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# Comparative Study on Collision Effect Using Response Spectrum Analysis

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**ABSTRACT:** For the building to be considered symmetrical, each floor's stiffness and mass, as well as its usefulness, must be taken into account at the right level. Most buildings that aren't symmetrical have different degrees of freedom in the plan, elevation, and distribution of vertical members, and the mass is spread out over the floors in a big way. This is something that you don't see very often. Think about the Research and Analysis section for the right way to analyse things like a pushover and time history analysis. The goal of this project was to come up with a good ending for the pounding effect. We found that there was a good distance between the two types of buildings in our day-to-day lives. Because these two buildings are so close to each other, they will probably crash into each other. Which is called a founding effect, and this pounding effect is studied under pushover and time history analysis as per Indian Standard code 1893:2002.

This codebook takes into account all kinds of load combinations and other important things. 13 After studying the collision and pounding that happens between two buildings with the right amount of space between them, a fluid viscous damper is put between them. The space between them was then made bigger by one metre for each. and to figure out if the fluid viscous damper will stop the movement and all the other forces. From the pushover analysis, we get the values of the comparison between the model with no fluid viscous damper and the models with fluid viscous dampers and increasing gaps. The top ground speed and acceleration are found by looking at the history of the ground. Here, we'll look at the peak ground velocity for the time history analysis. The response of the building will be written down, and all three models will be compared.

**KEYWORDS:** Indian Standard code, Pushover, Analysis, Fluid Viscous Damper.

## I. INTRODUCTION

Which are considered to be completely built in India using the traditional method and investigation of Fast, and also taking into account the recent earthquake, there is some damage shown between buildings that are next to each other with a certain gap. Due to the need to figure out how far apart the two structures are in the case of an earthquake, these models will crash into each other. A recent investigation shows that structures that can handle earthquakes and other types of seismic loads will crash into other structures and cause a lot of damage. Taking into account the fact that the earthquake had a magnitude of 6, it did a lot of damage to buildings, bridges, and other infrastructure. Think about a study done in the country, like if there is a lot of historical evidence, the distance, and how the earthquake load affects the buildings. A recent study also found that the minimum and maximum distances between the two structures affect how they are affected by seismic loads. One of the things to think about is the morning effect, which is a load that is put on two structures with a certain distance between them. To study the pounding effect, time history analysis on fast nonlinear analysis has been thought about.

There were many earthquakes in the north in 1995 and in Nepal in 1999. The damage between the two structures was about 90 km from the epicentre. Is expression leads you to believe that there is a big difference between the two buildings, which is seen as one of the biggest problems with symmetrical buildings and also makes the buildings last less long. Taking into account the pounding effect between two buildings, which could cause damage, and the different dynamic properties of the two buildings next to each other, which cause an unwanted vibration out of face and then a

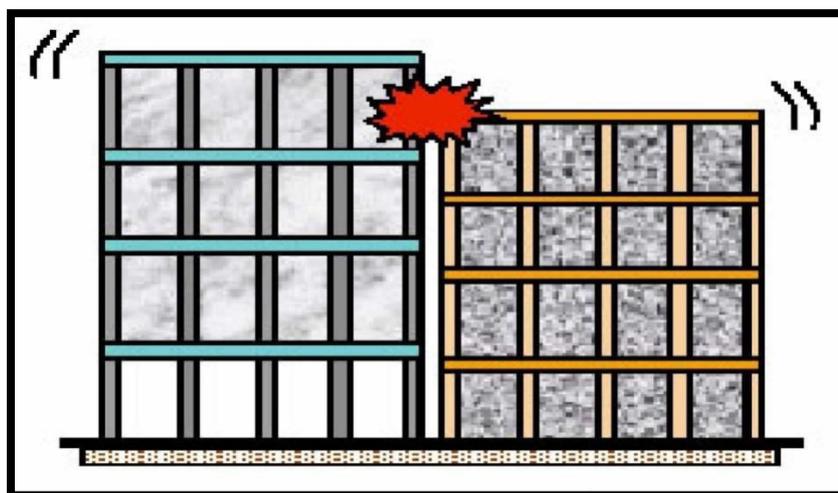


separation between the two buildings, which causes buildings to fall down because they are moving relative to each other,

