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A futuristic digital interface with a glowing Earth globe in the center. The background is dark blue with various data visualizations including bar charts, line graphs, and network diagrams. Text elements like 'BUSINESS', 'NETWORK SEARCH', and 'LADING 100%' are visible. The overall aesthetic is high-tech and data-driven.

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Study of Pounding Effect between two Structures using Nonlinear static Analysis by using ETABS

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ABSTRACT: The building must be sufficient consideration in terms of stiffness and mass as well as a practical approach for it to be judged symmetrical. The majority of asymmetrical structures have varying degrees of freedom in plan elevation and the arrangement of vertical features. Some basic analysis technique, such as a Nonlinear static analysis will also be used. The purpose of this investigation is to reach an accurate conclusion regarding the pounding impact. There will be a collision between these two buildings because of their close proximity to one another. the Nonlinear static analysis of this pounding effect is studied. A fluid viscous damper and bracings is built or installed between these two structures after evaluating the collision and pounding offenses between the two buildings of a correct spacing. To test whether the fluid viscous damper and bracings will stop the displacement and other related forces.

I. INTRODUCTION

In the case of an earthquake, these models will clash while measuring the closure distance between these. According to a recent study, earthquake- and other seismic-load-capable building structures will be colliding with neighbouring buildings, causing massive amounts of destruction. Considering the morning effect as one of the loads, applied to two structures separated by a specific distance in order to study the impact of nonlinear static analysis.

Using a flow discuss damper is the greatest way to adapt between the two building structures having a specific separation distance between them. taking the various zone region values from the IS standard code book 1893, consideration is given to the suitable zone for one condition, the soil state condition for the load combinations, as well as other essential factors. The fluid viscous damper significantly contributes to efficiently minimizing the displacement in between these two buildings because of, the ductility impact and the fluid's inclusion in the model.

A typical structural engineering method for providing buildings and other structures lateral support and stability is X-bracing which is placed between these building structures. It includes creating diagonal bracing in the shape of a "X" between beams, columns, or walls, and in order to distribute lateral stresses brought on by wind, seismic activity, or other loads and to ensure stability and safety for various building projects. It provides an effective and affordable method of reducing lateral forces that may otherwise cause a structures or superstructure to sway or collapse. The braces are arranged in an "X" shape, which considerably increases the structure's resistance to horizontal pressures by distributing the lateral stresses in two directions.

II. NON-LINEAR STATIC ANALYSIS

It is a static analysis in which the static loads are applied in an incremental fashion until the ultimate state of the structure is attained. The non-linear designation comes from the fact that the various components/elements are modelled using a non-linear mathematical model. This procedure involves some distinct phases as it defines the mathematical model with the non-linear force deformation relationships for the various components/elements and a suitable lateral load pattern and evaluate the performance of the building. It defines the non-linear behaviour that is initial stiffness, yield point, post yielding stiffness, ultimate resistance and, if required, the behaviour beyond the ultimate resistance of the section. The Non-linear Static Analysis procedure generally introduced in this project is also referred to by the term Pushover Analysis, because of the nature of application of lateral loads while defining the



capacity of the structure. In addition, it can be understood that this analysis technique offers means to establish/predict the inelastic forces, displacements, deformations etc., taking into account the non-linear behaviour on the structural material during a seismic event.

III. OBJECTIVES

Using ETABS to investigate pounding effect or impact in between these two structures (G+15 and G+10), you can create two separate models and perform a nonlinear static analysis on each. In **Normal Model** define appropriate materials, sections, and properties for the structural elements and apply appropriate loads, such as gravity loads and lateral loads and perform a separate analysis taking into account the lateral loads and boundary conditions of each structure. In **Model with Viscous Fluid Damper** incorporate fluid viscous dampers into the models in appropriate places. These dampers dissipate energy and can lessen the impact of pounding and define the features and properties/characteristics of the model's fluid viscous dampers In **Model with Bracings** incorporate bracing systems into the models in the proper places, such as diagonal steel bracing. Bracing systems assist in increasing lateral stiffness and minimizing pounding impacts and to evaluate how the structures will behave when the bracing systems are present, conduct a nonlinear static analysis than the efficiency of these mitigation techniques in lessening the pounding impact between the two structures may be assessed by comparing the results from the normal model, model with fluid viscous dampers, and model with bracing.

