InternationalJournalofResearchinEngineering and Science(IJRES)
ISSN (Online):2320-9364,ISSN (Print):2320-9356
www.ijres.orgVolume10 Issue4 ǁ2022ǁ PP.08-14

AStudyonDifferentCombinationsofShearWallsUsingET ABS

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Abstract. *Shear wall could be considered as a structural component which is designed to take care of thesideway forces which are imposed on it. These types of all play a very important role in seismically dynamicareas where the shear forces on the structural members increases because of earthquakes. Structural memberslike share where's will have more stiffness strength and or areresistant to in plane forces picture acting allalongthetallnessofthestructure.Anystructurewhichisprovidedwith shearwallthatarestructurallydesignedin correct way and detailed out properly will demonstrate an excellent performance during the earthquakeconditions. In the present project report a building is provided with shear wall three different locations in 3different models and the performance of the structure is observed. This way we can analyze the performance ofthe structure as well as the share with respect to the position of the provided shear wall. This project is carriedouttocalculatetheperformanceofprovidedshearwallwithreferencetoseismicactivities.*

Keywords:Shearwall,shearforces,structuralcomponent,seismicactivities

DateofSubmission: 02-04-2022 Dateofacceptance:16-04-2022

I. INTRODUCTION

The reaction of any structure during seismic loading will straight away depends on the sideway loadresisting structural system.We have varieties of sideway load resisting structural systemtotake care of sideway load like seismic and wind forces but only a few of them are really very effetely w.r.t performance and cost.However, when one type of sideway load resisting structural systemdoesn't prove itself sufficient or effectivewecanstillgowithcombinationofdifferentsidewayloadresistingstructuralsystemstofacethelateralloads.It has been observed that rather than regular shaped buildings or structures irregular shaped structures are moreunstable against lateral loads. Hence in such structures provision of sideway load resisting structural systembecomes very critical. By providing these typesof system we can reducethe damage to the structure bycontrollingvariousseismicparameterslike storydrift, displacementetc.

The selection of type of building structures becomes very important in earthquake prone areas. A verycommon source of damage during the earthquake to the structure is the shape of the structure itself. Secondreason is the placement of the shear wall in the structure. A poor placement of a shear wall done during thedesignmay cause damage to the structure rather than reducing the damage. This may even become the reasonfor the failure of the entire structure.Especially now a day’s architects are proposing a lot of irregular shapedstructure which look unique by their shapes. In such structures position of shear wall becomes a challenge as wehave to bare in mind that the purpose, functionality of the building should not be disturbed and at the same timethe beauty of the building should not also be affected. This becomes achallenge since we as a design engineershavetofulfillthestructuralaswell asarchitecturalrequirements.

a. ShearWall

A shearwall caneasily be considered as one on the structural element whose primary functionis toface and withstand sidewise forces i.e the forces which are acting at right angles to the plane of the shear walls.In case of slender/long walls in which the deformation due to bending is predominant, these shear walls willwithstand the loads by cantilever action. Or we can say shear wall are those category of vertical structuralmembers which can also be called as sideway force withstanding system. For lean walls in which the bendingbuckle is high, Shear wall takes care of the loads due to Cantilever Action. Or we can also say, it can beconsideredas uprightelementswhichworkashorizontalforceresistingsystem.

In structural engineering field a shear wall could be taken in to consideration as a structural systemwhich is consisting of shear panels, these are also called as braced panels. These are provided to encounter theeffectofsidewayforceswhichmayactonthestructureintheformofsayseismicforces orwindloads.

In any structure a inflexible and upright diaphragm will be able to transfer any sideway forces from the exteriorwalls, floors and roofs to the earth through thefoundation in the direction which is parallel to the plane ofshear-walls.

Astrongsidewayforcesalongwithtorsionforcesareproducedduringtheearthquake,wind,differentialsettlementofthefoundations,unevendistributionofliveload.Alloranyoneoftheseorcombinationofthesemaycausedamagetothestructureoreventhefailureofthestructures.

II. OBJECTIVES

Belowarethemajorobjectivesofthisproject.