Historical analysis has shown that this doesn't give any guidelines on how to reduce the pounding effect, so a recent study suggests that putting a fluid viscous damper between the two structures can stop them from crashing into each other. This way, the structures will move when they're doing their specific jobs instead of hitting each other. The fluid viscous damper is one of the best ways to adapt for two buildings that are separated by a certain distance. The gap between the two structures gets to a critical point where this project can tell how far apart they can be. At first, we looked at normal buildings with a one-meter gap between them and did analyses under pushover. We also looked at how the two buildings responded over time. For the second model, a viscous fluid damper is put between the two structures, and the response of the results has been measured. For the third model, the gap has been made bigger to see if the displacement values can be decreased. The best simple way to think about the pounding effect and how it affects the two structures is to use the above method. This is the best way to get the best results and compare the two structures that have fluid viscous dampers.

Taking into account the different zone values in the IS standard code book from 1893, the right zone for one condition, the right soil condition for that condition, and other important factors were taken into account. If you want to stop the pounding effect, you can do a lot with a viscous damper. To keep the two structures from running into each other, it's important to know how far apart they are. Fluid viscous damper plays an important role by reducing the amount of movement between two structures. This is done through the ductility effect and the presence of fluid in the model, which makes it more efficient.

### 1.2 Seismic Pounding Effect between Buildings



Seismic Pounding between Adjacent Buildings.

Separation joint which is the owner of the important distance between the two structures that are considered to have two Wings of the considered facility, which will allow the structures to move independently of each other.

A proper specific gap is a space between the joints of two structures that helps them resist the sideways force of an earthquake. So, taking into account the continuity of the functional criteria, there must be a separate structure between the two structures. This structure is often a wing that goes across the building and ends on the other side. The space between them can be anywhere from one inch to two metres, depending on the load combinations. This placement of drift story share auto lateral loads is an example. distance between the two buildings, which will determine how badly they are damaged during an earthquake. If there isn't enough space between the two structures, there will be a "founding effect" that hurts both of them.



## II. LITERATURE REVIEW

A series of analytics and experimental studies which has been conducted over the seismic gaps which is provided between the adjacent building in order to which time the highest peak risk. during the specific activities the building move front and backward side. which may collide with the adjacent structures. the effect will highly depends upon the size and mass of the structure which will swing at the upper edges and causes that damage to the adjacent buildings. consider the new form application of the buildings which are highly depends upon the height and also as well as single storey to multi storey structure which are in high risk of damages due to the earthquake. considering the Mexico earthquake which is considered that the building of different sizes and also as well as height vibrate at different frequency.

**Viviane Warnotte summarized basic concepts on which the seismic pounding effect occurs** Research and Analysis for the proper analysis some basic analysis methodology like a pushover and also as well as time history analysis. this project intent to create a proper conclusion over the pounding effect. day to day life we found that a proper distance between the two kinds of building. due to the shortest distance between these two buildings, there will be such make a collision between the two buildings. which is known as a founding effect and this founding effect.

**Robert Jankowski addressed the fundamental questions concerning the application of the nonlinear analysis** the gap between the separation may be one inch two Meter which depends upon the consider the load combinations which is like this placement drift story share auto lateral loads. distance between the gap which will decide the damage between the two structures during the earthquake. if proper gap is not provided there will be a founding affect which damages the two structure.

**Shehata E. Abdel Raheem developed and implemented a tool for the inelastic analysis of seismic pounding effect between buildings.** Is expression lead you to that of the major gap difference between the two structures which is considered one of the major disadvantages of the symmetrical and also as well as lifespan of the structure reduce. considering the pounding effect between the adjacent building which could create a words damage as considered to the adjacent building which is having different dynamic characteristics which will produces an unwanted vibration out of face and which causes in subsequent separation between the two consider buildings that causes buildings to collapse due to the relative motion of the adjacent buildings.

**ANAGNOSTOPOULOS SA, SPILIOPOULOS KV studied the earthquake induced pounding between adjacent buildings.** multi degree of freedom which is an important study conducted by these authors considering the lump mass and also as well as share beam type where the bilinear forces affect the characteristics of the structure and also consider in the collision between the ages and masses which can be occur due to the lateral load resistance failures during the earthquake time by means of providing the fuse viscous damper which will reduce all kind of effects.