IV. METHODOLOGY

The modelling and design of the models were carried out in ETABS software. Model description and parameters were tabulated below.

Table 1: Parameters consider for the model

SL. NO	PARTICULARS	VALUES
1	No. of Story	G+15, G+10
2	Ground floor height	3.1m
3	Plan area	60m x 25m
4	Thickness of slab	0.2m
5	Soil type	Medium
6	Steel Bracing	ISWB 150
7	Column 1	750mmx750mm
	Column 2	600mmx600mm
8	Beam 1	750mmx600mm
	Beam 2	600mmx600mm
9	Wall thickness	230mm
10	Grade of concrete	M45
11	Grade of Steel	Fe550
12	Seismic Zone	V
13	Density of concrete	25KN/m ³
14	Density of motor	20.4KN/m ³
15	Density of solid Brick	20KN/m ³
16	Code book consideration	1) IS: 1893–2002, 2) IS 456- 2000,

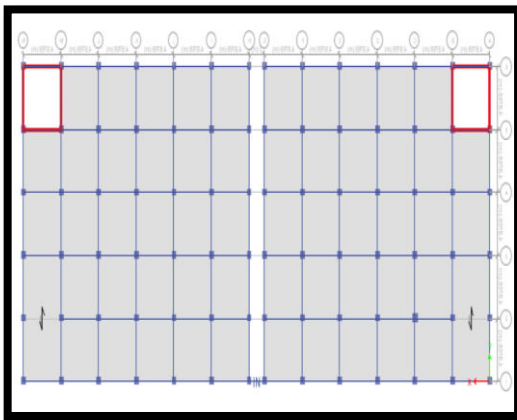


Fig. 1: 2D Plan of Model

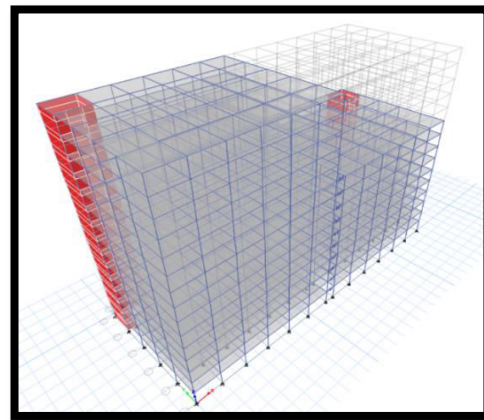


Fig. 2: 3D Plan of Model

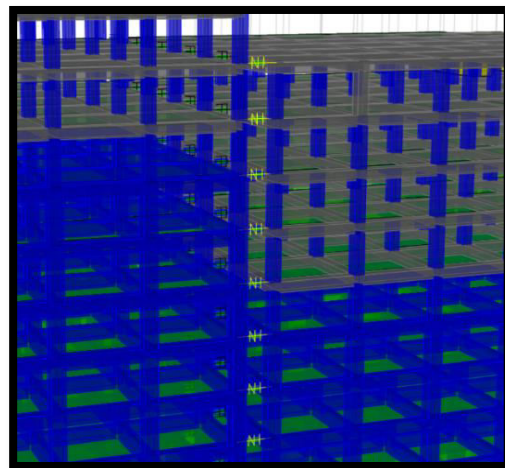
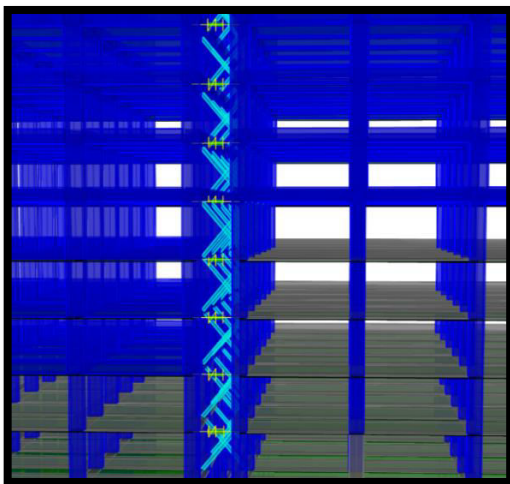