- Carryingoutanalysis usingresponsespectrummethodforseismiczoneV
- Toascertaintheeffectofearthquakeonhighrisestructureswhichhavedifferentshearwallconfigurations.
- Toascertainthebehaviorofthebuildingduringearthquakebyprovidingshearwallatpredefinedandwellplannedlocationsofthebuilding.
- Thecomparetheresultsofvariousanalysisresultsw.r.tearthquakefordifferentpositionoftheshearwalls.
- Togain knowledgeofbehaviorofshearwallanditsconfigurations.

III. SCOPEOFTHEPROJECT

Analyzing all the three models using response spectrum analysis method zone V using three differentcombinations of shear wall using a commonly used analysis and designsoftware Etabs and obtaining theanalysisresults.

IV. PROBLEMSTATEMENT

InthisprojectaG+12floorsbuildingisusedtoperformtherequiredtask.The buildinghas7spansof 6.0 m each on X direction & 5 spans of 7.0 m on Y direction,Floor to floor height of 3.2 m is considered.Height between the plinth and foundation is considered as 1.52 m. Column of 700 mm X 700 mm is considered.Beams of 500mm X 600 mm are considered. Slab thickness of 200 mm is accounted. It is assumed to be anoffice building hence in general office area live load of 4.0 kN/sqm and in common area like corridor, balconyand staircase itis taken as 3.0 kN/sqm. To obtain live load IS 875 part 2 is followed. Whereas self weight ofvariousbuildingmaterialslikebricks,concrete,plastering,mortar etcareobtainedfromIS 875Part-1.

After obtaining all these values from code, wall load in the form of UDL is calculated after deductingthebeamdepthsandthesameisappliedalongtheperipheryofthebuildingwhichactsasexteriorwall.

Three models were generated using ETABS. First model is provided with the shear wall at all the fourcorners in L shape. The second one is provide with shear wall at the centre of each face, thus 4 shear walls wereprovided on all the four faces. In the third model shear wall is provided at the centre or core of the buildingwherelift&staircasearelocated.Inthirdmodelbothliftandstaircasearesurroundedbyshearwalls.

Once all the three models were created analysis was performed on all the three models and then thecomparison of various results was carried out by tabulating the results. Comparison was also done in graphformat. At the end of the report conclusion is drawn. Response spectrum analysis(RSA)method is used in thisprojecttoobtaintheresults.

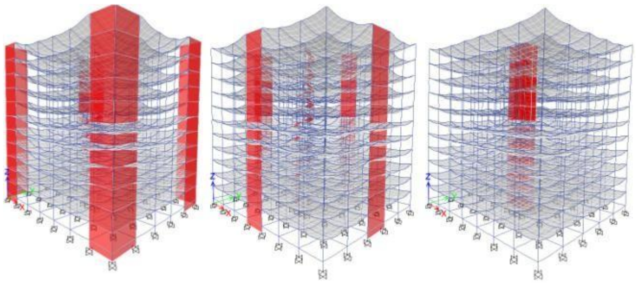
Ground +12 floor building structure is created which is aconventionalreinforcedconcretebuilding.Thebuilding is rectangle in shape and the dimensions are expressed in subsequent pages. Loads taken in to accountaredeadload,imposedloadasperIS875part-1andpart– 2 respectively and seismic load as per IS:1893(Part-1)- 2002. Analysis is carried out by RSA for seismic zoneV ofIndia. Z=0.36,I=1.0,R=5.0,dampingratio=5.0% andsoiltype=IIisconsidered.

Duringtheentireprocess someassumptions weremadeandarelistedbelow.

