ANALYSIS OF DIFFERENT SHAPE OF BUILDING WITH SAME AREA

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Abstract:- *Earthquake play an important rolein designing structures. Lot of work has been done by many researchers who worked to study the effect of earthquake ondifferent shape. Being inspired from the work contributed in the study on effects of earthquake ondifferent shaped building in plan, this paper presents effects of four shape configuration i.e., RECTANGULAR, SQUARE, TRIANGULAR, CIRCULAR with same area. Buildings with different shape geometryreact differently against earthquake. The effect of different shape of structure have been carried out by using SAP2000 software. SAP 2000 software is a software for designing a mathematical model of and mechanically analyzing civil structure like everything ranging from cable-stayed bridges to concrete walls. There are several factors which affect the behavior of building from which base shear and lateral displacement play an important role in understanding the behavior of structure. Results are expressed in form of tables, bar charts. It has been observed from the result that Triangularshapeis best for base shearas compared to rectangular, square, circular shape.*

Key Word: ***RECTANGULAR, SQUARE, TRIANGULAR, CIRCULAR shape, SAP2000***

Introduction:

Building construction is the engineering deals with the construction of building such as residential houses. In a simple way building can be define as an enclose space by walls with roof, food, cloth and the basic needs of human beings. In the early ancient times humans lived in caves, over trees or under trees, to protect themselves from wild animals, rain, sun, etc. as then times passed as humans being started living in huts made of timber branches. The shelters of those old have been developed nowadays into beautiful houses. Rich people live in sophisticated condition houses.
With the improvement of new technology, some change in the building construction has been observed. Architectural views have been rehabilitated as well. The buildings of 1800s are architecturally simple and are of less stories compared to this century. In 1900s, a bit complex architectural parameter has been introduced and the structures become comparatively taller. The building of the current century partakes a variety of changes in architectural views, shapes, size & aesthetical views. Now, it has become a challenge for structural and geotechnical engineers to meet up the design need considering the variation in shapes, vertical irregularities, client's requirements, safety against natural calamities like earthquake and economical facts.

For reasher point of view we have taken four different shapes of building, i.e.RETANGULAR,SQUARE, TRIANGULAR, CIRCULAR, With same external area i.e. 8500 sq. ft, and internal area 6000sq.ft.we have analysis the G+15 story building. After applying all the loads i.e liveload, deadload, wallload, stair case load, floorfinishes with shear wall in SAP 2000 Following tables gives the information regarding the Load data, Seismic data and geometrical and material data used in the research.

Table 1
Load data

Dead load	1KN/m^2
Live load	3KN/m^2
Floor finish	1KN/m^2

Table 2
Seismic Definition

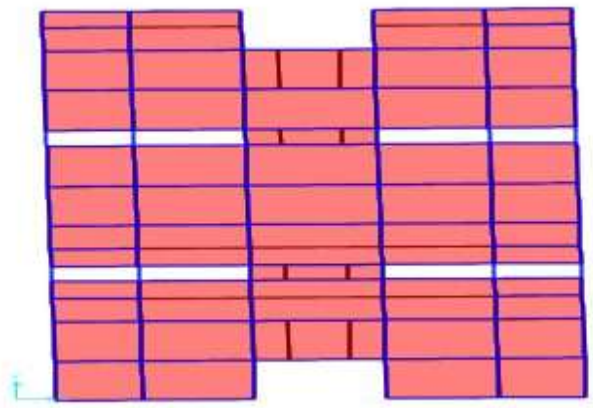
Earthquake zone	III
Damping ratio	0.05
Importance factor	1
Type of soil	Medium soil

Type of structure	All genral RC Frame
Response reduction factor	5(SMRF)
Time period	Program calculated
Poisons ratio	0.15m
Seismic zone factor	0.36

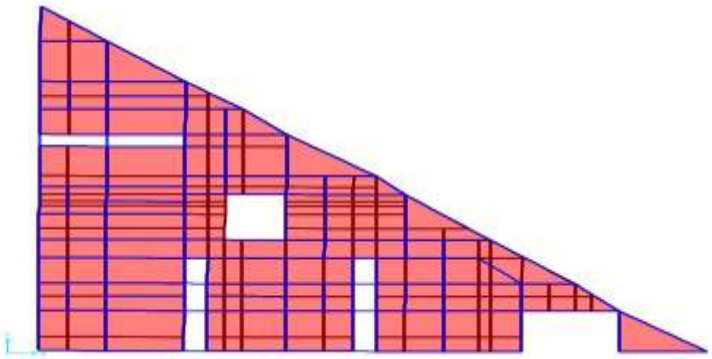
Table 3
Geometric and Material Data

Density of RCC considered	25KN/m^3
Thickness of slab	0.15m
Thickness of shear wall	0.23m
Beam staircase	0.23x0.6m
Beam all (other than staircase)	0.23x0.45m
Staircase column	0.23x0.6m
All column except stair column	0.23x0.45m
Density of infill	20KN/mm^2
Thickness of outer wall	0.23m
Thickness of inner wall	0.15m
Height of each floor	3.2m
Concrete cube compressive strength fck	30000N/mm^2
Yield strength fy	4150000N/mm^2
Shear reinforcement yield strength	4150000N/mm^2

