M Sowmya* et al.
(IJITR) INTERNATIONAL JOURNAL OF INNOVATIVE TECHNOLOGY AND RESEARCH
Volume No.7, Issue No.5, August-September 2019, 9229-9233.

Study On Seismic Response With Floating Column For G+5 And G+10 With Different Zones

M SOWMYA
MTech student, Dept of CIVIL, Priyadarshini Institute of Technology & Science for Women's, Chintalapudi, Tenali, A.P, India.

K KIRAN KUMAR
Assistant Professor, Dept of CIVIL, Priyadarshini Institute of Technology & Science for Women's, Chintalapudi, Tenali, A.P, India.

Abstract: **Shear wall surface systems are among one of the most commonly made use of lateral load withstanding systems in skyscrapers. Shear walls have very high in aircraft stiffness as well as strength, which can be made use of to all at once resist big horizontal lots and also assistance gravity tons, making them fairly helpful in lots of structural engineering applications. There are great deals of literary works available to create as well as assess the shear wall. However, the choice regarding the place of shear wall in multi-storey structure is very little reviewed in any type of literatures. In this paper, for that reason, primary emphasis is to establish the service for shear wall area in multi-storey building. In this research, a G+ 10 storied enhanced concrete (RC) structure with varying ground slope as 0º, 5º, 10º, 15º as well as 20º without shear wall surfaces as well as including shear walls symmetrically in plan as well as at peripheral edges have been considered for the analysis. Buildings are made according to IS 456:2000 and also later on subjected to quake lots. The modelling as well as analysis of the structure has been carried by Liner Static, Linear Dynamic analysis (Feedback Spectrum and Linear Time Background evaluation) utilizing framework analysis tool SAP 2000. The main goal is to recognize the practices of the building on sloping ground for the result of differing elevation of the column in lower floor and also numerous placements of shear walls and to study the performance of shear wall on sloping ground.**

Keywords: **Shear Seismic Strength; Linear Static Method; Shear Failure; Nonlinear Static Analysis;**

1. INTRODUCTION:

Usually shear wall can be specified as architectural upright participant that is able to resist mix of shear, moment as well as axial load caused by lateral lots and also gravity lots transfer to the wall surface from other architectural member. Enhanced concrete walls, which include lift wells or shear walls, are the typical demands of Multi Floor Structures. Layout by corresponding centred and also mass centre of the building is the suitable for a Structure. An introduction of shear wall stands for a structurally efficient remedy to tense a structure structural system due to the fact that the major function of a shear wall surface is to increase the rigidness for lateral load resistance. In contemporary high buildings, shear wall surfaces are generally utilized as a vertical structural component for withstanding the side lots that may be generated by the effect of wind as well as quakes which cause the failing of structure as received number Shear walls of differing samples i.e. rectangular shapes to much more uneven cores such as channel, T, L, barbell shape, box etc. can be made use of. Arrangement of walls aids to divide an enclose space, whereas of cores to include and also convey services such as lift. Wall openings are inevitably required for windows in external walls and for doors or hallways in inner wall surfaces or in lift cores. The size and location of openings might differ from building and also functional perspective. The use of shear wall surface structure has gained appeal in high building structure, especially in the construction of service apartment or condo or office/ commercial tower. Quakes demonstrate vulnerability of numerous poor structures, whenever they occur. The lessons taught from the consequences of quakes and also the research functions being executed in laboratories offer far better understanding about the performance of the framework and their components. Damages in strengthened concrete framework was mostly attributed to the poor describing of reinforcement, lack of transverse steel as well as arrest of concrete in architectural components. Normal failures were brittle in nature, demonstrating poor capacity to dissipate and also take in inelastic energy. This requires a much better understanding of the style and also describing of the strengthened concrete structures under numerous sorts of loading. In modern high buildings, shear wall surfaces are commonly used as a vertical architectural component for resisting the side lots that may be generated by the result of wind as well as quakes.

