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COMPARATIVE STUDY ON MULTISTORY BUILDING AGAINST RESPONSE SPECTRUM ANALYSIS WITH STAGGERED OPENING AND NORMAL OPENING SHEAR WALLS USING ETABS

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Abstract: Different opening in the Highrise building caused the reduction in the stiffness and strength as opening cause the reduction of cross section area so it is directly affect on the distribution of forces and handling different lateral forces is quit difficult for such multistore buildings. So, such kind of the buildings are needs to be analysed by micro level of analysis so it can give proper behaviour against different critical loadings such as Earthquake loads etc.

Index Terms **- Response spectrum analysis, Equivalent static analysis, Mass of the buildings, stiffness, Etabs.**

1. INTRODUCTION

Shear walls are vertical stiffening elements designed to resist lateral forces exerted by wind or earthquake. The shape and location of shear wall have significant effect on their structural behavior under lateral loads. Lateral loads are distributed through the structure acting as a horizontal diaphragm, to the shear walls, parallel to the force of action. These shear wall resist horizontal forces because their high rigidity as deep beams, reacting to shear and flexure against overturning. A core eccentrically located with respect to the building shapes has to carry torsion as well as bending and direct shear. shear walls are economical up to 35 stories. If, in low to medium rise buildings, shear walls are combined with frames, it is reasonable to assume that the shear walls attract all the lateral loading so that frame may be designed for gravity loads only. Resistance of a shear wall increases linearly with its thickness. However, the effect of width is much higher. A coupled shear wall structure is a particular, but very common, form of shear wall structure. It consists of two or more shear walls in the same plane, or almost the same plane, connected at floor levels by means of stiff beams or slabs. These results in a horizontal stiffness very much greater than if the walls acted as a set of separate uncoupled cantilevers.

These shear wall if opened in the Surface all over the floors for such kind of shear wall the analysis must be carried out and proper design needs to check before execution of the buildings so such buildings are mostly less in stiffens due to different kind of opening mechanism and these all opening are compulsory to provide due to architectural requirement or Ventilations or aesthetic view purpose etc.

2. Properties considered

Plan Area = 26m x 56 m.
Height of Building = 100 m
Floor to Floor Height = 3m
Shear wall details
Conventional and Staggered opening shear wall model =450 mm thick

Beam details
Conventional and Staggered opening -------shear wall model =230x450
-R.C.C. design : IS 456: 2000
-Earthquake design : IS1893: 2016
-Code for Dead load : IS875: Part 1
-Code for Live load : IS875: Part 2
-ZONE : V
-Z :0.36
-I : 1.5