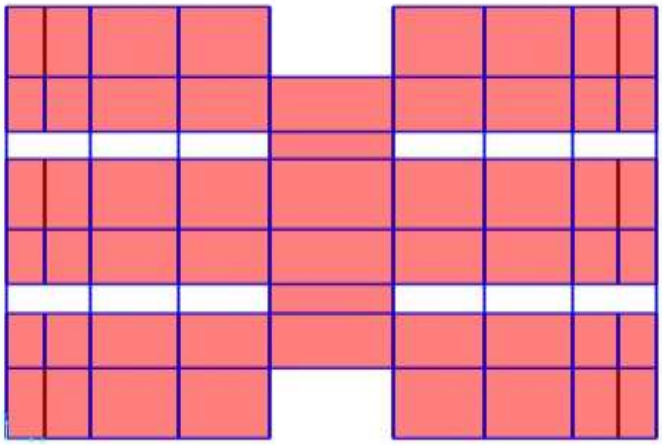
These 4 models are shaped by considering Plan irregularities i.e. the plan area for each structure is same only there is difference of geometry. For all types of structure total numbers of storeys are 15. The elevation is same for all the 15 Story Distribution of each storey height is 3.2m. Follwing are the plan of rectangular,square,triangular,cirular shape buildings.



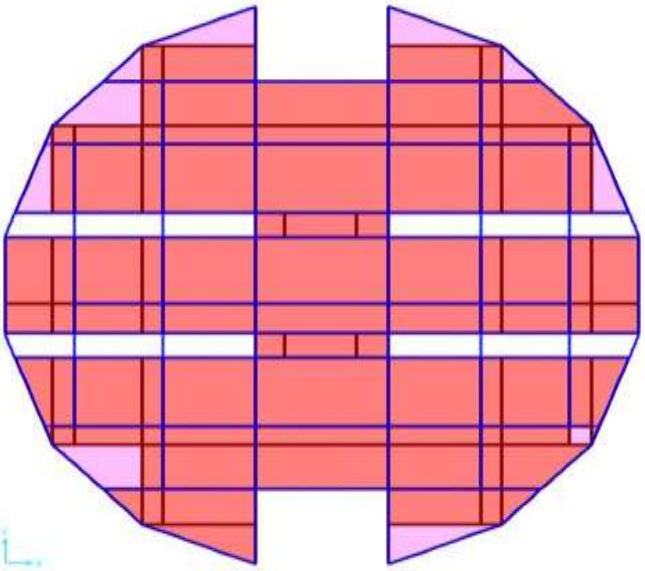
RECTANGULAR PLAN



