International Journal of Interdisciplinary Innovative Research & Development (IJIIRD)

ISSN: 2456-236X

Vol. 02 Issue 01 | 2017

Seismic Analysis of Shear Wall at Different Location on Multi-storey RCC Building

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ABSTRACT

Looking to the past records of earthquake, there's increase within the demand of earthquake resisting building which might be consummated by providing the shear wall systems within the building. Additionally attributable to the foremost earthquakes within the recent pats the codal provisions revised and implementing additional weightage on earthquake style of structure. Usually shear wall will be outlined as structural vertical member that's ready to resist combination of shear, moment and axial load iatrogenic by lateral load and gravity load transfer to the wall from different support. Ferro concrete walls, that include raise wells or shear walls, square measure the standard needs of Multi structure Buildings. Style by coinciding centre of mass and mass centre of the building is that the ideal for a Structure. Associate in Nursing introduction of shear wall represents a structurally economical answer to stiffen a building structural system as a result of the most operate of a shear wall is to extend the rigidity for lateral load resistance.

Shear wall systems square measure one amongst the foremost usually used lateral load resisting systems in high-rise buildings. Shear walls square measure incorporated in building to resist lateral Forces and support the gravity masses. RCC shear wall has high in plane stiffness, which may be accustomed at the same time resist massive horizontal masses and support gravity masses, creating them quite advantageous in several structural engineering applications. There square measure several literatures offered to style and analyse the shear wall. However, the choice concerning the placement of shear enclose multi-storey building isn't a lot of mentioned in any literatures. Positioning of shear wall has influence on the general behaviour of the building. For effective and economic performance of building it's essential to position shear enclose a perfect location.

The main aim of the project is to work out the solution for shear wall location in multi-storey building. it's administrated to work out the strength of RC shear wall of a high-rise building by dynamical shear wall location. three completely different cases of shear wall position for a building are analysed. associate degree earthquake load is calculated by the unstable constant technique victimisation IS 1893 (PART–I): 2002.STAAD professional V8i software is used for the analysis of structures. The structures area unit compared on four completely different parameters specifically joint displacement, axial force, bending moment and base shear

1. INTRODUCTION

Generally shear wall are often outlined as structural vertical member that's able to resist combination of shear, moment and axial load elicited by lateral load and gravity load transfer to the wall from alternative support. Reinforced concrete walls, that embrace raise wells or shear walls, area unit the same old requirements of Multi story Buildings Style by coinciding centre of mass and mass centre of the building is the ideal for a Structure. Shear walls have terribly high in-plane stiffness and strength, which may be wont to at the same time resist massive horizontal masses and support gravity masses, creating them quite advantageous in several structural engineering applications. associate degree introduction of shear wall represents a structurally economical resolution to stiffen a building structural system as a result of the most operate of a shear wall is to extend the rigidity for lateral load resistance.

Fig1. Damage of building because of earthquake

In trendy tall buildings, shear walls are usually used as a vertical structural component for resisting the lateral masses that may be elicited by the impact of wind and earthquakes. Shear walls of varied cross sections i.e. rectangular shapes to a lot of irregular cores like channel, T, L, barbell shape, box etc. will be used. Provision of walls helps to divide AN enclose area, whereas of cores to contain and convey services like elevator. Wall openings are inevitably needed for windows in external walls and for doors or corridors in inner walls or in elevate cores. the dimensions and placement of openings might vary from architectural and useful purpose of view**.**

The use of shear wall structure has gained quality in high rise building structure, particularly within the construction of service flat or office/ industrial tower. it's been well-tried that this method provides economical structural system for multi construction building within the vary of 30-35 storey's (MARSONO & SUBEDI, 2000). Within the past thirty years of the record service history of tall building containing shear wall component, none has folded throughout robust winds and earthquakes (FINTEL, 1995).

Fig2. Construction of shear wall

1.1 Reinforced Concrete Shear Wall

Reinforced concrete (RC) buildings usually have vertical plate-like RC walls known as Shear Walls (Figure2) additionally to slabs, beams and columns. These walls typically begin at foundation level and square measure continuous throughout the building height. Their thickness will be as low as 150mm, or as high as 400mm in high rise buildings. The overwhelming success of buildings with shear walls in resisting robust earthquakes is summarised within the quote: "We cannot afford to make concrete buildings meant to resist severe earthquakes while not shear walls." Mark Fintel, a noted consulting engineer in USA.