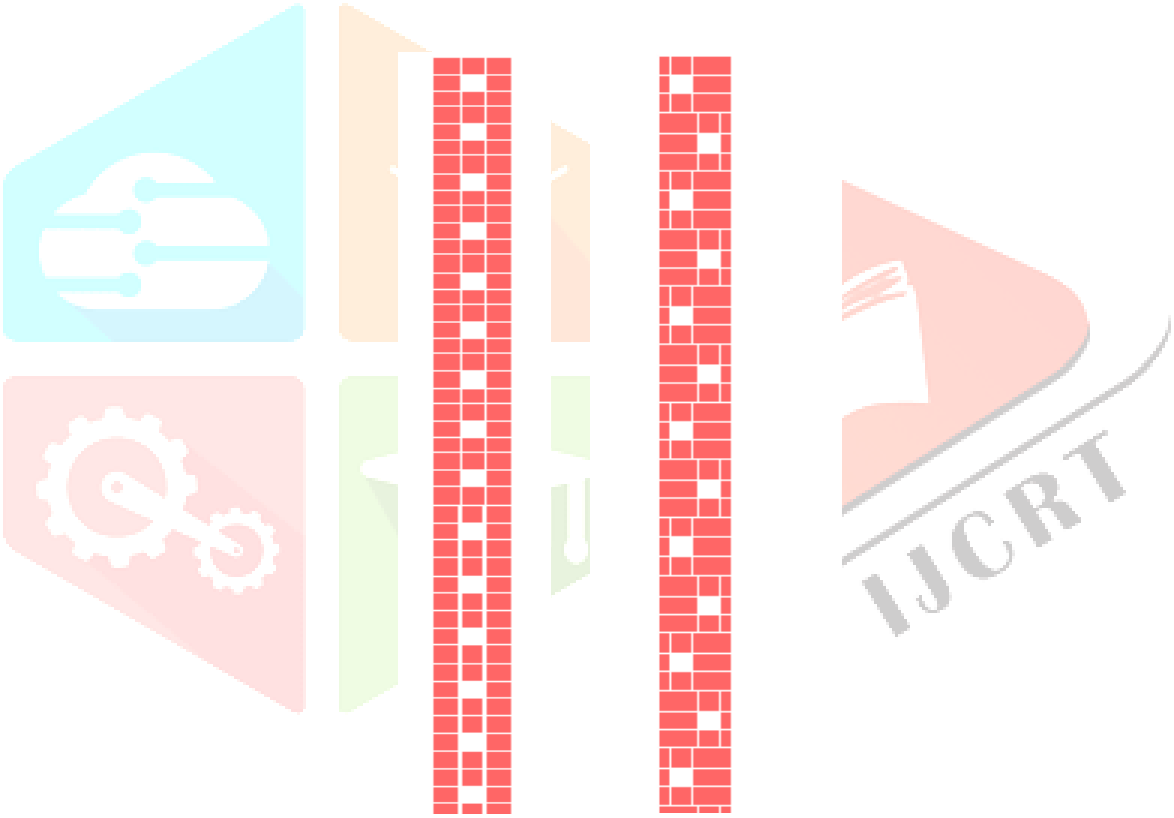


FIG: SHOWS THE DIFFERENT OPENING AT PERIPHERI OF THE STRUCTURE

4. RESULTS: -

Table1. TIME PERIOD

SR.NO	MODE	CONVENTIONAL OPENING	STAGGERED OPENING
1.	MODE 01	4.73	4.27
2.	MODE 02	4.015	4.01
3	MODE 03	3.125	3.12
4	MODE 04	1.316	1.317
5	MODE 05	1.092	1.09
6	MODE 06	0.862	0.863

Table3. Base shear

Story	CONVENTIONAL OPENING(KN)	STAGGERED OPENING(KN)
Equivalent static X direction	13393	15776
Equivalent static Y direction	13017	8230.31
Dynamic X direction	10290	10293.47
Dynamic Y direction	7912.59	7901.68

Table -02 Displacement details (convensional opening at peripheri)

DIRECTIONS	CONVENTIONAL OPENING(mm)	STAGGERED OPENING(mm)
Max storey displacement for Equivalent static X direction	86	144
Max storey displacement for Equivalent static Y direction	159	125
Max storey displacement for Dynamic X direction	61	61
Max storey displacement for Dynamic Y direction	92	91

Table -07 Drift details

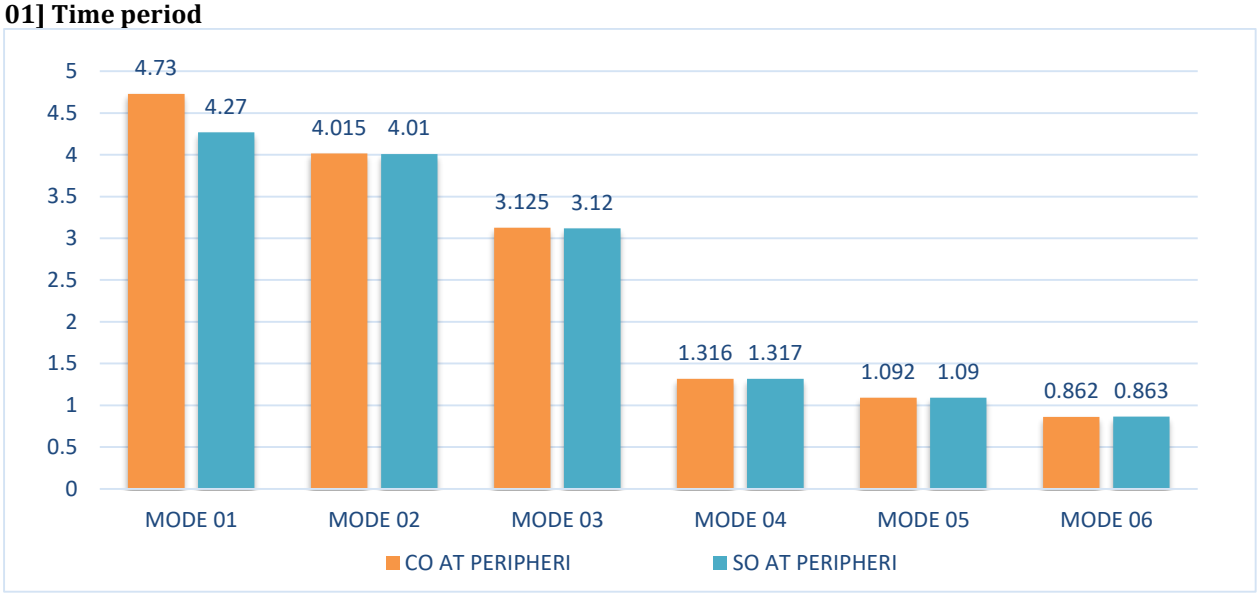
DIRECTIONS	CONVENTIONAL OPENING	STAGGERED OPENING
Max storey Drift for Equivalent static X direction	0.0012	0.0017
Max storey Drift for Equivalent static y direction	0.0023	0.0015
Max storey Drift for Dynamic X direction	0.00077	0.00076
Max storey Drift for Dynamic y direction	0.0011	0.0017