1) Thisisanofficebuilding,thusthemainfocus isontheresponseofframeconfiguration's.
2) Story1hasplinthbeamonlyandnoslabsareprovidedastheseplinthbeamswillrestdirectlyontheground.
3) Thecentreofcolumnsandbeamsareinline.Thisisdoneinordertoavoidanyeccentricity.Thesoftware willdoitbydefault.
4) Forallthestructuralelementsconcretegradeof M30 andsteelgradeofFe500areconsidered.
5) Allthelowerends ofcolumns whererepresentsthefootingsareconsideredasfixedends

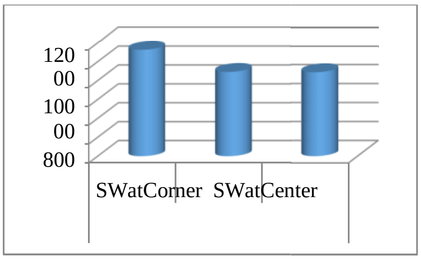
V. RESULT

a. Deflection Shapeforall3 Buildings



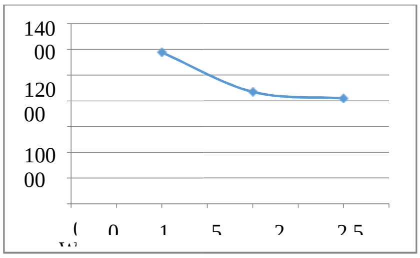
b. BaseReactionsinXdirection

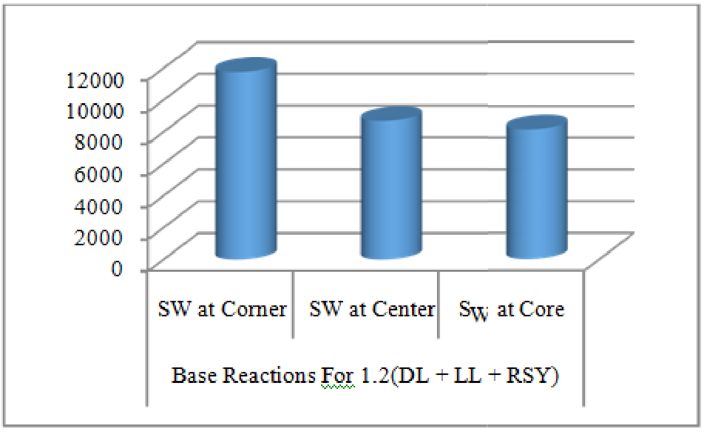
BaseReactionsInXDir		
SWatCorner		SWatC ore

