Seismic Analysis Of Performance On High-Story Building With And Without Using Pall Friction Damper In Various Seismic Zone By Using ETABS

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Abstract - *Due to rapid growth and demand of commercial complex with shopping mall and parking facilities, various problems are generated in structures during earthquakes different levels of lead to partial to full collapsed of structures. In this study we are trying to study the effect of pall friction damper at different levels on the seismic performance of building like storey drift, storey displacement, time period. Also, to reduces the soft storey effect by pall friction dampers using the ETABS for this study. G+30, G+45, G+60 storey building with L shape plan will considered and damper provided at various level of floor.*

***Key Words* - Pall Friction damper (Energy dissipation device), Seismic Analysis, Time history analysis, ETABS.**

1. INTRODUCTION

Earthquake is the most tragic due to its randomness and huge power of destruction. Earthquakes themselves do not kill people rather the enormous loss of human lives and life. Building structures collapse during earthquakes and cause loss of human lives. Several research works have been directed worldwide in last few decades to investigate the cause of failure of different types of buildings under earthquake. recent devastating earthquake proves that in developing countries like India, such investigation is the desideratum of the hour. Hence, seismic comportment of asymmetric building structures has become a topic of ecumenical active research. Many Investigations have conducted on elastic and inelastic seismic effect deportment of asymmetric systems to the cause of seismic susceptibility of such structures.

Energy Dissipation are the specially designe Mechanical System to dissipate an astronomically portion of earthquake input energy in specialized connection details which deforms during in Earthquakes. In General Energy Dissipation Contrivances are characterized by its capacity to energy dissipation in structural systems to which they are installed, so that the structure has to resist lesser amount of Earthquake forces. It operates on principles such as frictional sliding, yielding of metals, and phase transformation in metals and fluid orrificing in fluid viscous damper.

Friction damper device of several one or more steel plates sliding against each other in opposite directions. The steel plates are separated by shims of using one type of friction pad material. The damper dissipates energy means of friction between the surfaces which are rubbing against to each other.

Another type of friction damper is Pall friction damper. This damper includes a bracing system and some steel plate with friction screws. And they should be installed in the middle of bracing system. Steel sheets are connected to each other by high strength bolts and they have a slip by a certain force .

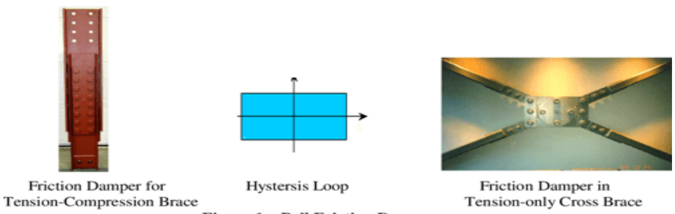


Figure 1. Pall Friction Dampers

2. OBJECTIVE

1) To study the seismic response of building with and without pall friction damper installed at various storey floors and various locations of pall friction dampers placed using standard analysis software ETABS.
2) To study the behaviour of structure using pall friction damper.
3) To check the effectiveness of the pall Friction dampers in reduction of the seismic responses such as storey drift, storey displacement, time period.

3. LITREATURE VIEW

Ali Naghshineh (2018) [1] investigated the Seismic Performance of Reinforced Concrete Frame Buildings Equipped with Friction Dampers In this paper, the seismic performance of a 14 story moderately ductile concrete frame, designed based on National Building Code of Canada (NBCC) has been carried out with and without friction dampers. There are 6 type of model Elastic, Ductile, Moderately Ductile, Elastic + Dampers, Ductile + Dampers, Moderate+ Dampers. Nonlinear dynamic time history using a set of ground motion records has been performed to determine their effects. The cost analysis as presented s that using friction dampers can improve the overall performance of the building with less cost.

Parin Panchal (2020) [2] investigated the Seismic Performance of Reinforced Concrete Frame Buildings Equipped with Friction Dampers various location at soft storey floor. They consider multistory building having 10, 20, and 30 store. The analysis was carried out by considering different parameters to understand the behavior of FD with soft storey. A standard G+10, G+20 and G+30 story buildings with FD were modelled. The analysis is carried out on the 90 models using response spectrum method in ETABs. The results of this investigation show that the response of the structure i.e. time period, storey displacement, storey drift can be reduced by using friction damper. The time period goes on increasing as the building height goes on increasing and also when we provide friction dampers in the building the time period of the building decreases. The friction damper located in soft storey floor in all most effective then alternate, center and corner. base shear has increased due to additional mass of brace and friction damper system.

Magendra, Titiksh, Qureshi (2007) [3] Allocation and slip load of friction dampers for a seismically building structure based on storey shear force distribution . seismic design methodology of the friction dampers based on the storey shear force distribution of an elastic building structure is proposed. First, using two normalization methods for the slip-load of a friction damper, numerical analysis of various single degree-of-freedom systems is performed systems is performed. From this analysis, the effect of the slip-load and brace stiffness is investigated and optimal stiffness ratios of the braces versus primary structures are found. it is observed that, if the slipload of the friction damper is normalized with respect to the storey shear force of the original primary structure, optimal stiffness ratios for the displacement and storey shear force become similar.

Julius Marko (2004) [4] investigated Influence of damping systems on building structures subject to seismic effect the response of multi-storey structures under simulated earthquake loads with friction dampers, viscoelastic dampers and combined friction-viscoelastic damping devices strategically located within shear walls. There are two types of configuration dampers was fitted diagonal and horizontal configuration best performance was observed when damper were placed in the upper level, while greatest reductions in the peak values of tip acceleration were achieved when dampers were placed in the lower level.

