DYNAMIC RESPONSE OF HIGH RISE STRUCTURES AND ANALYSIS OF REGULAR AND IRREGULAR BUILDING UNDER THE INFLUENCE OF SHEAR WALLS

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ABSTRACT- Earthquake is the natural calamity, it produce strong ground motions which affect the structure. Small or weak motions, that can or cannot be felt by the humans. Shear walls are installed to enhance the lateral stiffness, ductility, minimum lateral displacements and safety of the structure. Storey drift and lateral displacements are the critical issues in seismic design of buildings. Different types of frame models are developed and evaluated by Time history analysis and response spectrum analysis by ETABS Software. Shear walls are RC walls that are projected along the structure from base. Shear walls reduce the Storey displacement when seismic forces counter the building. Since, the structure may not have aesthetic appearance if the structure is closed with shear wall along the building so shear wall is proved in side of the building. For low rise buildings, bracings may not be suitable.

In the current study the shear walls with corner, shear walls with center, shear walls at alternative 1 and shear walls at alternative 2 are provided for G+11 storey regular building and irregular model and the comparison made without shear wall buildings. These 10 models are analyzed using Response spectrum analysis method for Zone V. The results like storey drift, storey shear, storey bending, torsion, time period, frequency, storey stiffness values are studied to know the most effective model.

Key words: Shear walls, lateral displacement, storey drift, storey shear, storey bending, response spectrum, time history

1. INTRODUCTION

Numerous medium rise structures are being built, in India, utilizing shear walls to give seismic tremor protection from strengthened solid casings. These shear walls may have openings for the windows, entryways and pipe spaces for useful reasons. The number, area and size of openings influence the conduct of a structure just as worry in the shear wall.

Confined structures with shear wall are as often as possible embraced as the auxiliary framework for tall structure structures. This basic framework would likewise have numerous openings for the passageway to lifts or staircases and so forth. For the most part, plane pressure components and bar components are utilized to display the shear wall and edges separately in the investigation of this sort of structure. An arrangement stress component ought to have penetrating degrees of opportunity to speak to the association of shear wall center and casings. Something else, the twisting minute toward the finish of a bar can't be moved to the shear wall.

The openings might be of enormous size that is for the situation where it resembles work lobbies, gathering corridors, and cinemas. The number, area, size, and state of opening influences the conduct of structure as redirection, worry in the individuals. These openings truly impacts the productivity and precision of the investigation.

Objectives of the study

The following are the main objectives of the project

1. To study the seismic behavior of G+11 multi story regular and irregular building by using IS 1893:2002 and to design the earth quack resistant structure.
2. To compare the multi story buildings with and without shear wall at different locations namely corner, center, alternative 1 and alternative 2 on multi story Building.
3. To compare the results of Story Drift, Shear force, bending moment, Building torsion of buildings without shear wall at different locations on multi story Building
4. To study the buildings in ETABS software using Response spectrum analysis.

2. LITERATURE REVIEW

R.S.Mishra, V.Kushwaha, S.Kumar,et al[7] (2015) This examination has been done utilizing STAAD.PRO programming, IS 1893:2002, IS 13920:1993 and IS 456:2000. The structure under investigation comprise of 11 stories and has 5 coves along both bearing with a range of 4m each, floor to floor tallness is 3m, ground floor to initially floor stature is 2.80m. From this investigation it was presumed that On examination dependent on planned structure with different positional setup of shear wall concerning seismic burden going about as determined from STAAD.Pro programming demonstrates that, Intermediate position of shear wall is most appropriate as for center and fringe places of the structure.

Zeeshan Baseer[1] and Syed Farrukh Anwar[2] et al.,(2015) This study is completed on 20 story edge wall structures utilizing direct static examination with assistance of limited component programming, ETABS under horizontal loads in identical static investigation 10 models of the structures with changes in opening and its situation in shear wall are broke down. From this examination it was reasoned that 1. With the arrangement of opening in the shear wall the float are expanding.

3. METHODOLOGY MODELING OF BUILDING

Problem statement

In the present study, analysis of G+21 stories building in Zone V seismic zones is carried out in ETABS.