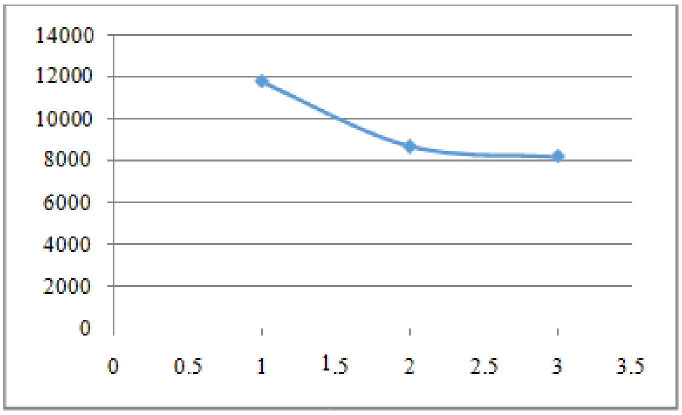


c. BaseReactionsinYdirection

BaseReactionsInYDir		
SWatCorner		SWatC ore

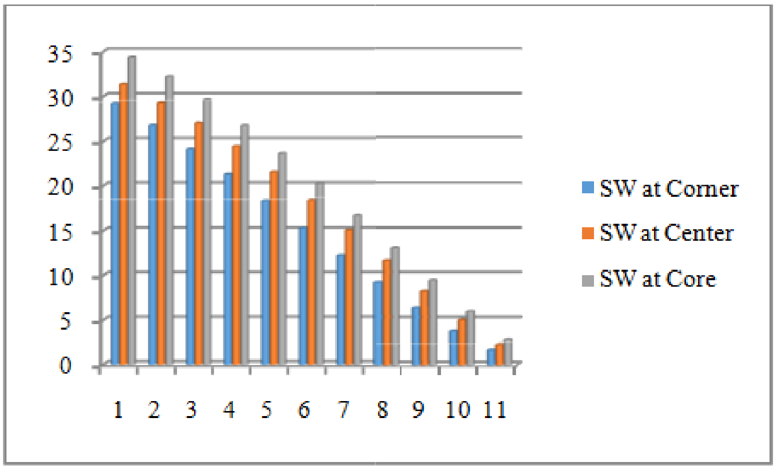


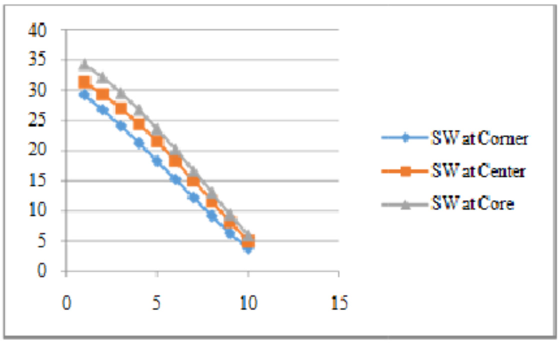


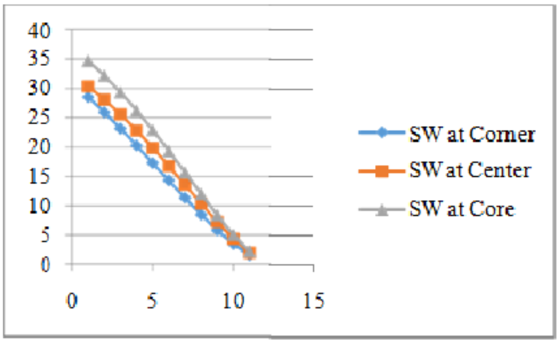


d. *StoryDisplacementinX direction*

StorydisplacementinXdirection		
Floor	SWatCorner	SWatCenter
Story11	26.78	29.325
Story10	24.107	27.01
Story9	21.279	24.406
Story8	18.318	21.516
Story7	15.271	18.377
Story6	12.202	15.048
Story5	9.192	11.619





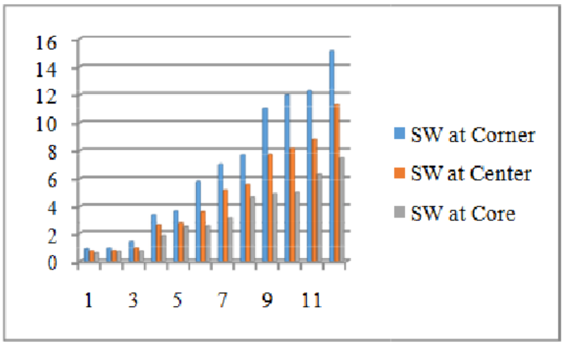


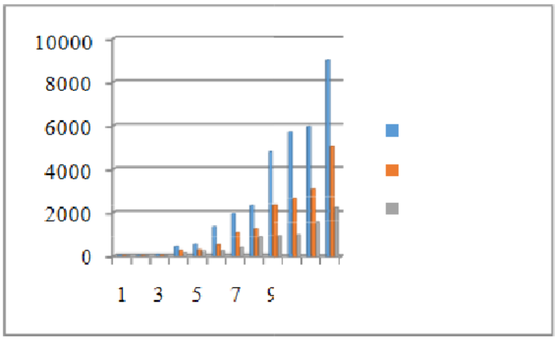
g. Modal Frequencies

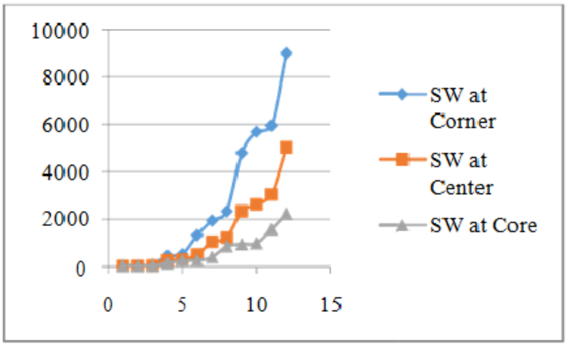
Modal Frequency, Mode v/s Frequency cyc/sec			
	SW at Corner	SW at Center	SW at Core
1	0.886	0.742	0.59
2	0.934	0.758	0.7
3	1.398	0.944	0.729
4	3.346	2.573	1.813
5	3.643	2.717	2.459
6	5.79	3.6	2.491
7	7.005	5.16	3.154
8	7.68	5.564	4.638
9	11.016	7.703	4.886
10	11.994	8.152	5
11	12.271	8.788	6.292
12	15.09	11.289	7.51