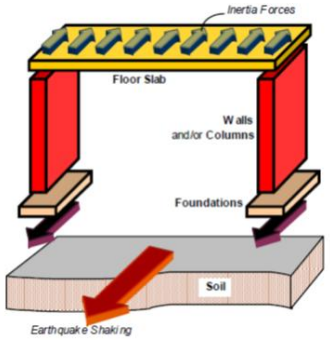

Fig.1.1. Flow of seismic inertia forces.

2. RELATED STUDY:

A quake may be defined as a wave-like movement generated forcibly in continuous chaos under the surface layer of the earth (the lithosphere), travelling with the earth's crust. It may also be specified as the resonance, often terrible, of the earth's surface as a result of release of power in the planet's crust. This launch of energy can be caused by unexpected misplacements of segment of the crust, volcanic eruptions or perhaps surges created by humans. Dislocations of crust sectors, however, lead to the most destructive quakes. In the process of misplacement, vibrations called seismic waves are generated.

Today buildings, which were developed as well as created according to earlier code provisions, do not please needs of existing seismic code and also design methods. Consequently it is important to secure undesirable dangers to residential or commercial property and also life of passengers, postured during future anticipating quake. The security of dangers is possible by means of seismic examination and performance, retrofitting of poor existing structure structures. Framed structures are obtaining speed in sloped areas specifically in hills, due to increased population and the land value. And hence, most of them are constructed on slopes and also bent grounds. Shear walls meeting each other at best angles cause flanged configurations and are referred to as flanged wall surfaces. In such instances, a section of the intersecting wall can be treated as a flange of the shear wall surface (e.g., as an I-section or a T-section). Such wall surfaces are generally called for to withstand quake forces in both principal directions of the building. The flanges will considerably boost the minute capability of tall cantilever shear wall surface. For this reason the shear resistance of their internet might end up being an important style product. The huge need for web reinforcement can be easily satisfied by using steel with higher return strength. Efficiency of shear walls is described in terms of strength (or rigidity). Solid shear wall surfaces are most efficient so it is highly desirable. Commonly openings are needed in shear walls for useful necessity (e.g., doors and windows); such walls are referred to as perforated (i.e., wall surface with openings). The part of a shear wall in between two adjacent openings is called a pier, whereas, the sector of shear wall surface above the adjacent openings is called a spandrel or a light beam. A shear wall surface with openings can be evaluated as a frame made up of short stiff wall surface sections (additionally called piers). In several shear walls, a normal pattern of windows or doors, or both, is needed for practical considerations. In such instances, the wall surfaces in between the openings may be interconnected by spandrels (or light beams), resulting in paired shear wall surfaces. The connecting aspects (i.e., beams) in between combined shear walls normally call for straight as well as upright support to move shear from one section of the wall to the various others. When the connecting elements are unable of moving shear from one shear wall surface to the various others, the wall surfaces are described as non-coupled and can be evaluated as cantilevers dealt with at the base.

3. METHODOLOGY:

Similar to reinforced concrete (RC) beam of lights and also columns, RC shear walls also perform far better if made to be ductile. Total geometric percentages of the wall, kinds and quantity of reinforcement, and also connection with staying components in the structure aid in enhancing the ductility of walls. The Indian Requirement Ductile Outlining Code for RC members (IS: 13920-1993) supplies unique layout guidelines for pliable outlining of shear wall surfaces. Shear wall surfaces are oblong in cross-section, i.e., one dimension of the cross-section is a lot larger than the other. While rectangular cross-section is common, L- and also U-shaped sections are additionally used. Thin-walled hollow RC shafts around the lift core of buildings likewise act as shear wall surfaces, and also must be benefited from to stand up to quake pressures. Steel strengthening bars are to be provided in walls in on a regular basis spaced upright and straight grids. The vertical and also straight reinforcement in the wall can be put in 1 or 2 identical layers called drapes. Straight support needs to be secured at the ends of wall surfaces. The minimum location of reinforcing steel to be offered is 0.0025 times the cross-sectional area, along each of the horizontal as well as upright instructions. This upright support needs to be distributed uniformly throughout the wall surface cross-section.