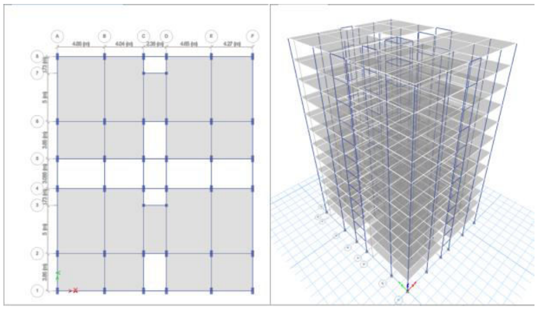
Basic parameters considered for the analysis are

1. Grade of concrete : M30
2. Grade of Reinforcing steel : HYSD Fe500
3. Dimensions of beam : 230mmX300mm
4. Dimensions of column : 230mmX480mm
5. Thickness of slab : 120mm
6. Height of bottom story : 3m
7. Height of Remaining story : 3m
8. Live load : 3.5 KN/m^2
9. Floor load : 1.5 KN/m^2
10. Density of concrete : 25 KN/m^3
11. Seismic Zone : Zone 5
12. Site type : II
13. Importance factor : 1.5
14. Response reduction factor : 5
15. Damping Ratio : 5%
16. Structure class : B
17. Basic wind speed : 39m/s
18. Risk coefficient (K1) : 1.08
19. Terrain size coefficient (K2) : 1.14
20. Topography factor (K3) : 1.36
21. Wind design code : IS 875: 1987 (Part 3)
22. RCC design code : IS 456:2000
23. Steel design code : IS 800: 2007
24. Earth quake design code : IS 1893 : 2002 (Part 1).