**Hasan et al. [17] presented a simple computer based pushover analysis technique for performance based design of building** considering the Framework which is subjected to the earthquake the concept is considered for the conventional displacement method where analysis done on the elastic nature of the structure in order to measure the specific degree of freedom consider in the plasticity of the structure in order to reach that value the standard elastic and geometry the stiffness which is been utilized for the progressive analysis of the structure under the nonlinear elastic behavior and also as well as plastic consideration zone where the gravity loads and also as well as increase in lateral loads can be reduced by providing the FVD.

**Korkmaz and Sari [24] studied the performance of structures for various load patterns and variety of natural periods** by the push over analysis which is an one of the important nonlinear dynamic and also as well as time history analysis which can give the result of the tallest structure under the consideration of pounding effect. Considering the real earthquake zones the study is been conducted for the multi-storey structure which is in variation with different



height and also as well as gap between them where the systemic resistance and impact are also studied. the collision between the both the bridge structure which will undergo possible specific activities which is known as a founding affect weight is studied under the time history analysis in order to overcome all kind of lateral displacement and to reduce the fluid viscous damper is provided.

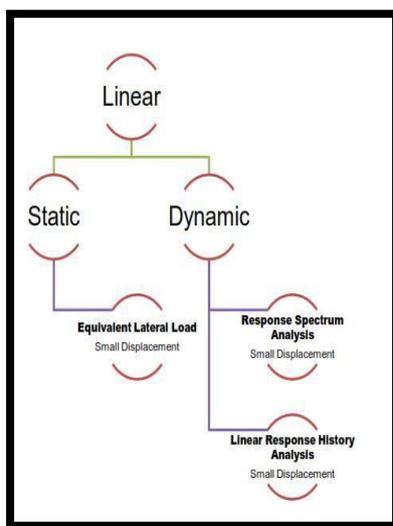
### III.OBJECTIVES AND METHODOLOGY

#### OBJECTIVES OF STUDY

This Thesis aims at computing the minimum seismic gap between buildings idealizations by dynamic and pushover analysis using ETABS

The principal objectives of the study are as follows:

1. Generation of three dimensional models of buildings for idealization to analyze Pushover and Time history Pounding Effect using Etabs
2. Pushover and Time history Pounding Effect using analysis for idealization for medium soil at Zone V.
3. Analyzing the displacement of two building cases to permit movement, in order to avoid pounding due to earthquake.
4. Performing Pounding Effect using time history FNA for both buildings idealization for three lateral load pattern on the models i.e LL,DL and EL
5. Comparison all graphs and table values for Max displacement, story shear etc And PGV for pounding effect



Flow chart

### 3.2 METHODOLOGY

#### METHODS OF SEISMIC ANALYSIS OF STRUCTURE

Different approaches for conflicting obstacle have been generated for the seismic inspection of structures. They can be termed below