RC shear walls give massive strength and stiffness to buildings within the direction of their orientation, which significantly reduces lateral sway of the building and thereby reduces harm to structure and its contents. Since shear walls carry massive horizontal earthquake forces, the overturning effects on them area unit massive. Shear walls in buildings should be symmetrically located in decide to cut back ill-effects of twist in buildings. They may be placed symmetrically on one or each directions in arrange. Shear walls area unit more effective

once situated on exterior perimeter of the building – such a layout will increase resistance of the building to twisting.

1.2 Function of Shear wall

Shear walls should give the mandatory lateral strength to resist horizontal earthquake forces. once shear walls square measure strong enough, they'll transfer these horizontal forces to future part within the load path below them. These alternative components within the load path are also other shear walls, floors, foundation walls, slabs or footings. Shear walls additionally give lateral stiffness to prevent the roof or floor on top of from excessive side-sway. once shear walls square measure stiff enough, they'll stop floor and roof framing members from moving off their supports. Also, buildings that are sufficiently stiff can sometimes suffer less non-functional damage.

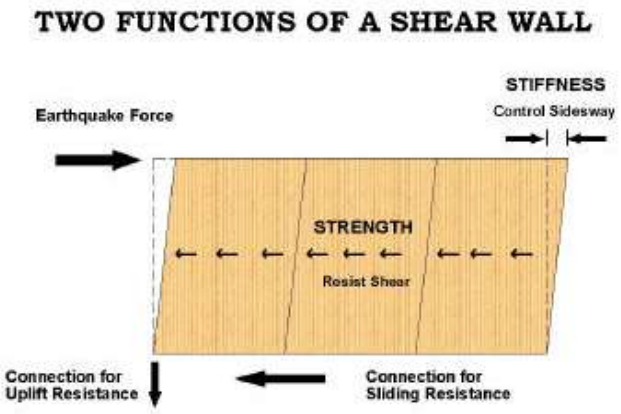

Fig. 1.2Function of shear wall

Shear walls conjointly offer lateral stiffness to stop the roof or floor higher than from excessive side-sway. once shear walls are stiff enough, they're going to stop floor and roof framing members from moving off their supports. Also, buildings that are sufficiently stiff can typically suffer less non-structural damage. (Fig. 1.2)

1.5 Types of seismic analysis Code based Procedure for Seismic Analysis (IS 1893:2002)

- **Equivalent Lateral Force**

  Seismic analysis of most of the structures remains applied on the premise of lateral force assumed to be equivalent to the particular loading. the bottom shear that is that the total horizontal force on the structure is calculated on the premise of structure mass and elementary amount of vibration and corresponding mode shape. the bottom shear is distributed on the peak of structures in terms of lateral force in line with code formula. This technique is conservative for low to medium height buildings with regular conformation.

- **Response Spectrum Analysis**

  This technique is applicable for those structures wherever modes apart from the elemental one affect significantly the response of the structure. during this technique the response of Multi-Degree-of-Freedom(MDOF) system is expressed because the superposition of modal response, every modal response being determined from the spectral analysis of single -degree-of-freedom (SDOF) system, that is then combined to compute total response. Modal analysis ends up in the response history of the structure to a such ground motion; however, the strategy is sometimes utilized in conjunction with a response spectrum. A response spectrum is simply a plot of the height or steady-state response (displacement, rate or acceleration) of a series of oscillators of varied natural frequency, that square measure forced into motion by an equivalent base vibration or shock. The resulting plot will then be wont to decide off the response of any linear system, given its natural frequency of oscillation. One such use is in assessing the height response of buildings to earthquakes. The science of strong ground motion could use some values from the bottom response spectrum (calculated from recordings of surface ground motion from seismographs) for

correlation with seismal harm. If the input used in calculating a response spectrum is steady-state periodic, then the steady-state result's recorded. Damping must be gift, alternatively the response are going to be infinite. For transient input (such as seismal ground motion),the peak response is reported . Some level of damping is usually assumed, however a worth are going to be obtained even with no damping. Response spectra can even be utilized in assessing the response of linear systems with multiple modes of oscillation (multi-degree of freedom systems), though they're solely correct for low levels of damping. Modal analysis is performed to spot the modes, and also the response in this mode will be picked from the response spectrum. This peak response is then combined to estimate a complete response. Atypical combination technique is that the root of the add of the squares (SRSS) if the modal frequencies are not shut. The result's generally completely different from that which might be calculated directly from associate degree input, since phase info is lost within the method of generating the response spectrum. The main limitation of response spectra is that they're solely universally applicable for linear systems. Response spectra will be generated for non-linear systems, however ar solely applicable to systems with an equivalent non-linearity, though tries have been created to develop non-linear seismal style spectra with wider structural application. The results of this cannot be directly combined for multi-mode response.