Fig. 3: X Bracings Wireframe View of Rcc Structure

Fig. 3: Fluid viscous damper Wireframe View of Rcc Structure

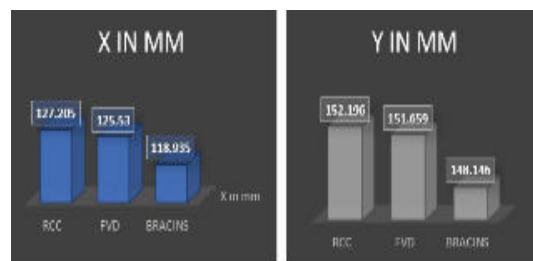
V. RESULT AND DISCUSSION

Maximum Value of Story displacement, Story drift and auto lateral load were tabulated and graphs were plotted below

Story Displacement

Story displacement in (mm)		
Model	X direction	Y direction
RCC	127.205	152.196
FVD	125.53	151.659
Bracings	118.935	148.146

Table 2: Comparison of Story Displacement



X-Direction Y-Direction
Chart1: Comparison of Story Displacement in X and Y direction of all Models

Story Drift

Story Drift in (KN)		
Model	X direction	Y direction
RCC	0.001876	0.00216
FVD	0.001784	0.00213
Bracings	0.001748	0.00215

Table 3: Comparison of Story Drift

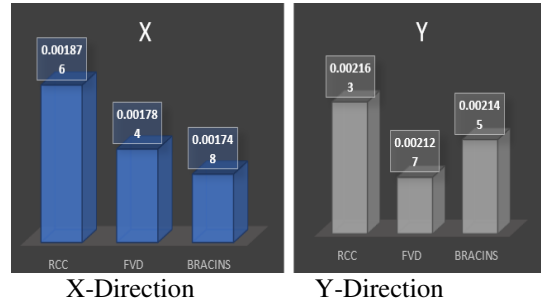


Chart 2: Comparison of Story Drift in X and Y direction of all Models

Auto lateral Load

Auto lateral load in (KN)		
Model	X direction	Y direction
RCC	3930.772	3497.82
FVD	4101.577	3517.52
Bracings	4158.696	3548.33

Table 4: Comparison of Auto lateral Load

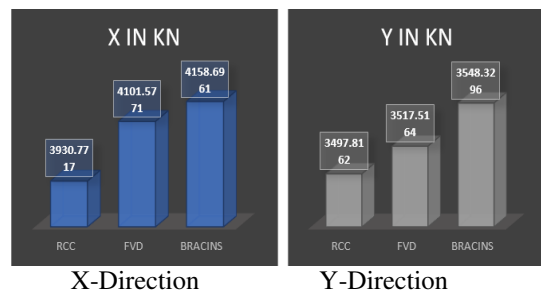


Chart 3: Comparison of Auto lateral Load in X and Y direction of all Models

VI. CONCLUSION

In conclusion, based over analysis results of G+15 and G+10 structures using ETABS, it is evident that both models exhibit satisfactory performance in several aspects.

1. The X-bracing model is performing well in reducing story drift and mitigating lateral loads in the X-direction.
2. The fluid viscous damper model is performing well in reducing story drift and mitigating lateral loads in the Y-direction. This indicates that the fluid viscous dampers are effectively dissipating energy and reducing the structure's dynamic reaction.
3. The addition or imposition of autolateral loads has influenced the performance of the bracing and fluid viscous damper models. It might be required to review the design assumptions, adjust the parameters, or consider additional measures to improve their performance under autolateral loads.
4. The X-bracing system is commonly considered effective for several reasons such as Stiffness and Stability, Symmetry and Balance, Torsional Resistance, Cost-Effectiveness and Architectural Flexibility.

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