TRIANGULAR PLAN



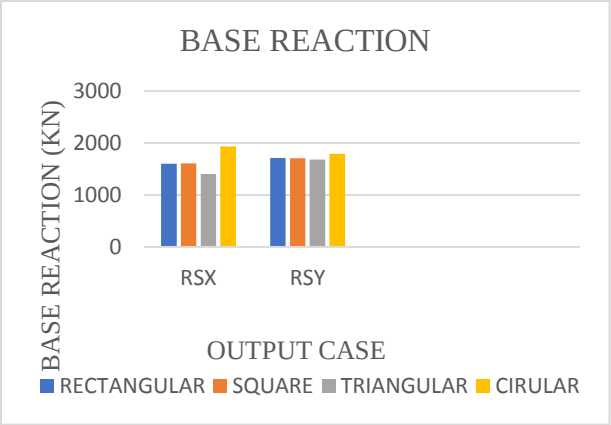
SQUARE PLAN

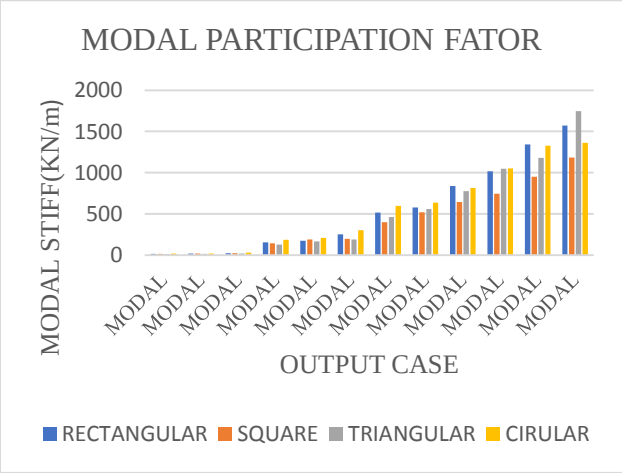


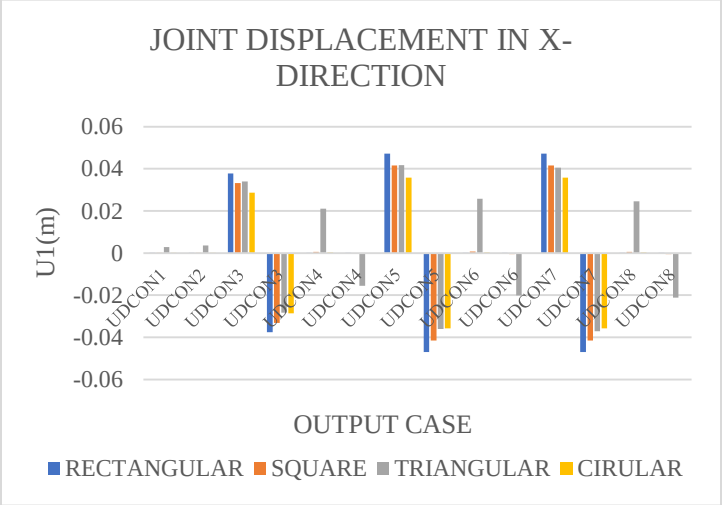
CIRCULAR PLAN

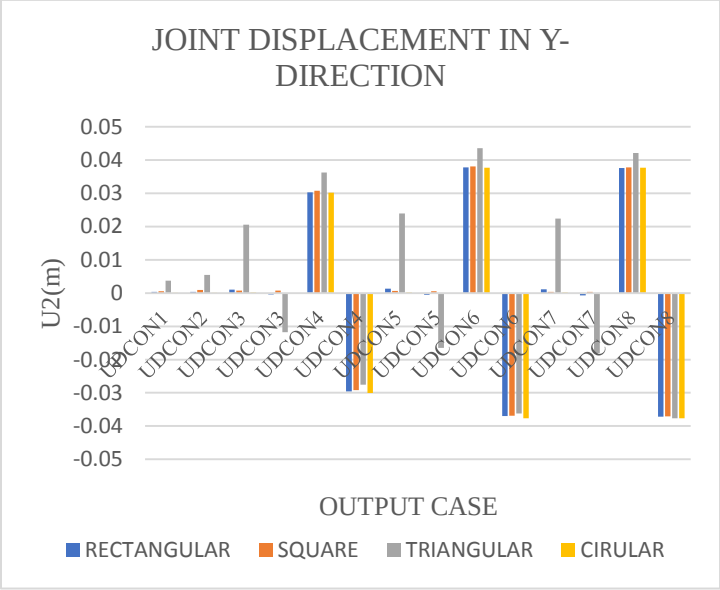
Results:

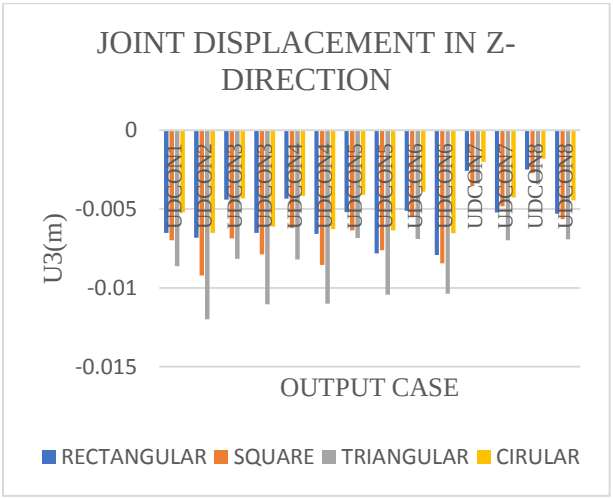
Follwing are the bar graph shows the comparision of Base reaction, Model participation factor, joint displacement in ,X,Y and Z direction and joint acceleration in X,Y,Z direction of different four shapes.