- **Time History Analysis**

A linear time history analysis overcomes all the disadvantages of modal response spectroscopy, provided non-linear behavior isn't concerned. This methodology needs larger machine efforts for calculating the response at discreet time's .One attention-grabbing advantage of such procedure is that the relative signs of response quantities square measure preserved within the response histories. this is often necessary once interaction effects square measure thought of in style among stress resultants. though this is often too oversimplified to use to a real structure, the physicist Step perform may be a cheap model for the applying of the many real masses, such as the fulminant addition of a chunk of furnishings, or the removal of a prop to a freshly forged concrete floor. However, in reality masses square measure ne'er applied instantly - they build up over a amount of your time (this is also very short indeed). now is termed the increase time. As the range of degrees of freedom of a structure increases it terribly quickly becomes too tough to calculate the time history manually - real structures square measure analyzed using non-linear finite part analysis software package. Time-history analysis is more and more employed in style of new Structures and analysis of existing ones .In the case of time-history analysis, seismal action is represented by suite of ground acceleration records.

- **Objective of the study**

(i) The gift study on Dynamic analysis reveals an effort to see the elemental natural frequency of various buildings victimisation Matrix methodology based mostly software package, STAAD.
(ii) To analyze a high-rise RC framed building (G+9) for earthquake zone III by response spectrum methodology.
(iii) To study behavior of RC building (G+9) with totally different position of shear wall.
(iv)To measure the displacements in structure at numerous levels, relative to ground displacements inhorizontal direction.
(v) To aim at the determination of elementary natural frequency for the various building models.
(vi) To notice the bottom shear price for various structures.

2. LITERATURE REVIEW

Anshuman, DipenduBhunia, BhavinRamjiyani(2011) it's been determined that the each bending moment and shear force within the first and twelfth frame were reduced and high deflection is additionally reduced once providing the shear wall up any of the sixth and seventh frame and first and twelfth in close the shorter direction. Hence, it is said that shear wall is provided in sixth and seventh frame or first and twelfth in close shorter direction. In analysis hinge formation has additionally been determined.

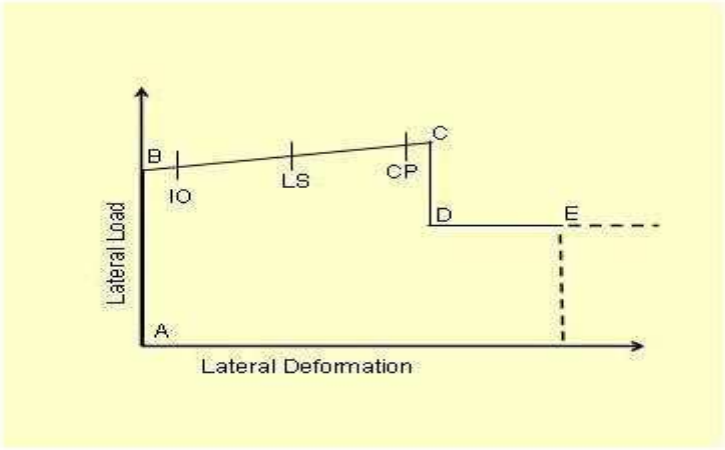

Fig. 2.1 Graph showing Hinge Formation Levels

Hinge formation levels square measure divided as yield level (B), immediate occupancy level (IO), life safety level (LS), collapse level (CP),full collapse level (E) [Figure 3]. At the immediate occupancy level structures haven't any sever damage and structures may be used for more lifetime of structure. Life safety level indicates there won't be any casualty because of earthquake however structure cannot be used for more living. At collapse level member can begin to collapse and full collapse member can already collapse.

Ashish S. Agrawal and S. D. Charkha 2012This paper highlights on the impact of amendment in position of shear wall with totally different shapes for crucial parameters like structure drift, axial load and displacement. inserting shear wall far away from the centre of gravity resulted in increase in most of the member forces. They conclude like the rise in eccentricity, the building shows non-uniform movement of right and left edges of roof owing to torsion and induce excessive moment and forces in member.

