Study The Effect of Shear Wall Area To Floor Area Ratio on The Seismic Behaviour of RC Structure

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Abstract- *The shear wall is a structural element which is used to resist earthquake forces. These wall will consumptives shear forces & will prevent changing location-position of construction & consequently destruction. On other hand, shear wall arrangement must be absolutely accurate, if not, we will find negative effect instead. Shear wall, Buildings often have vertical plate-like RC walls called Shear Walls in addition to slabs, beams and columns. These walls generally start at foundation level and are continuous throughout the building height. This study is aimed to evaluate the effect of shear wall area to floor area ratio on the seismic behavior of RC structures. For this purpose, 12 building models that have five, ten and fifteen stories and shear wall ratios ranging between 0.5 and 2% in both directions are generated. A three dimensional modeling and analysis of the structure are carried out with the help of ETABS software. Then, the behavior of these building models under earthquake loading is examined by carrying out linear time history analyses and response spectrum analysis is done. In the analyses, three different ground motion records are applied to the building models. Main parameters considered in this study that affect the overall seismic performance of the buildings are the displacements, story drifts and the base shear responses. The results indicate that at least 1.0% shear wall ratio should be provided in the design of buildings to control the drift. In addition, when the shear wall ratio increases beyond 1.5%, it is observed that the improvement of the seismic performance of a structure. The software used is ETABS 9.5.*

Keywords- Shear Wall, Story Drift, Displacement, ETABS, High Rise Buildings.

I. INTRODUCTION

In most buildings shear walls are considered an integral part of the building system and provide the majority of the lateral force resistance. In particular, shear walls resist many of the large lateral loads that can be induced as a result of strong winds, earth-quakes, or even human-induced hazard such as blasts. The advantage of using shear walls is not solely for service utilities but rather because of their physical characteristics. Shear walls have very high in-plane stiffness and strength, which can be used to resist these large horizontal loads, and they are able to simultaneously support large gravity loads. Investigations of strong ground motions revealed that properly designed and detailed shear wall buildings performed well in past earthquakes. Shear walls built in high seismic regions should be in compliance with special detailing requirements. However, prior observations indicated that even buildings that have high shear wall area to floor area ratios with walls that do not have special seismic detailing survived high magnitude earthquakes. These observations drew attention of both practical engineers and academic researchers to shear wall-frame buildings. To minimize loss after earthquakes, the experimental and analytical studies on seismic design approaches encourage use of shear walls for earthquake-resistant design.The behavior of modern structures under strong ground motions for a period starting with the Skopje earthquake of 1963 through the Armenian earthquake of 1988, in which no collapse and life loss occurred in the buildings containing shear walls even though cracking with various degrees of severity was observed in some cases. Excessive story drifts that caused shear failures of columns were indicated as the main reason for the collapse of hundreds of RC frame structures. Even when total collapse was not observed, large story drifts in frames caused significant property loss. The shear wall area to floor area ratio (also referred to as shear wall ratio), the wall aspect ratio, and the wall configuration in plan are indicated as important parameters that affect the detailing of a shear wall for RC design. However, among these parameters, shear wall ratio is also accepted as an essential parameter affecting the global performance of a building under severe ground motions. Therefore, shear wall ratio is set as a key parameter to be investigated in this analytical s

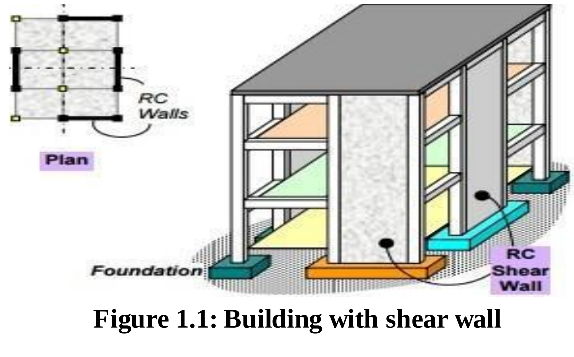


Figure 1.1: Building with shear wall

This project deals with the effect of shear wall area to floor area ratio on the seismic behavior of midrise RC structures. The main need of the study is to prevent the building from the damage due to earthquakes. Analytical study shows the results of displacement and story drift. These practical difficulties call for the introduction of flat slabs in high rise buildings. Flat slabs are easy to construct and cost effective as a remedial measure beam-column clogging of joints and flat slabs less efficiency.