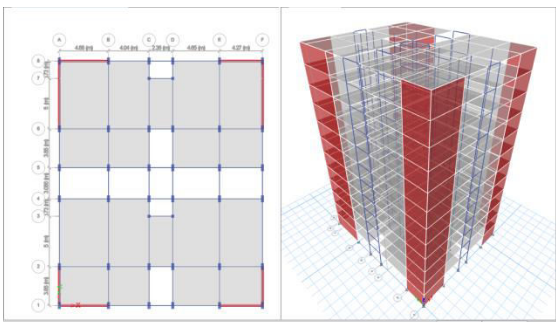
BUILDING MODELS IN ETABS

Regular building models

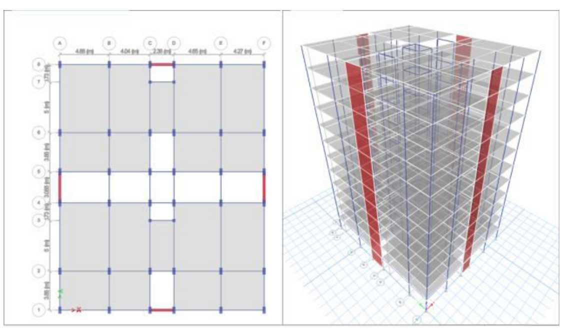
Building without Shear walls



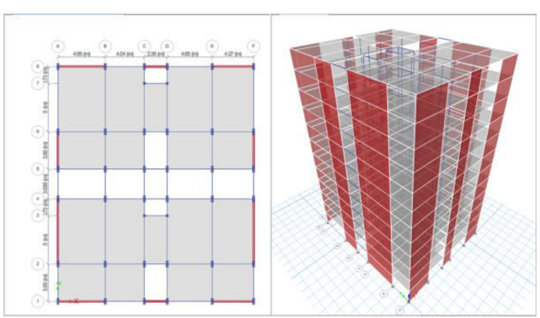
Building with Corner shear walls



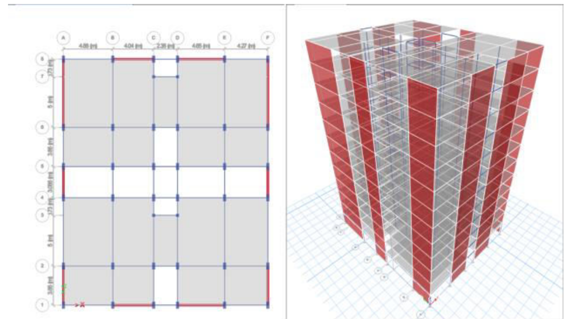
Building with center shear walls



Building with alternative shear walls 1

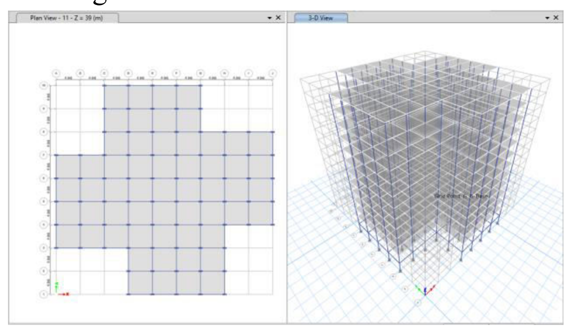


Building with alternative shear walls 2

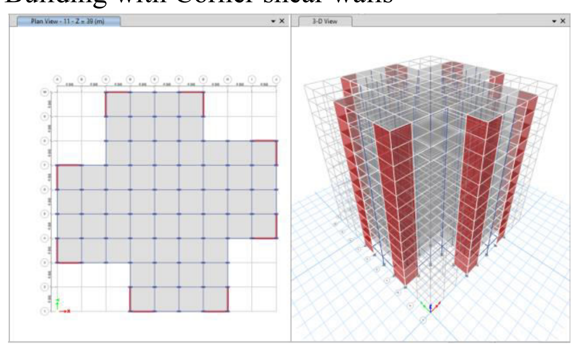


IRREGULAR BUILDING MODELS

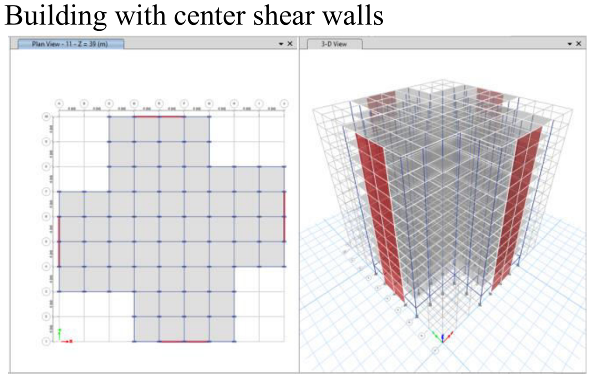
Building without Shear walls



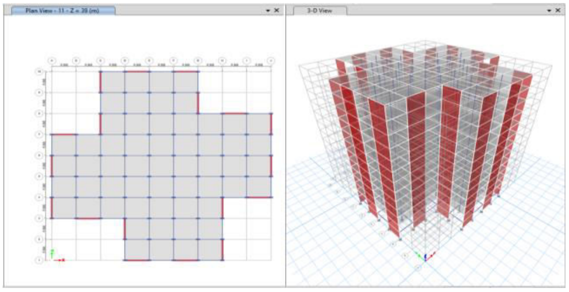
Building with Corner shear walls



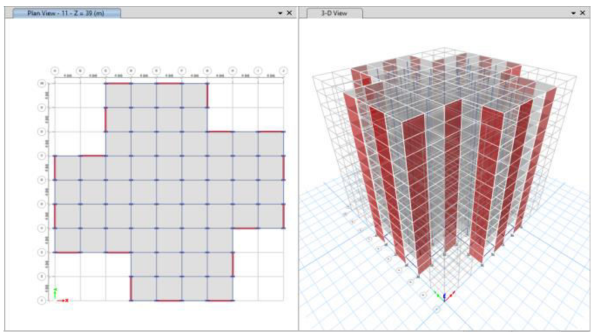
Building with center shear walls



Building with alternative shear walls 1



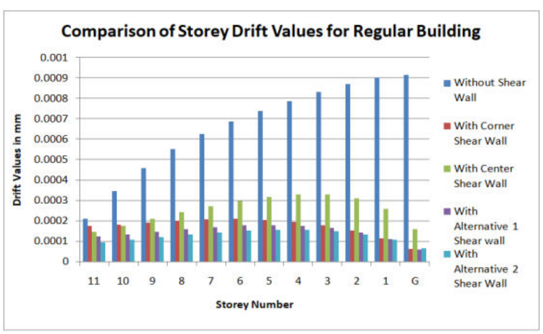
Building with alternative shear walls 2



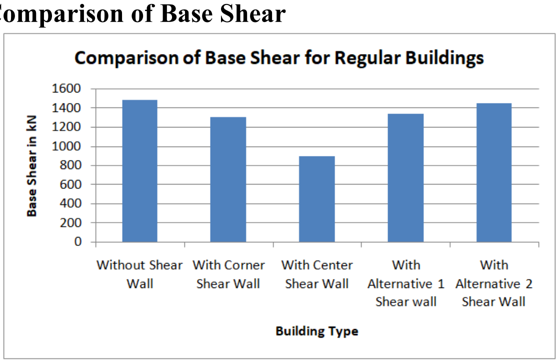
4. RESULTS AND ANALYSIS

Regular Building Results

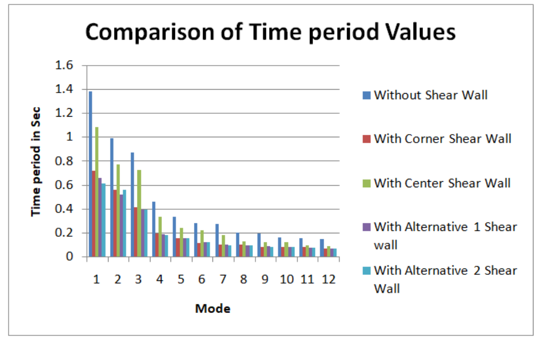
Comparison of Storey Drift



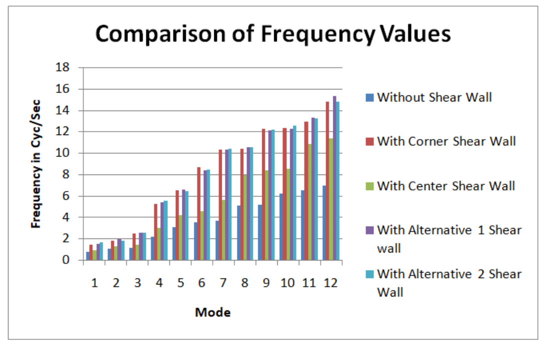
Comparison of Base Shear



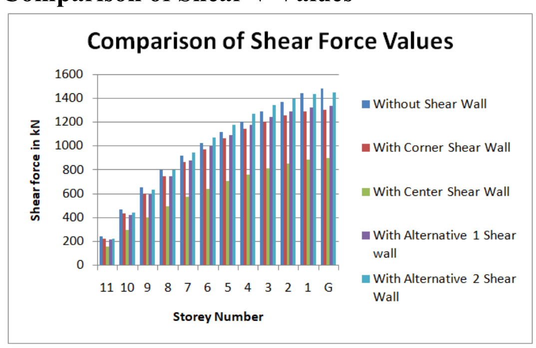
Comparison of Time period