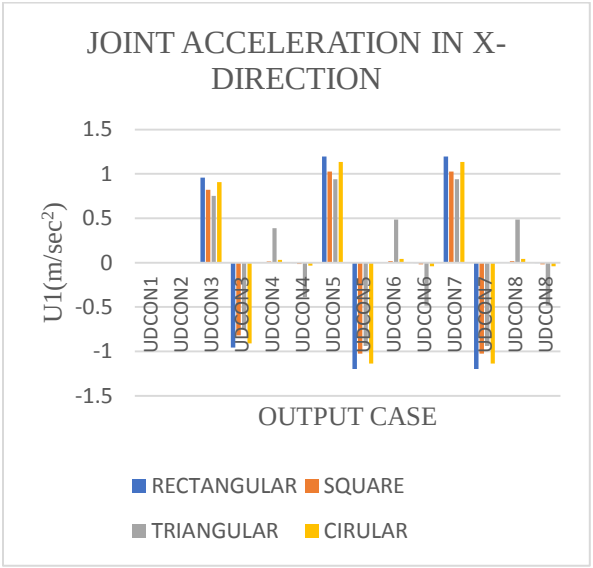


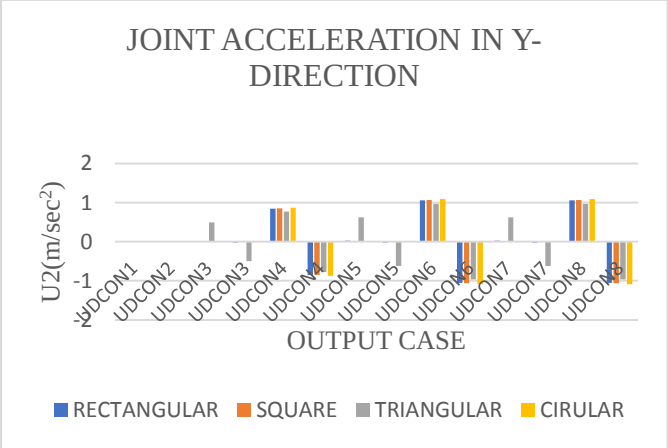


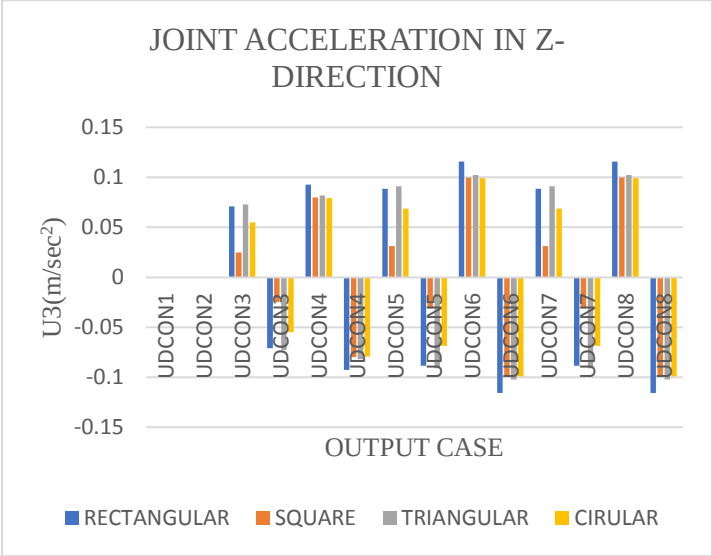



JOINT DISPLACEMENT IN Y-DIRECTION
U2(m)
0.05
0.04
0.03
0.02
0.01
0
-0.01
-0.02
-0.03
-0.04
-0.05
UDCON1
UDCON2
UDCON3
UDCON3
UDCON4
UDCON4
UDCON5
UDCON5
UDCON6
UDCON6
UDCON7
UDCON7
UDCON8
UDCON8
OUTPUT CASE
RECTANGULAR
SQUARE
TRIANGULAR
CIRULAR


JOINT DISPLACEMENT IN Z-DIRECTION
U3(m)
0
-0.005
-0.01
-0.015
UDCON1
UDCON2
UDCON3
UDCON3
UDCON4
UDCON4
UDCON5
UDCON5
UDCON6
UDCON6
UDCON7
UDCON7
UDCON8
UDCON8
OUTPUT CASE
RECTANGULAR
SQUARE
TRIANGULAR
CIRULAR


JOINT ACCELERATION IN X-DIRECTION
U1(m/sec2)
1.5
1
0.5
0
-0.5
-1
-1.5
UDCON1
UDCON2
UDCON3
UDCON3
UDCON4
UDCON4
UDCON5
UDCON5
UDCON6
UDCON6
UDCON7
UDCON7
UDCON8
UDCON8
OUTPUT CASE
RECTANGULAR
SQUARE
TRIANGULAR
CIRULAR





Conclusion:

After analyzing the buildings with the help of SAP2000 Software to evaluate the effect of shape of building on the Base Reaction and displacement due to earthquake loads. Following are the conclusions can be made from the present study.

1)Base reaction is less in triangular shape buildings as compare to other tree shapes.

2)For joint displacement in X-direction,Y and Z direction circular shape is best.

3)For joint acceleration in X-direction rectangular shape is best but in Y Z direction square shape is best.

4)For modal participation factor square give min value as compare to other shapes.

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