h. Modal Eigen Values

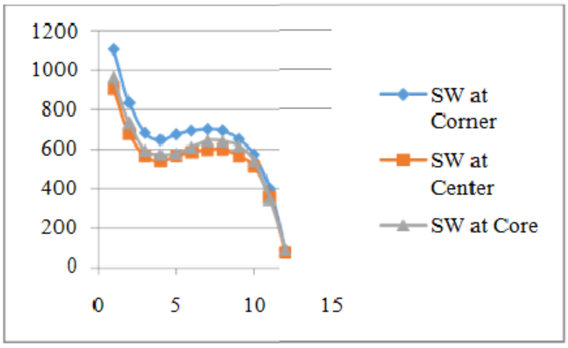
Modal Frequency, Mode v/s Eigenvalue rad²/sec²			
	SW at Corner	SW at Center	SW at Core
1	30.98	21.74	13.76
2	34.44	22.70	19.35
3	77.12	35.19	20.95
4	441.9	261.30	129.
5	523.80	291.41	238.68
6	1323.40	511.72	245.04
7	1937.27	1051.07	392.71
8	2328.27	1222.39	849.38
9	4790.36	2342.56	942.54
10	5679.26	2623.42	986.87
11	5944.82	3048.66	1563.03
12	8990.07	5030.81	2226.77







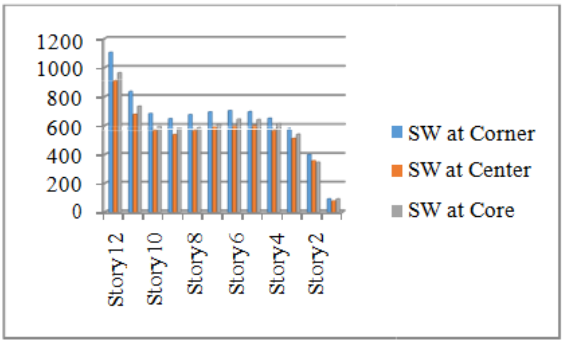
i. Story Acceleration for RS Function X dir

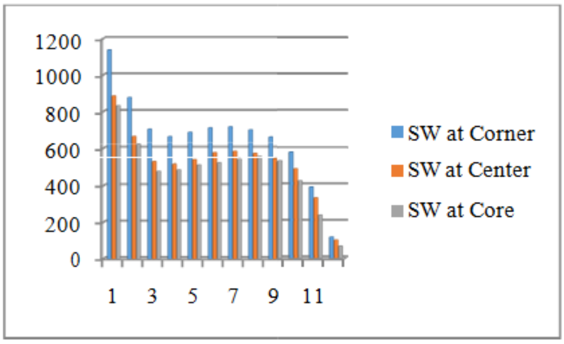


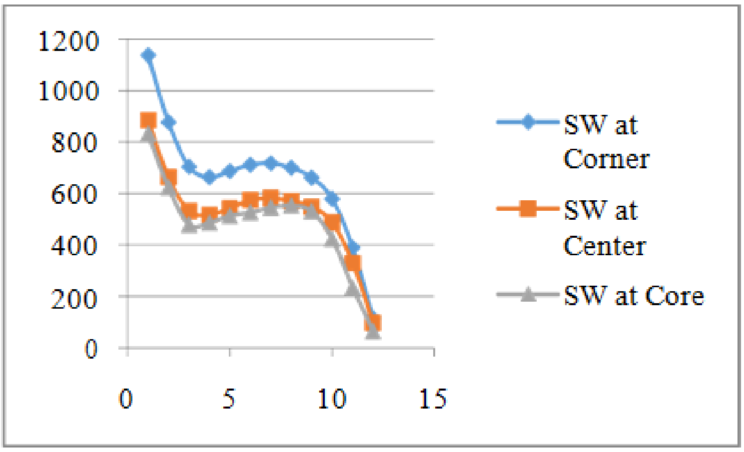
j. Story Acceleration for RS Function Y dir