- Static analysis
- Non Linear Static Analysis



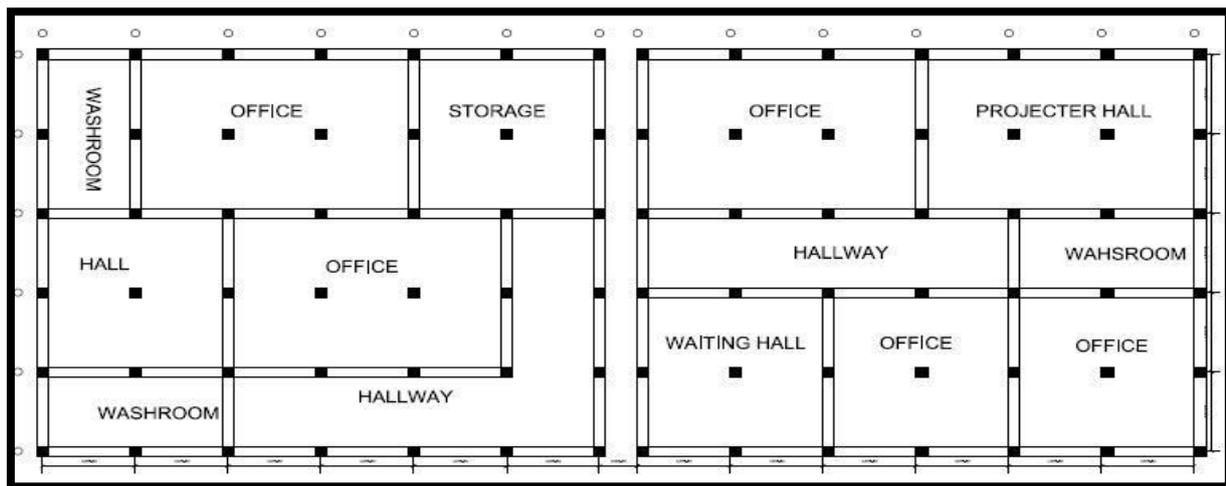
**RESPONSE SPECTRUM ANALYSIS**

Pushover analysis is one of the static nonlinear analysis methods. It is given to a structure that is subjected to gravity loading and controlled lateral loads that follow a certain pattern and increase in the elastic and also in the elastic behaviour when the ultimate load values are reached. The pushover analysis takes into account the lateral load, which varies from base shear induced into the structure during an earthquake to the proportionality between the two structures to the distribution of the mass, which depends a lot on the parameters of the structures, such as their height, mode, and shape, as well as other practical means.

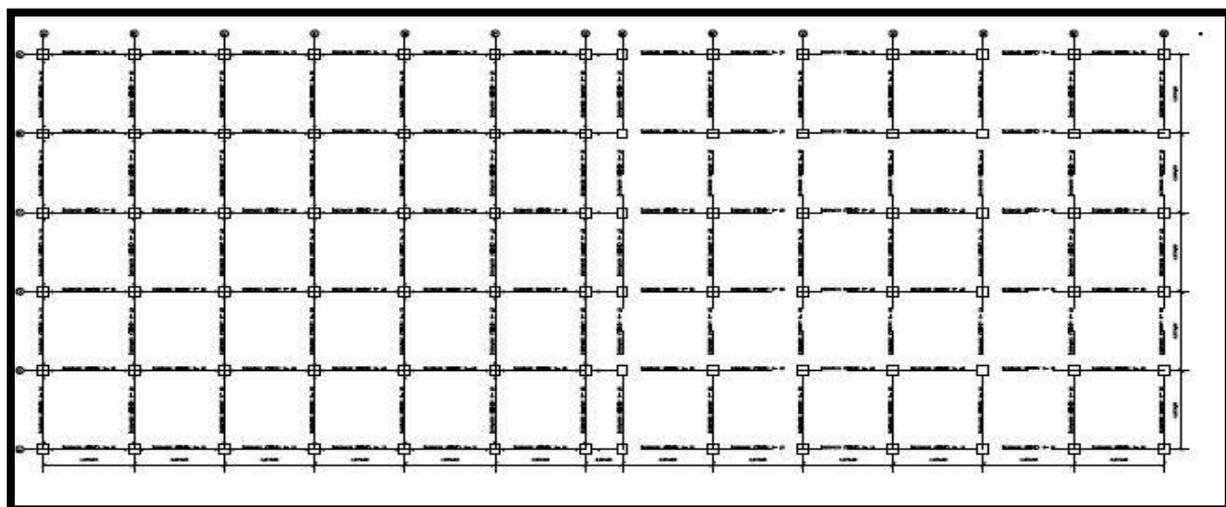
For example, taking into account the strength level of the auto letter load displacement and story share, the table and graph can be plotted for the pushover analysis. The result will depend a lot on how flexible the fluid viscous damper is, which shows that it has a good reflection mechanism during the highest assembly activities.

It's important to look at the structure in a nonlinear way, so pushover analysis is the best way to look at the load combination method approved by the Indian standard 1893 2002 code book in order to deal with all kinds of seismic activities, such as a drop in strength and control of movement.

**BUILDING DESCRIPTION:**



**2D PLAN**





### BEAM AND COLUMN LAYOUT

Basically to this take a look at 2 models might make which includes cement structure and unbending span for numerous helping structures, with a regular straight width about 6m; the one's shape could be G+15 and G+10 memories skyscraper structure to distinct configurations for assisting frameworks. every remaining bit those models would break down utilizing ETABS programming

### RCC STRUCTURE

Grade of concrete	:	M45
Grade of steel	:	Fe550
Beam	:	B750*550
Column	:	C750*750
One way slab	:	200mm
Dead Load	:	1kN/M <sup>3</sup>
Live Load	:	2kN/M <sup>3</sup>

### SEISMIC LOADS

Seismic design shall be done in accordance with IS: 1893:2002. The building is situated in earthquake zone III. The parameters to be used for analysis and design are given below (As per IS: 1893:2002 (Part I)).

