

The min displacement is decrease in 20 storey with damper system and in RCC than normal RCC building system

The max storey drift is decrease in 20 storey with damper system and in RCC than normal RCC building system

The min storey drift at top and bottom are more in multistoried 20 storey building with damper system and in RCC than normal RCC building system

The minimum storey stiffness at both the top and bottom is higher in the 20-story multi-storey building with a damper system compared to the standard RCC building system.

The maximum storey stiffness at both the top and bottom is higher in the 20-story multi-storey building with a damper system compared to the normal RCC building system.

The maximum storey force at both the top and bottom is higher in the 20-story multi-storey building with a damper system compared to the conventional RCC building system.

The minimum storey force at both the top and bottom is greater in the 20-story multi-storey building with a damper system compared to the standard RCC building system.

The storey period and frequencies at top and bottom are more in multistoried 20 storey building with damper system and in RCC than normal RCC building system

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