Story Accelerations in X dirc, mm/sec²			
	SW at Corner	SW at Center	SW at Core
Story12	1104.05	907.87	963.46
Story11	834.29	676.55	732.69
Story10	682.13	565.12	592.81
Story9	647.13	538.33	573.64
Story8	674.65	564.92	576.99
Story7	693.66	584.44	608.47
Story6	701.85	596.24	643.63
Story5	694.53	598.84	641.22
Story4	649.78	564.79	615.38
Story3	572.26	511.65	539.83
Story2	399.61	356.03	345.64
Story1	91.31	75.8	91.05

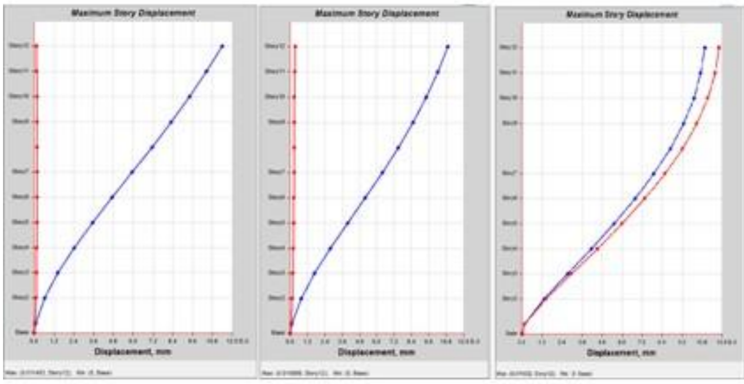
Story Accelerations in Y dirc, mm/sec²			
	SW at Corner	SW at Center	SW at Core
Story12	1136.6	884.65	831.11
Story11	876.44	663.51	622.72
Story10	703.42	532.16	478.5
Story9	662.9	517.34	486.14
Story8	686.51	542.69	513.09
Story7	710.77	574.34	525.43
Story6	716.53	581.93	544.69
Story5	699.45	570.45	552.04
Story4	660.6	547.87	530.44
Story3	578.56	487.27	422.14
Story2	388.94	328.83	234.1
Story1	114.12	97.04	64.24



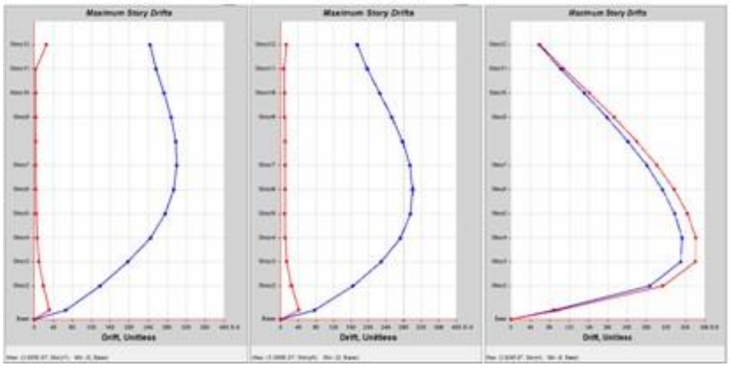




k. Maximum Story Displacement for 1st Mode



l. Maximum Story Drift for 1st Mode



VI. CONCLUSION

On the basis of above study for G+ 12 building with 3 different configuration of shear wall below conclusionswere drawn:

1) A building which is provided with shear wall at right places will have more rigidity to resist sidewayloadslikeseismicandwindloads

2) Base shear is maximum in the building with shear wall at corner due to obvious reason that the totalweigh of structure is more in first model as the area and volume shear wall is more in comparison with the othertwo.

3) In building with shear wall at corners is the most rigid when compared with the other two buildings.Thisisevidentfromstorydisplacementforallthe 3buildings.

4) Themodalperiodisalsotheleastin thebuildingwithcornershear wallincompressiontoother two.

5) Thus by looking at the above values, points and comparison it is clear that for the chosen shape, size ofthe building if we provide the shear wall at the corner the building will be more rigid and will be able to face theseismicwavesforthegivezone effectively.

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