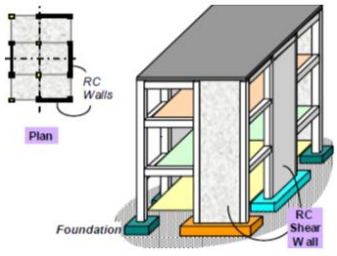

Fig.3.1. Reinforced shear walls in buildings.

Quake or seismic analysis is a part of structural evaluation which includes the computation of the reaction of a structure based on quake excitation. After selecting the architectural design, it is feasible to execute evaluation to establish the seismically caused forces in the frameworks. The analysis can be executed on the basis of the external activity, the behavior of the framework or architectural materials and the kind of architectural

version selected. The analysis of the process can be classified as straight fixed analysis, straight dynamic evaluation, non- direct static analysis and also non straight vibrant analysis. In this chapter linear static evaluation, response spectrum and also direct time background are talked about. The versions for evaluation are generated via the structural software program SAP 2000 and analysis is lugged by three evaluation methods, i.e., straight fixed analysis, response spectrum evaluation as well as linear time background analysis. The style of structures to stand up to earthquakes includes managing the damages to acceptable levels at an affordable price. Earthquake-resistant design is consequently concerned regarding making certain that the problems in buildings during quakes are of the appropriate selection, and also that they take place at the ideal places and in correct amounts. Ductility is just one of one of the most vital factors influencing the building efficiency. Thus, earthquake-resistant layout aims to predetermine the locations where damage takes place and then to give excellent describing at these places to guarantee pliable behaviour of the building.

Seismic codes are special to a certain region or nation. In India, IS 1893(Component 1): 2002 is the primary code that offers overview for calculating seismic design pressure. This force relies on the mass and also seismic coefficient of the structure and the latter subsequently depends on buildings like seismic area in which framework lies, importance of the structure, its rigidity, the soil on which it rests, as well as its ductility. IS 1893(Part1):2002 deals with assessment of seismic lots on various structures as well as structures. Relying on the height of the framework and also area to which it belongs, sort of analysis i.e., static evaluation or vibrant evaluation is carried out. Fundamental concept consists of the idealization of whole framework right into a lumped mass at each flooring level. Quite a few methods are readily available for the earthquake analysis of buildings; two of them exist here:

1. Linear static analysis
2. Linear dynamic analysis
   i. Response spectrum method.
   ii. Linear Time history method.

LINEAR STATIC ANALYSIS

In the equivalent static method, the lateral force equivalent to the design basis earthquake is applied statically. The equivalent lateral forces at each storey level are applied at the design 'centre of mass' locations. It is located at the design eccentricity from the calculated 'centre of rigidity (or stiffness)'.

$$V_b = A_h W$$

DYNAMIC ANALYSIS:

Dynamic analysis shall be performed to obtain the design seismic force, and its distribution to different levels along the height of the building and to the various lateral load resisting elements, for the following buildings:

Regular buildings: Those greater than 40m in height in zones IV and V, those greater than 90m in height in zone II and III.

Irregular buildings: All framed buildings higher than 12m in zones IV and V, and those greater than 40m in height in zones II and III.

4. EXPERIMENTAL ANALYSIS:

Only seldom will a single cantilever wall be called upon to resist the whole of the lateral load acting upon a multistorey structure. It is more 1ikely that a number of such walls wi1l share in the total load resistance. In the majority of multistorey buildings shear wal1s wi1l occur around the service core and rigid jointed frames are likely to carry the gravity load over the remainder of the floor. The response of rigid jointed frames and cantilever shear walls to lateral loads can be so markedly different, particularly in the upper storeys, that undesirable interaction may ensure. The two types of structures may work against each other, and an unusually large ductility demand may possibly result in the process of developing the ultimate strength of the whole structure. Most of the seismic codes recommend an equivalent static procedure for the design of regular buildings where the design base shear is calculated as a fraction of the seismic weight, based on factors such as seismic zone, importance of the building, design ductility, fundamental natural period and type of soil.