Table -08 STORY STIFFNESS

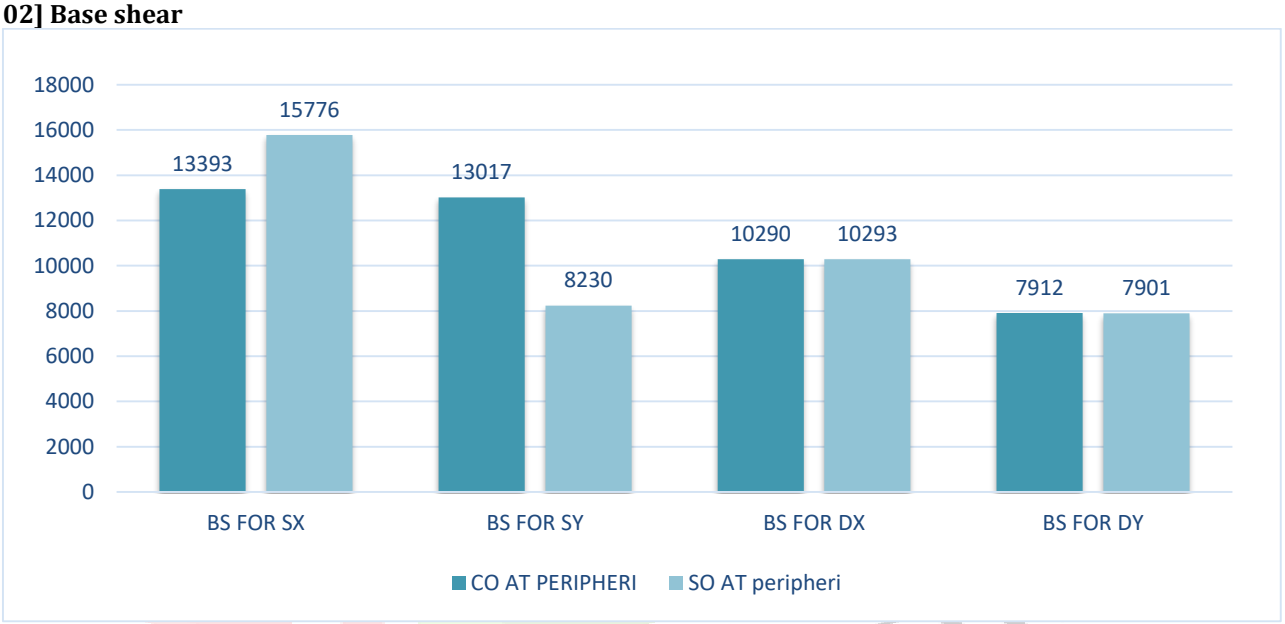
DIRECTIONS	CONVENTIONAL OPENING	STAGGERED OPENING
STATIC X DIRECTION	8905042	8500366
STATIC Y DIRECTION	5059635	4799948
DYNAMIC X DIRECTION	9317720	9371420
DYNAMIC Y DIRECTION	4722508	4712523