II. AIM AND OBJECTIVES

The aim of the present study is to know the effect of shear wall area to floor area ratio on the seismic behavior of reinforced concrete structures.

- In the first stage three dimensional models with shear wall ratios 0.5, 1, 1.5 and 2%. Will be developed and gravity design check will be carried out using ETABS software.
- In Second stage to study the analysis of building by time history analysis and response spectrum analysis.
- In third stage, the calculations of displacements and story drift of the buildings

III. LITERATURE SURVEY

Several studies were conducted regarding the analysis of structures with shear walls

1]Chandukar and Pajgade (2013) In this paper, main focus is to determine the solution for shear wall location in multi-story building. Effectiveness of shear wall has been studied with the help of four different models. 2]Hiremath and Hussain (2012) In this paper, the study has been carried out to check earthquake response of tall building by using varying thickness shear wall and its position. 25 story`s building in zone IV is presented with some preliminary investigation to reduce the effect of earthquake reinforced concrete shear walls are used in the building3]Burcu Burak and Hakki Gurhan (2013) The main objective of this study is to investigate the structural behavior of midrise buildings with different shear wall area to floor area ratios under earthquake loading and study the improvement in overall behavior with increasing shear wall ratios.4]Giurian and Gubana (2007) This paper main focus is to determine foundation problem in seismic resistant buildings braced by structural walls. The shear wall system in seismic resistant buildings requires oversized ordinary raft foundations. 5]Arturo Tena Colunga and Cano Licona (2010) In this paper, an improved version of a simplified method to assess lateral shear forces attracted by shear walls of regular, low-rise masonry structures is presented. This simplified method for seismic analysis SMSA is allowed by Mexican building codes since the 1970s 6]Anshuman et, al., (2011)In this paper, main focus is to determine the solution for shear wall location in multi-story building based on its both elastic and elasto-plastic behaviors 7]Mishra et,al., (2015)The main objective of this paper is Study of Different Configuration of Shear Wall Location in Soft Story Building Subjected to Seismic Load. 8]Mahdi Hosseini et, al., (2015) In this paper, the structural performance of the RC framed building with Rectangular shear wall in will be analysis 9]Nikam N.M., and Kalurkar L.G., (2016)This paper aims to conduct the non -linear static analysis (Pushover Analysis) of reinforced concrete building with shear walls. The performance of reinforced concrete frames was investigated using the pushover analysis. 10] Y M Fahjan, J Kubin and M.T.Tan[5](2010) Proper modeling of the shear walls is very important for both linear and nonlinear analyses of building structures. 11] Romy Mohan and C Prabha:(2005) As the world move towards the implementation of Performance Based Engineering philosophies in seismic design of Civil Engineering structures, new seismic design provisions require Structural Engineers to perform both linear and nonlinear analyses for the design of structures. 12]Erol Kalkan, Sashi K Kunnath An essential and critical component of evolving performance-based design methodologies is the accurate estimation of seismic demand parameters. 13] Shaohua Chen and Toshimi Kabeyasawa(2000). A member model of reinforced concrete shear wall with boundary columns and beams was proposed for nonlinear and dynamic frame analysis. 14]AKI¸ S, Tolga(2004) The purpose of this study is to model and analyze the non planar shear wall assemblies of shear wall-frame structures 15].Krishnaraj R. Chavan, H.S.Jadhav. (2014)In general the most suitable choices in improvement of reinforcement concrete frame against lateral loading is used steel bracing system

3.1 Conclusion on Literature Survey

From the literature reviews it is observed that providing the shear wall at adequate locations reduces the displacements due to earth quake and the position of shear wall affect the attraction of forces. Also if the dimensions of shear walls are large then major amount of horizontal forces are taken by shear wall. Excessive story drifts that caused shear failures of columns were indicated as the main reason for the collapse of hundreds of RC frame structures. Even when total collapse was not observed, large story drifts in frames caused significant property loss.

IV. METHODOLOGY OF WORK

4.1 Static Linear Analysis

response displacement or stress, for example is linearly related to the applied force. The term “static” means that the forces do not vary with time or, that the time variation is insignificant and can therefore be safely ignored. An example of a static force is a building's dead load, which is comprised of the building's weight plus the weight of offices, equipment, and furniture. This dead load is often expressed in terms of lb/ft^2 or N/m^2. Such loads are often defined using a maximum expected load with some factor of safety applied for conservatism.