R.Chittiprolu, R.Pradeep Kumar (2014), during this paper study the importance of Shear enclose High rise Irregular Buildings. A study on associate degree irregular high rise building with shear wall and while not shear wall was studied to grasp the lateral hundreds, story drifts and torsion effects. From the results it's inferred that shear walls area unit a lot of proof against lateral hundreds in associate degree irregular structure. and it had been determined that the dynamic linear analysis mistreatment response spectrum methodology is performed and lateral load analysis is completed for structure while not shear wall and structure with shear wall. Results area unit compared for the frame lateral forces and story drifts of each the cases. it's additionally determined that lateral forces area unit reducing once the shear walls area unit intercalary at the acceptable locations of frames having minimum lateral forces. Therefore, it's inferred that shear walls area unit a lot of proof against lateral hundreds in associate degree irregular structure. additionally they'll be accustomed cut back the results of torsion.

Mohammed yousuf, P.M. shimpale (2013) the most objective of earthquake engineering is to style associate degreed build a structure in such the way that the injury to the structure and its structural part throughout an earthquake is decreased . This paper aims towards the dynamic analysis of concrete building with set up irregularity. Four models of G+5 building with one symmetrical set up and remaining irregular set up are taken for the investigation. The analysis of R.C.C. building is dispensed with the metal based mostly computer code ETABS nine.5. Estimation of response such as; lateral forces, base shear, construction drift, construction shear is dispensed. Four cross sectional variation in columns section ar thought of for finding out effectiveness in resisting lateral forces. The paper additionally deals with the impact of the variation of the building set up on the structural response building. Dynamic responses underneath distinguished earthquake, associated with IS 1893–2002(part1) are dispensed. In dynamic analysis; Response Spectrum methodology is employed. The CQC (complete quadratic combination) methodology has additionally been utilized for every model for estimation of dynamic response for five, 10%, 15%, and 2 hundredth damping and dynamic responses were compared.

H.Rahangdale, S.R.Satone (2013), dispensed the survey of style and analysis of multi-storied building with result of shear wall. In this paper Study of G+5 construction building in Zone IV is conferred with some preliminary investigation that is analyzed by ever-changing numerous position of shear wall with totally different shapes for confirm parameter like axial load and moments. This analysis is completed by victimization customary package STADD-pro. currently the project describes the analysis of structure with result of shear wall. In Structural engineering, a shear wall could be a wall composed of braced panels (also referred to as shear panels) to counter the results of lateral load performing on a structure. Wind and earthquake hundreds square measure the foremost common hundreds braced wall lines square measure designed to counteract. it had been found that the various location of shear wall result on axial load on the column. In absence of shear wall axial

load and moments square measure most on column. Case-3 is safe as compare to case-1 and case-2. Shear walls square measure simple to construct, as a result of reinforcement particularization of walls is comparatively clear-cut and thus simply enforced at website. therefore shear walls square measure one in every of the foremost effective building components in resisting lateral forces throughout earthquake. By constructing shear walls damages owing to result of lateral forces owing to earthquake and high winds are often reduced. Shear walls construction can offer larger stiffness to the buildings there by reducing the injury to structure and its contents.

P. P. Chandurkar, Dr.P.S.Pajgade(2013) was studied the unstable Analysis of RCC Building with and while not Shear Wall. during this paper, effectiveness of shear wall has been studied with the assistance of 4 completely different models. Model one is blank frame structural system and different 3 models square measure twin sort structural system. AN earthquake load is applied to a building of 10 stories placed in zone II, zone III, zone IV and zone V. Lateral displacement, story drift and total value needed for ground floor square measure calculated in each the cases commutation column with shear wall.And discovered that in ten story building, constructing building with shear shut in short span at corner (model 4) is economical as compared with different models. From this it may be ended that giant dimension of shear wall isn't effective in ten stories or below ten stories buildings. it's discovered that the shear wall is economical and effective in high rise building.

O. Esmaili, S. Epackachi(2008) allotted the Study of Structural RC Shear Wall System in a56-Story RC Tall Building. during this paper, study the structural aspects of 1 of the tallest RC buildings, set within the high unstable zone, with fifty six stories. during this Tower, shear wall system with irregular openings square measure used beneath each lateral and gravity masses, and will result some exceptional problems within the behavior of structural components like shear walls, coupling beams and etc. to own a unstable analysis of the Tower, plenty of non-linear analyses were performed to verify its behavior with the foremost rife retrofitting pointers like FEMA 356. during this paper; some exceptional aspects of the tower and therefore the assessment of its unstable load bearing system with considering some necessary factors are going to be mentioned.