Graph:

01] Time period



02] Base shear



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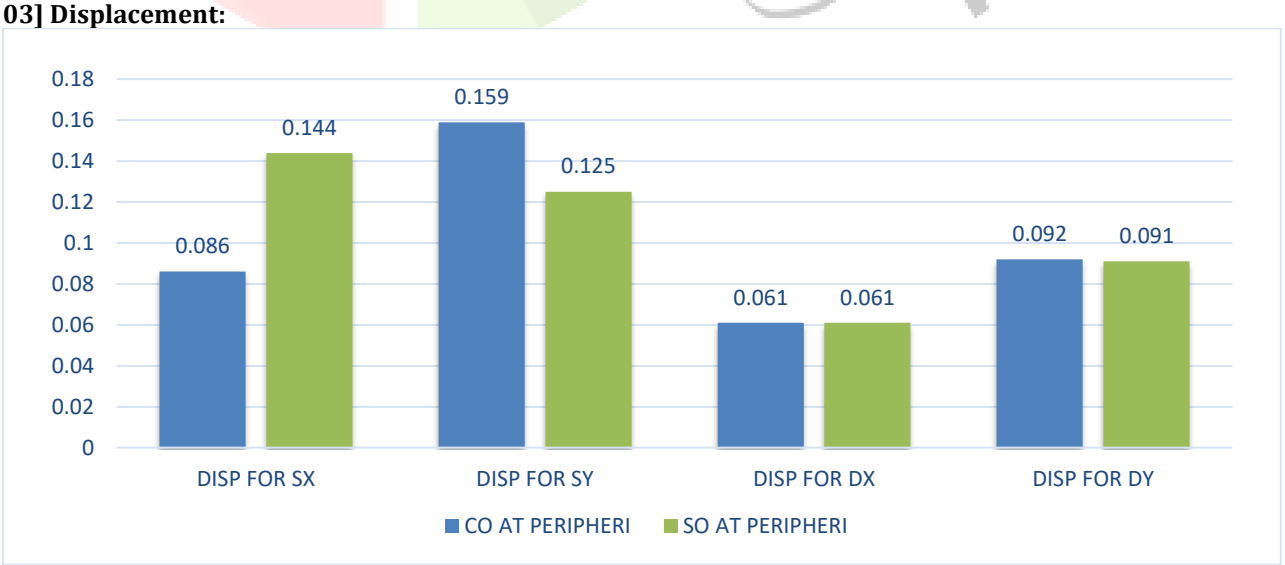
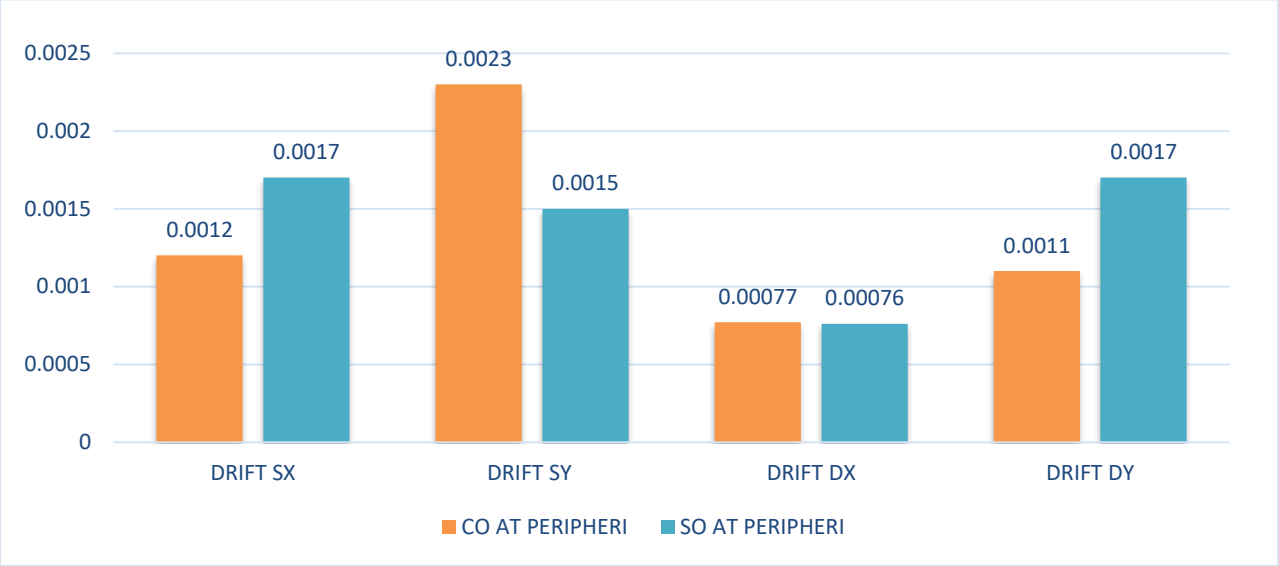
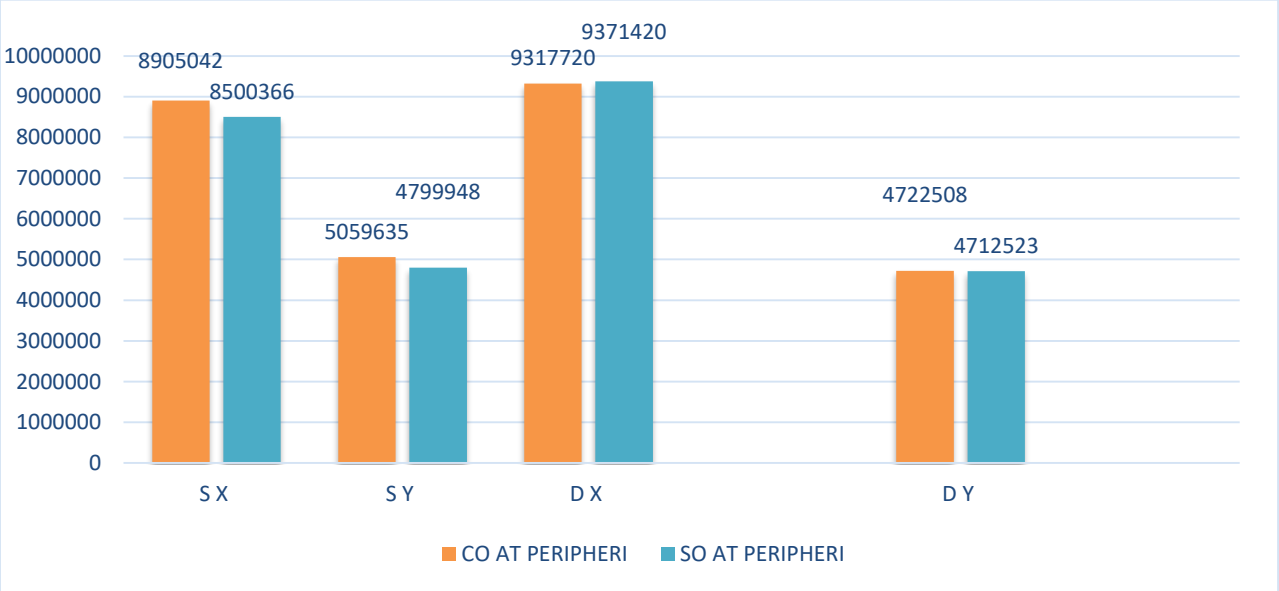
03] Displacement:



04] Drift Details:



05] Stiffness



3. CONCLUSIONS

Following are the conclusion we have obtained from above analysis results are:-

1. Time period
   The time period is almost same in all 6 modes as shown in the graph and table. From which the 1st and 2nd modes the staggered opening wall getting lower time in seconds to complete one single oscillation.
2. Base shear
   in case of Base shear the value in conventional opening at periphery in more in Static Earthquake x and y and in Dynamic Earthquake x and y when compared with Staggered opening at periphery X and y direction.
3. Displacement
   The displacement is more in Staggered opening at periphery than the conventional opening at periphery.
4. Drift
   The Drift values for both conventional and staggered opening in periphery is almost similar. but in some cases, the staggered opening is higher drift values as shown in table.
5. Stiffness
   The stiffness is higher in case of conventional opening in shear wall and reduce in staggered opening.

From the above conclusion it is obtained that it is better to provide opening in periphery in conventional manner instead of Staggered manner.
The staggered manner will be decreasing the stiffness of the structure and not performing well against the earthquake.

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