Ji-Young Seong (2012) [3] investigate analytically a singledegree-of-freedom (SDOF) building structure equipped with a friction damper for assessing its vibration control effect. Friction dampers are installed between stories to reduce inter-story displacements of building structures subjected to external loading. The building single storey structure model with friction dampers is represented by mass-spring-viscous Coulomb damping system. The Building response reduction as a result of damper installation can be provided by observing equivalent viscous damping ratio rather than friction force contributed by friction dampers.

4. METHEDOLOGY

4.1 MODELLING OF BUILDING

Here the study is carried out for the behavior of G+30 ,G+45, and G+60 multi-storey reinforced concrete building with pall friction damper in L shape plans. Floor height provided 3m. And also the properties are defined for the structure. The pall friction damper located in all, alternate ,center ,corner.

4.2 BUILDING PLAN AND DIMENSION DETAILS

The analysis was carried out by considering different parameters to understand the behavior of PFD . A standard G+30, G+45 and G+60 story of buildings with PFD were modelled. The analysis is carried out on the 60 models using time history analysis method in ETABs 2017. IS 1893:2002 codal provisions is considered for the analysis. The plan dimensions considered for analysis are as shown in fig. L shape building has 40m x 40m plan dimensions. Each bay having 5 m.

Table -1: Considered Parameters

Parameter	Values
Concrete grade	M35
Steel grade	Fe500
Thickness of slab	150mm
Dimension of beam	350mm x 750 mm
Dimension of column G+10 G+20 G+30	G 500mm x 500mm 750mm x 750mm 900mm x 900mm
Floor height	3000mm
Thickness of exterior walls	230mm
Thickness of inner walls	115mm

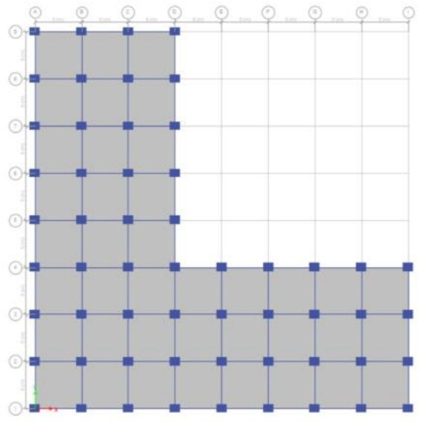


Fig.2 : L shape

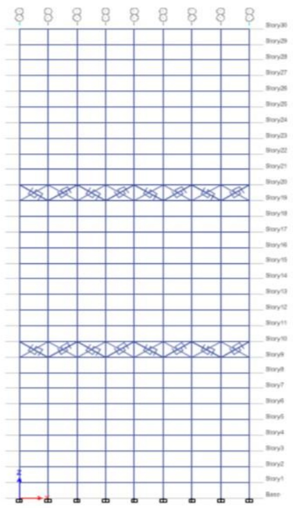


Fig.3 : PFD with building

4.3 ASSIGNING LOADS

- Dead load = 1.5 kN/m2
- Live load = 2 kN/m2

5. SEISMIC ANALYSIS OF BUILDING

Seismic parameters are considered as per IS 1893 (Part 1):2002

- Soil type= II
- Seismic zones = V,IV,III,II
- Importance factor = 1
- Building type = SMRF
- Response reduction factor: 5
- Friction Damper properties provide by Quaketek in Canada

6. RESULTS

6.1 G+30

Graphical representation of G+30

Graph -1: storey displacement and storey drift

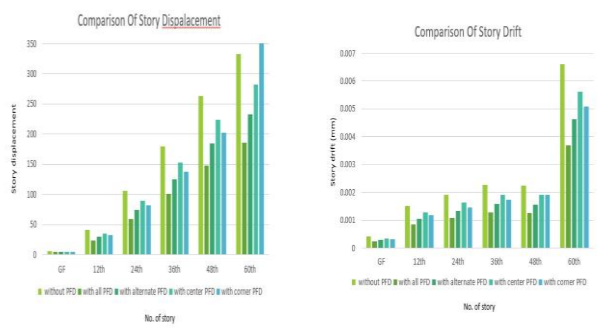
6.2 G+45

Graphical representation of G+45

Graph -2: storey displacement and storey drift

6.3 G+60

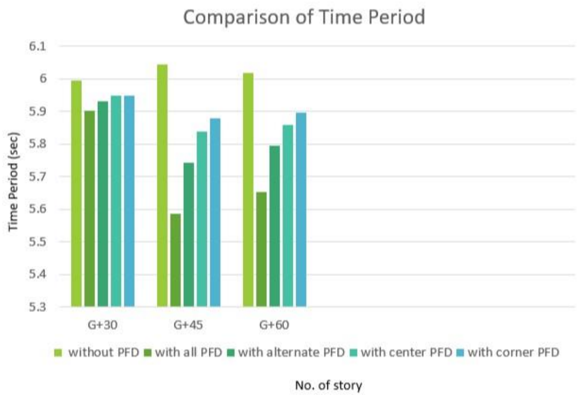
Graphical representation of G+60



Graph -3: storey displacement and storey drift

6.4 G+30, G+45, G+60

Graphical representation of time period



Graph -4: time period

7. CONCLUSIONS

- The Pall Friction damper provided at the storey floor level of buildings and shows considerable changes in seismic parameters like Storey Displacement, Storey Drift and Time Period.
- The pall friction damper provided at floor level in all, alternate, center, corner .The effectiveness accordingly in L shape in all, alternate, corner ,center arrangement .
- applying pall Friction damper in building the seismic parameters like Storey Displacement, Storey Drift and Time period are reduced.
- The time period of Structure decrease with the installation of friction damper.
- Base shear has increased due to additional mass of brace and pall friction damper system.

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