Finally when a general study of malleability levels in shear walls; we are going to conclude the optimality and construct of the tower style. Finally, having some technical info concerning the structural behavior of the case would be terribly fascinating and helpful for designers. As is treated here, mistreatment shear walls for each gravity and bracing system is unacceptable neither conceptually nor economically. Not solely main walls square measure assumed to hold unstable masses, however conjointly they're about to bear a big proportion of gravity masses. Despite the actual fact that coupling beams square measure assumed to be cracked untimely in earthquake, this event would possibly occur beneath permanent gravity masses as a results of concrete time dependency. distribution of masses consistent with creep and successive loading can intensely modification the primitive assumptions on gravity load tributaries and consequently the extent of malleability. By considering each time dependency of concrete and construction sequence Loading at the same time in analyses, the vital demands would be found to occur within the middle height of the structure.

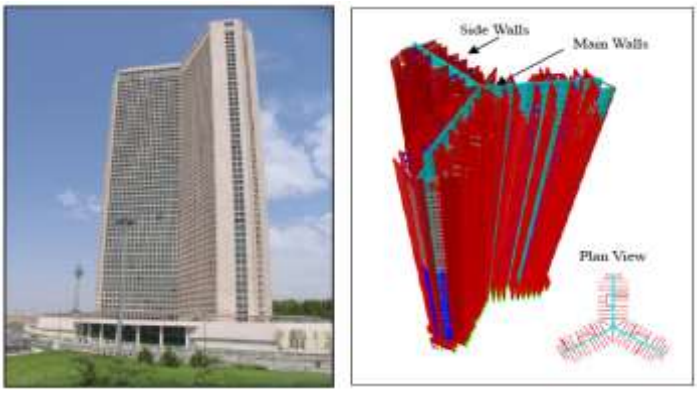

Figure 2.1 the view and structural system of the tower

3. CONCLUSION FROM THE LITERATURE

There square measure adequate analysis and also the development of varied kinds of shear wall with completely different positions in frame with smart adjustability of strength. Properly designed and elaborated buildings with shear walls have shown superb performance in past earthquakes. Thus Shear walls in high seismic regions need special description. as a result of its smart unstable behaviour, construction feasibility.

4. REFERENCES

1. Solution of shear wall in multi-storey building", Anshuman, DipenduBhunia, BhavinRamjiyani, International journal of civil and structural engineering, Volume 2, no.2, 2011.
2. "Review on Shear wall for soft storey high rise building, MisamAbidi and MangulkarMadhuri N. ,International Journal of Civil and Advance Technology, ISSN 2249-8958,Volume-1,Issue-6, August 2012
3. "Effect of change in shear wall location on storey drift of multi-storey residential building subjected to lateral load", Ashish S. Agrawal and S. D. Charkha, International journal of Engineering Research and Applications, Volume 2, Issue 3,may-june 2012, pp.1786-1793.
4. "Configuration of multi-storey building subjected to lateral forces", M Ashraf, Z. A. Siddiqui, M. A. Javed, Asian journal of civil engineering ,vol. 9,no.5, pp. 525-535, 2008.
5. Shrikhande Manish, AgrawalPankaj(2010)."Earthquake Resistant Design of Structures." PHI Learning Private Limited New Delhi.
6. Duggal S K (2010), "Earthquake Resistance Design of Structure", Fourth Edition, Oxford University Press, New Delhi.
7. Haselton C B and Whittaker A S (2012), "Selecting and Scaling Earthquake Ground Motions for Performing Response-History Analyses", The 15th World Conference on Earthquake Engineering.
8. Romy M and Prabha C (2011), "Dynamic Analysis of RCC Buildings with Shear Wall", International Journal of Earth Sciences and Engineering, ISSN 0974- 5904, Vol. 04, 659-662.
9. Shaha V and Karve S (2010), "Illustrated Design of Reinforced Concrete Buildings", Sixth Edition, Structures Publication, Pune.
10. Wilkinson S and Hiley R (2006), "A Non- Linear Response History Model for the Seismic Analysis of High-Rise Framed Buildings", Computers and Structures, Vol. 84.
11. Watson-Lamprey, J.A. and N.A. Abrahamson (2006), "Selection of Ground Motion Time Series and Limits on Scaling", Soil Dynamics and Earthquake Engineering, 26(5) 477-482.