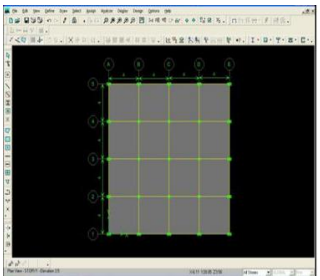

Fig.4.1. Model of Building without shear wall

When shear walls are strong enough, they will transfer these horizontal forces to the next element in the load path below them. These other components in the load path may be other shear walls, floors, foundation walls, slabs or footings. Shear walls also provide lateral stiffness to prevent the roof or floor above from excessive side-sway. When shear walls are stiff enough, they will prevent floor and roof framing members from moving off their supports. Also, buildings that are

sufficiently stiff will usually suffer less non-structural damage.

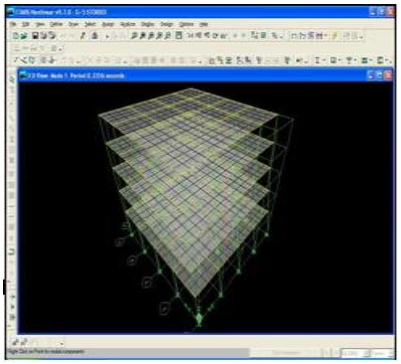

Fig.4.2. Model I: Structure without shear wall.

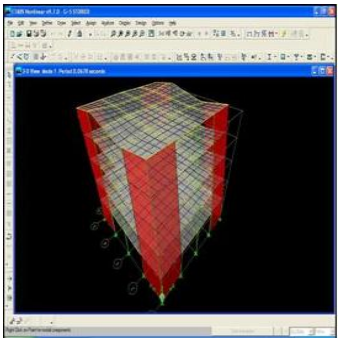

Fig.4.3. Structure with L type shear wall.

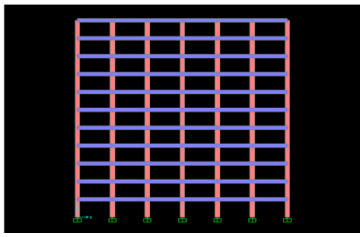

Fig.4.4. Building model without shear wall on plane ground.

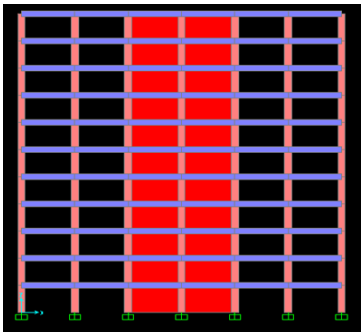

Fig.4.5. Building model with shear walls provided symmetrically in plan on plane ground.

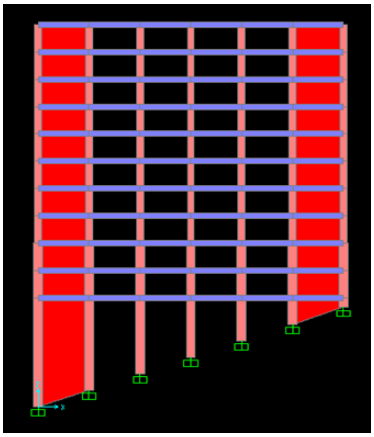

Fig.4.6. Building model with shear walls provided at peripheral corners on 20º slope ground.

The displacements for the building resting on flat ground are found to be relatively higher than the building resting on sloped ground. As the slope of the ground is increasing the displacements in the building are getting reduced.