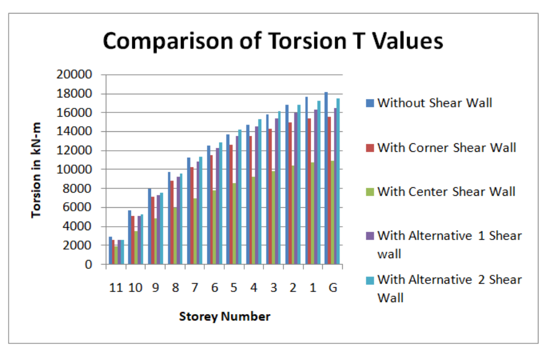
Comparison of Frequency



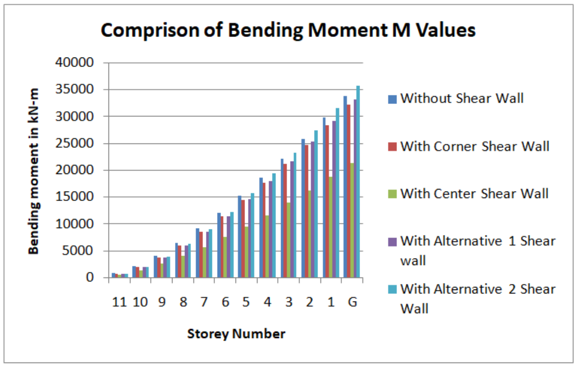
Comparison of Shear V Values



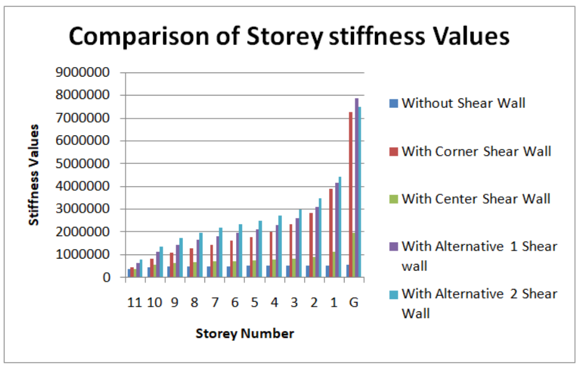
Comparison of Torsion T Values



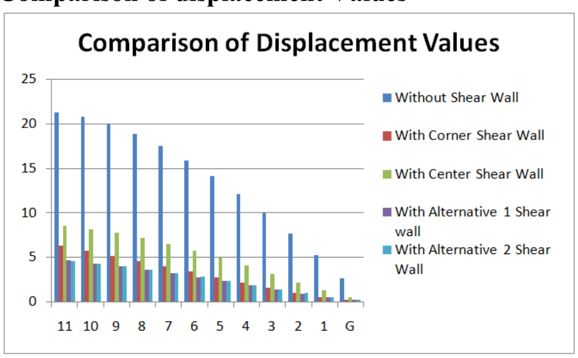
Comparison of Bending M Values



Comparison of Storey stiffness Values

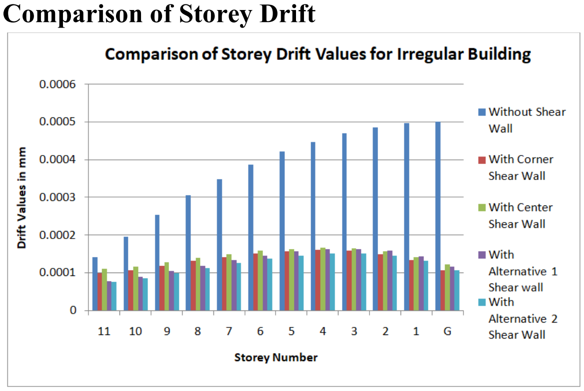


Comparison of displacement Values

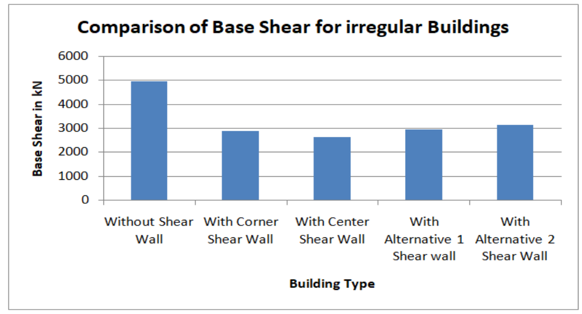


Irregular Building Results

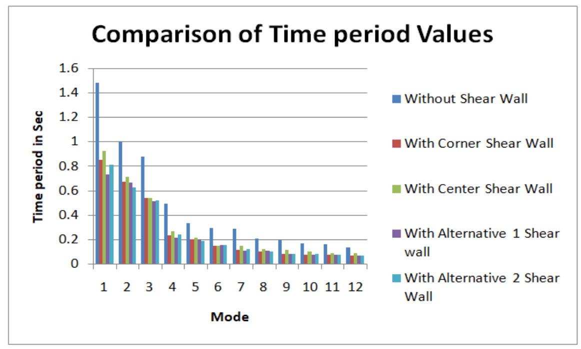
Comparison of Storey Drift



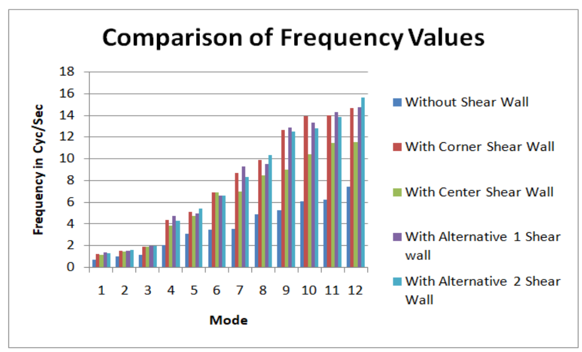
Comparison of Base Shear



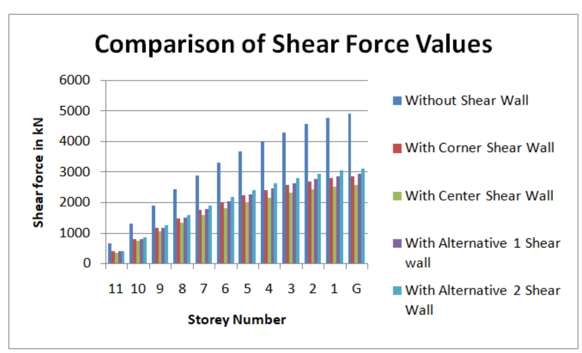
Comparison of Time period



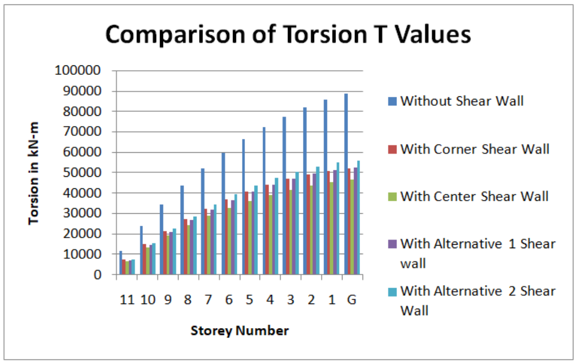
Comparison of Frequency



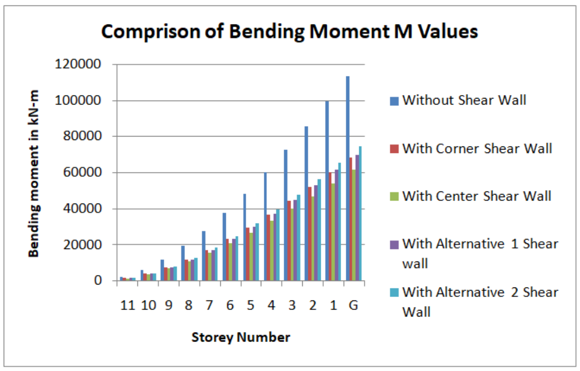
Comparison of Shear V Values



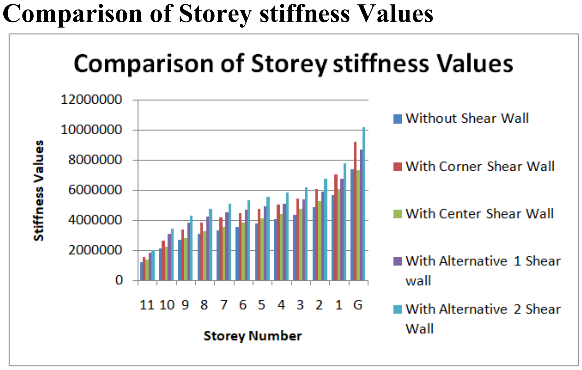
Comparison of Torsion T Values



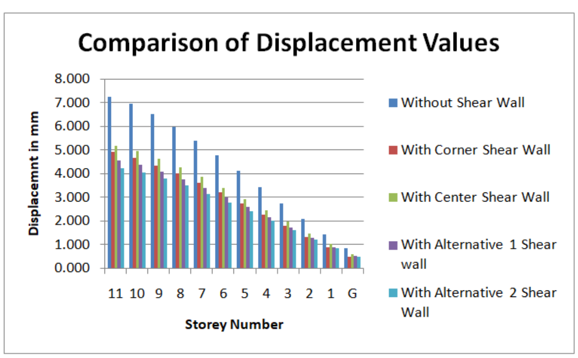
Comparison of Bending M Values



Comparison of Storey stiffness Values



Comparison of displacement Values



5. CONCLUSIONS

From the above study the following conclusions were made