### CODE FOR RCC

Zone	:	5 <sup>th</sup> Zone
Zone factor	:	0.36 (Refer Table 2)
Importance factor	:	1.5 (Refer Table 6)
Response reduction Factor	:	3.0 (Refer Table 7)
Soil Type	:	Medium
Structure Type	:	RC Frame Structure

### LOAD COMBINATIONS:

According to IS 1893 (Part 1) 2002 for the limit state design of reinforced and pre- stressed concrete structures, the following load combinations have been defined Earthquake lateral loads.

- 1.5(DL+LL) DL- Dead Load
- 1.2(DL+LL+EL) LL- Live load
- 1.2(DL+LL-EL) EL- Earthquake load.
- 1.5(DL+EL)
- 1.5(DL-EL)
- 0.9DL+1.5EL
- 0.9DL-1.5EL

## IV. RESULTS AND COMPARISON

### DISPLACEMENT

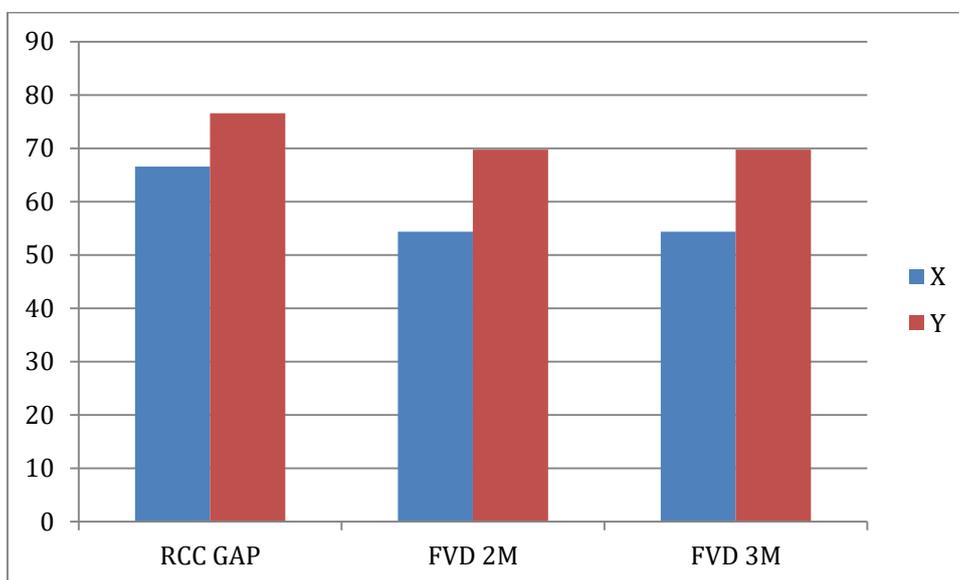
Below is the Table which is for Maximum displacement and we found that the structure is reduced in displacement value for 2M. and after 2M i.e. for 3M the Value increases hence for Maximum 2M gap the FVD can successfully with stand the loads.



MODEL	X	Y
RCC GAP	66.556	76.566
FVD 2M	54.342	69.738
FVD 3M	54.36	69.744

**Table**

Below is the graph comparisons for all the three models which is for Maximum displacement and we found that the structure is reduced in displacement value for 2M. Both in X and Y Direction the value which will get reduced simultaneously and usual after 3M there will be increase in Values. So it is recommended that to considered the gap 2M below for optimum Results.