The static analysis equation is: [K]{u} = {f} In linear static analysis displacements, strains, stresses and reaction forces under the effect of applied loads are calculated.

4.2 Dynamic Linear Analysis

Dynamic linear analysis is discussed with seismic analysis of the structure and dynamic analysis can be used to find natural frequency, dynamic displacements, time history results, modal analysis.

4.3 Time History Method

Time history method of analysis shall be based on an appropriate ground motion and shall be performed using accepted principles of dynamics**.** Time history analysis is the study of the dynamic response of the structure at every addition of time, when its base is exposed to a particular ground motion. Static techniques are applicable when higher mode effects are not important. This is for the most part valid for short, regular structures.

4.4 Response Spectrum Method

Response spectrum method of analysis shall be performed using the design spectrum specified, or by a site-specific design spectrum mentioned.in the response spectrum method. This approach permits the multiple modes of response of a building to be taken into account (in the frequency domain). This is required in many building codes for all except very simple or very complex structures.

4.5 Design Parameters

The program contains a number of parameters that are needed to perform design as per IS 13920: 1993. It accepts all parameters that are needed to perform design as per IS: 456: 2000. Over and above it has some other parameters that are required only when designed is performed as per IS: 13920: 1993. Default parameter values have been selected such that they are frequently used numbers for conventional design requirements. These values may be changed to suit the particular design being performed by this manual contains a complete list of the available parameters and their default values. It is necessary to declare length and force units as Millimeter and Newton before performing the concrete design.

4.6 Beam Design

Beams are designed for flexure, shear and torsion. If required the effect of the axial force may be taken into consideration. For all these forces, all active beam loadings are pre scanned to identify the critical load cases at different sections of the beams. For design to be performed as per IS: 13920: 1993 Cl 6.1 the width of the member shall not be less than 200mm. Also the member shall preferably have a width-to depth ratio of more than 0.3. The beam considered is rectangular beam. The bending moment and deflection of the beam will be calculated by considering the different types of loads.

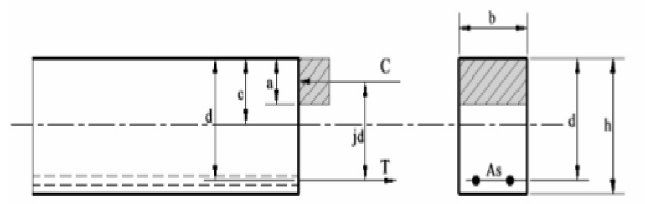


Figure 4.6: .Reinforced Concrete Beam

4.7. Design for Flexure

Design procedure is same as that for IS 456:2000. However while designing following criteria are satisfied as per IS-13920: 1993 cl 6 Design for flexure:

1. The minimum grade of concrete shall preferably be M20.
2. Steel reinforcements of grade Fe415 or less only shall be used.
3. The minimum tension steel ratio on any face, at any section, is given by:$\rho min = 0.24\sqrt{fck}/fy$.The maximum steel ratio on any face, at any section, is given by $\rho max = 0.025$
4. The positive steel ratio at a joint face must be at least equal to half the negative steel at that face.
5. The steel provided at each of the top and bottom face, at any section, shall at least be equal to one-fourth of the maximum negative moment steel provided at the face of either joint.

4.8.Design for Shear

The shear force to be resisted by vertical hoops is guided by the IS 13920:1993 cl 6.3.3 revision. Elastic sagging and hogging moments of resistance of the beam section at ends are considered while calculating shear force. Plastic sagging and hogging moments of resistance can also be considered for shear design if Plastic parameter is mentioned in the input file. Shear reinforcement is calculated to resist both shear forces and torsional moments.