Storey level	Step back building without providing shear walls(mm)				
	0°	5° slope	10° slope	15° slope	20° slope
10	20.23	13.99	16.26	13.65	10.68
9	19.51	13.51	15.63	13.25	10.29
8	18.39	12.75	14.62	12.61	9.67
7	16.87	11.71	13.24	11.74	8.82
6	15.03	10.44	11.55	10.66	7.77
5	12.95	8.99	9.61	9.42	6.55
4	10.68	7.41	7.50	8.04	5.20
3	8.29	5.73	5.28	6.56	3.77
2	5.85	4.02	3.10	5.00	2.33
1	3.42	2.53	1.38	3.59	1.15
0	1.23	1.18	0.19	2.21	0.25

Fig.4.7. Displacement for buildings without providing shear walls in X Direction.

It is observed that building on plane ground without providing shear walls are having relatively higher displacements when compared to buildings with shear walls placed at different locations. When the shears walls are provided symmetrically in plan, displacements are reduced compared to building with shear walls provided at peripheral corners.

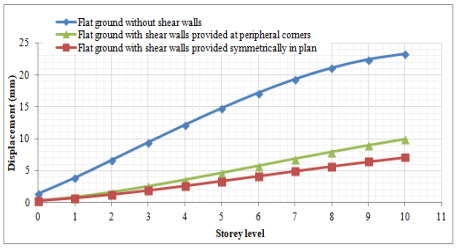

Fig.4.8. Displacements in Y-direction of buildings resting on flat ground without shear wall and with shear wall.

5. CONCLUSION:

Short columns are the most critical members for the building on the slope ground. To have a good control over the forces such as shear force and bending moment, it is preferable to locate the shear

wall towards the shorter column side. Time period of vibration for building with shear walls located towards shorter column is found to be least than any other location. There is a significant improvement in seismic performance of building on slopes by providing shear walls with different configurations since storey displacement, storey drifts and bending moments reduces considerably in building due to provision of shear walls. It is observed that the displacements are getting reduced when the shear walls are provided symmetrically in plan and as the sloping angle is increasing there is a decrease in displacements. The displacements in Linear Static analysis are relatively higher compared to the displacements in Response Spectrum analysis. There is a large increase in the displacements in Linear Time History Analysis compared to the Linear Static and Response Spectrum analysis.

REFERENCES:

[1] Alireza Mortezaei, Seismic behavior of flanged shear wall buildings subjected to near-fault earthquakes having forward directivity, Proc. 15th World Conference on Earthquake Engineering, Lisboa, 2012.

[2] Ashish S.Agrawal, S.D.Charkha, Effect of change in shear wall location on storey drift of multistorey building subjected to lateral loads, International Journal of Engineering Research and Applications (IJERA), Vol. 2, Issue 3, 2012, 1786-1793.

[3] Rahul Rana, Limin Jin and Atila Zekioglu, Pushover analysis of a 19 story concrete shear wall building, Proc. 13th World Conference on Earthquake Engineering, Vancouver, B.C., Canada, 2004,133.

[4] Ravikanth Chittiprolu, Ramancharla Pradeep Kumar, Significance of shear wall in highrise irregular buildings, International journal of education and applied research (ijear), Vol 4, Issue Spl-2, 2014, 2348-0033.

[5] Ashish S Agarwal, S D Charkha, (2012), Effect of change in shear wall location on storey drift of multistory building subjected to lateral load International Journal of Engineering Research & Applications (IJERA) ISSA: 2248- 9622 www.ijera.com Vol. 2, Issue 3, May-June 2012, pp.1786-1793

[6] Ashraf M Siddiqi Z A and Javed M A, (2008), Configuration of Multi-Storey Building Subjected to Lateral Forces, Asian Journal of Civil Engineering (Building and Housing), Vol. 9, No. 5, pp. 525-537.

[7] Castillo R., Carr A.J. and Restrepo J. (2001), The Rotation of asymmetric Plan Structures, proceeding of NZSEE conference, Paper No. 4.08.01.