1. The values of the drift are obtained less values for the regular and irregular building model made with alternative shear wall 2 case than the remaining building namely without bracings, corner shear walls, center shear wall and alternative shear wall models. So as per the drift values the efficient building structure is alternative shear wall 2 case.
2. The storey shear values shows less intensity for the regular and irregular building model made with center shear wall case. So the center shear wall case will be efficient model as per the storey shear.
3. The storey bending values shows less intensity for the regular and irregular building model made with center shear wall case. So the center shear wall case will be efficient model as per the storey bending.
4. The storey torsion values shows less intensity for the regular and irregular building model made with center shear wall case. So the center shear wall case will be efficient model as per the storey torsion.
5. By providing shear walls at various positions and locations the values of time period and frequency increasing when we compared with other building models this will give extra resistance for the structure in both regular and irregular models.
6. Opening in the shear walls lead to a significant increase in the bending moment and shear force in the columns connected to that shear wall and when opening is to top the percentage of the increase percentage increase it is less for the opening percent in both regular and irregular building models.

7. It was observed for a particular opening in wall when the opening position is shifted from one position to other position.
8. From this study it was concluded that increase in the percentage of Shear wall results in decrease in the drift and increases the Shear force, Bending moment, Building Torsion

REFERENCES

[1]. EhsanSalimiFiroozabad,Dr.K.RamaMohanRao,BahadorBagheri,EffectofShearWallConfigurationonSeismicPerformanceofBuilding,Proc.ofInt.Conf.onAdvancesinCivilEngineering2012

[2]. ShahzadJamilSardarandUmesh.N.Karadi,"EFFECTOFCHANGEINSHEARWALLLOCATIONONSTOREYDRIFTOFMULTISTOREYBUILDINGSUBJECTEDTOLATERALLOADS",InternationalJournalofInnovativeResearchinScience,EngineeringandTechnology,Vol.2,Issue9,September2013.

[3]. NajmaNainan,AliceTV,DynamicResponseOfSeismoresistantBuildingFrames,InternationalJournalofEngineeringScienceandTechnology(IJEST)ISSN:0975-5462 Vol.4No.05 ,May 2012.