**Graph**

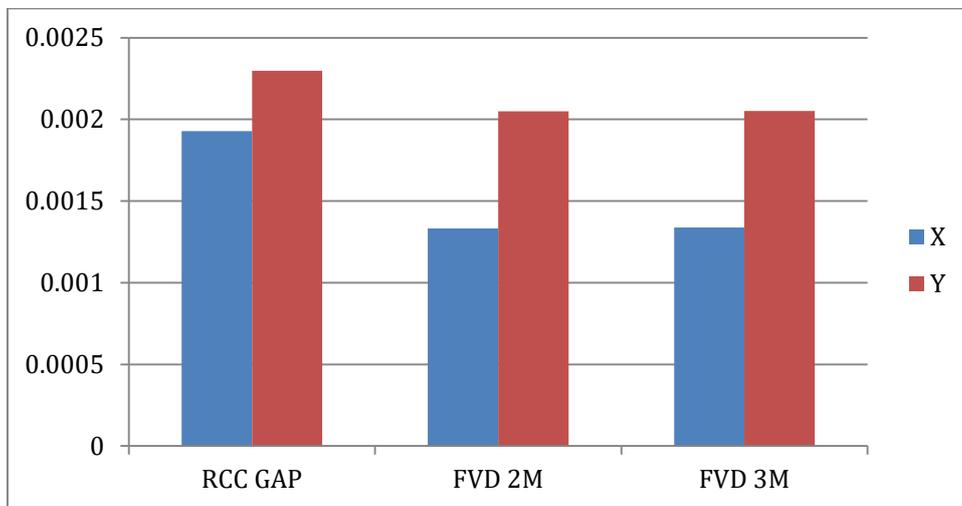
**STOREY DRIFT**

Below is the Table which is for Maximum drift and we found that the structure is reduced in drift value for 2M. and after 2M i.e. for 3M the Value increases hence for Maximum 2M gap the FVD can successfully with stand the loads.

MODEL	X	Y
RCC GAP	0.001929	0.002298
FVD 2M	0.001332	0.002049
FVD 3M	0.001338	0.002051

**Table**

Below is the graph comparisons for all the three models which is for Maximum drift and we found that the structure is reduced in drift value for 2M. Both in X and Y Direction the value which will get reduced simultaneously and usual after 3M there will be increase in Values. So it is recommended that to considered the gap 2M below for optimum Results.



**Graph**

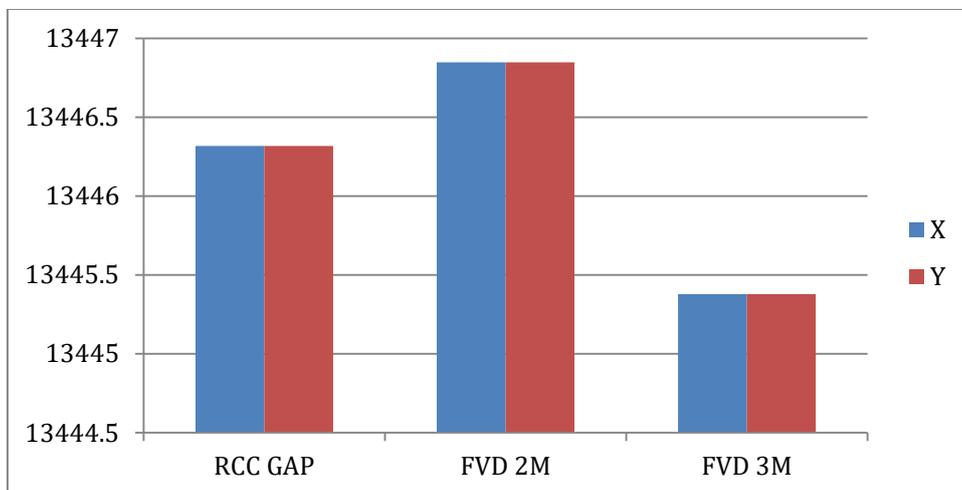
**STOREY SHEAR**

Below is the Table which is for Maximum shear and we found that the structure is reduced in shear value for 3M. Hence For shear effect to be considered the FVD is found to reduce the value for shear as further gap Increases.

MODEL	X	Y
RCC GAP	13446.32	13446.32
FVD 2M	13446.85	13446.85
FVD 3M	13445.38	13445.38

**Table**

Below is the graph comparisons for all the three models which is for Maximum shear and we found that the structure is reduced in shear value for 3M. Both in X and Y Direction the value which will get reduced simultaneously and usual after 3M there will be decreased in Values. So it is recommended that to considered the gap 3M further reduction in shear values.