[4]. Mr.K.LovaRaju,Dr.K.V.G.D.Balaji,Effectivelocationofshearwallonperformanceofbuildingframesubjectedtoearthquake load,InternationalAdvancedResearchJournalinScience,EngineeringandTechnology,ISSN23941588Vol.2,Issue1,January2015.

[5]. VarshaR.Harne,ComparativeStudyofStrengthofRCShearWallatDifferentLocationonMulti-storiedResidentialBuilding, InternationalJournalofCivilEngineeringResearch.ISSN2278-3652Volume5, Number4(2014),pp.391- 400

[6]. SyedKhasimMutwalli1,Dr.ShaikKamal MohammedAzam2,"DynamicResponseofHigRiseStructuresUnderTheInfluence ofShearWalls",Int.Journalof EngineeringResearchandApplications,ISSN:2248-9622,Vol.4,Issue9(Version6), September2014,pp.87-96.

[7]. R.S.Mishra1,V.Kushwaha2,S.Kumar3, "AComparativeStudyofDifferentConfigurationofShearWallLocationinSoftStory BuildingSubjectedtoSeismicLoad.", InternationalResearchJournalofEngineering andTechnology(IRJET),Volume:02 Issue: 07 | Oct-2015.

[8]. ZeeshanBaseerandSyedFarrukh Anwar," EFFECTOFPERFORATIONOF SHEARWALLONVARIOUSDESIGN PARAMETERSOFAHIGHRISE BUILDING",GLOBALJOURNAL OFENGINEERINGSCIENCEANDRESEARCHES.