**Graph**



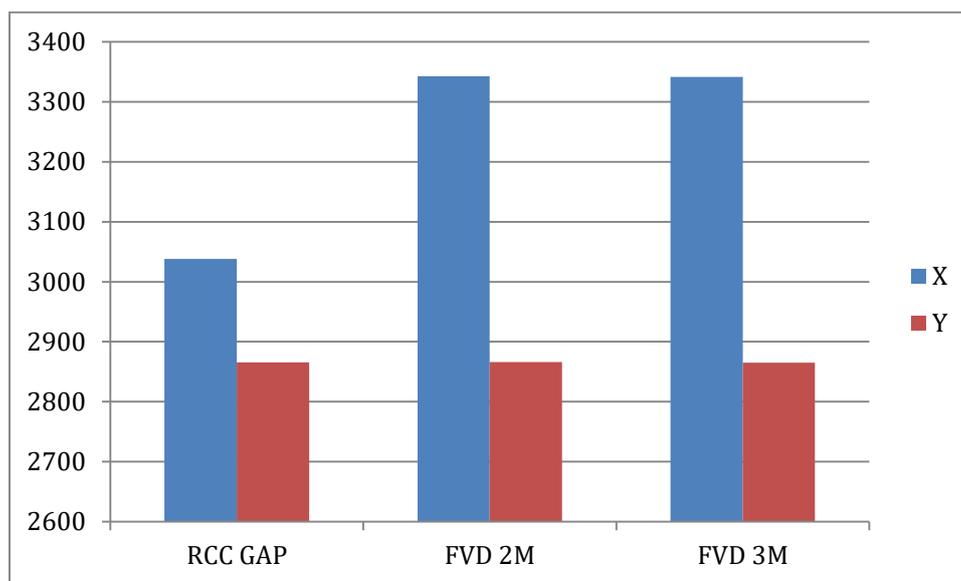
**AUTOLATERAL:**

Below is the Table which is for Auto lateral Loads and we found that the structure is reduced in Auto lateral Loads and 3M. Hence For shear effect to be considered the FVD is found to reduce the value for shear as further gap Increases.

MODEL	X	Y
RCC GAP	3038.081	2865.698
FVD 2M	3342.561	2866.141
FVD 3M	3341.162	2865.113

**Table**

Below is the graph comparisons for all the three models which is for Auto lateral Loads and we found that the structure is reduced in Auto lateral Loads and value for 3M. Both in X and Y Direction the value which will get reduced simultaneously and usual after 3M there will be decreased in Values. So it is recommended that to considered the gap 3M further reduction in Auto lateral Loads and.



**Graph**

**V. CONCLUSION**

1. The graph comparisons for all the three models which is for Auto lateral Loads and we found that the structure is reduced in Auto lateral Loads and value for 3M. Both in X and Y Direction the value which will get reduced simultaneously and usual after 3M there will be decreased in Values. So it is recommended that to considered the gap 3M further reduction in Auto lateral Loads and.
2. The Table which is for Auto lateral Loads and we found that the structure is reduced in Auto lateral Loads and 3M. Hence For shear effect to be considered the FVD is found to reduce the value for shear as further gap Increases.
3. The graph comparisons for all the three models which is for Maximum shear and we found that the structure is reduced in shear value for 3M. Both in X and Y Direction the value which will get reduced simultaneously and usual after 3M there will be decreased in Values. So it is recommended that to considered the gap 3M further reduction in shear values.

4. The Table which is for Maximum shear and we found that the structure is reduced in shear value for 3M. Hence For shear effect to be considered the FVD is found to reduce the value for shear as further gap Increases.
5. The graph comparisons for all the three models which is for Maximum drift and we found that the structure is reduced in drift value for 2M. Both in X and Y Direction the value which will get reduced simultaneously and usual after 3M there will be increase in Values. So it is recommended that to considered the gap 2M below for optimum Results.
6. The Table which is for Maximum drift and we found that the structure is reduced in drift value for 2M. and after 2M i.e. for 3M the Value increases hence for Maximum 2M gap the FVD can successfully with stand the loads.
7. The graph comparisons for all the three models which is for Maximum displacement and we found that the structure is reduced in displacement value for 2M. Both in X and Y Direction the value which will get reduced simultaneously and usual after 3M there will be increase in Values. So it is recommended that to considered the gap 2M below for optimum Results.
8. The Table which is for Maximum displacement and we found that the structure is reduced in displacement value for 2M. and after 2M i.e. for 3M the Value increases hence for Maximum 2M gap the FVD can successfully with stand the loads.
9. We can finally Conclude that apart from the Shear values and Auto lateral loads the 2M gap is sufficient enough to provide the FVD since the displacement is the Major criteria for all Structures even the Pounding effect from the Time history analysis such the same.

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