4.9.Column Design

- Columns are designed for axial forces and biaxial moments per IS 456:2000. Columns are also designed for shear forces. All major criteria for selecting longitudinal and transverse reinforcement as stipulated by IS: 456: 2000 have been taken care of in the column design of E-TABS. However following clauses have been satisfied to incorporate provisions of IS 13920: 1993 cl 7 The minimum grade of concrete shall preferably be M30
- Steel reinforcements of grade Fe415 or less only shall be used.
- The minimum dimension of column member shall not be less than 200 mm. For columns having unsupported length exceeding 4m, the shortest dimension of column shall not be less than 300 mm.
- The ratio of the shortest cross-sectional dimension to the perpendicular dimension shall preferably be not less than 0.
- The spacing of hoops shall not exceed half the least lateral dimension of the column, except where special confining reinforcement is provided.
- Special confining reinforcement shall be provided over a length lo from each joint face, towards mid span, and on either side of any section, where flexural yielding may occur. The length lo shall not be less than a) larger lateral dimension of the member at the section where yielding occurs, b) 1/6 of clear span of the member, and c) 450 mm.
- The spacing of hoops used as special confining reinforcement shall not exceed ¼ of minimum member dimension but need not be less than 75 mm nor more than 100 mm.
- Reinforced concrete building can adequately resist both horizontal and vertical load. Whenever there is requirement for building to resist higher value of seismic forces, lateral load resisting system such as shear wall should be introduced in a building. In this chapter modeling and design of rcc buildings with shear wall ratios are explained. Shear wall ratio is determined by dividing the total area of shear wall in one principal direction to the plan area of the ground floor (ASw/Ap). In the building models shear wall ratios of about 0.5, 1.0, 1.5, and 2.0% are used to investigate the seismic behavior of rcc buildings.

V. MODELING OF FIVE STORY BUILDING

5.1 Case-1: Five Story Building 0.5% Shear Wall Ration in Each Direction

The plan dimension of the building is 21 m x 16.5 m. The floor plans were divided into six bays in X direction and four bays in Y direction. The shear wall thickness is 250 mm and shear walls are placed symmetrically on both directions to avoid torsion.

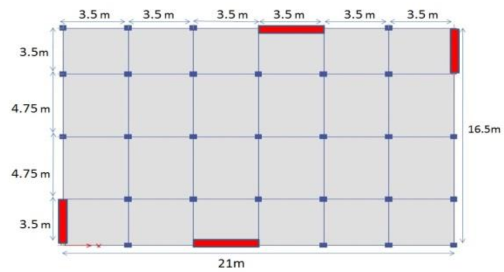


Figure 5.1: Plan of the building model with 0.5% shear wall ratio in each direction

Three Dimensional Modeling of Five Story Building with 0.5% shear wall ratio

Building model will be developed by using E-TABS software. Assumed that building is located in seismic zone III and for earthquake loading, the provisions of the IS: 1893(Part1)2002 is considered. The plan dimension of the building is 21 m x 16.5 m. The basic loading on all structures are kept same, other relevant data is tabulated in Table 4.1

Table.5.1: RCC structure properties

Section properties	2 m X 16.5m
Beam dimensions	400 X 250 mm
Column dimensions	400 X 400 mm
Thickness of slab	125 mm
Grade of concrete	M30
Grade of reinforcement	Fe415
Live load	2 KN/m^2
Dead load	3 KN/m^2
Floor finishes	1 KN/m^2
Seismic zone	III
Importance factor	1
Zone factor	0.16
Density of concrete	25 KN/m^3

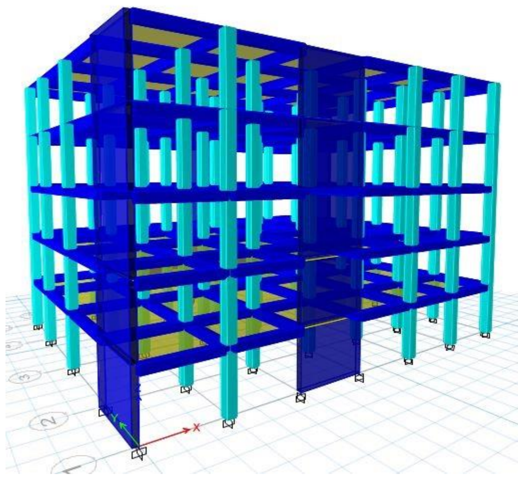


Figure 5.2 Five story building model with 0.5% shear wall ratio in each direction

5.2 Case-2: Five Story Building 1% Shear Wall Ration in Each Direction

The plan dimension of the building is 21 m x 16.5 m. The floor plans were divided into six bays in X direction and four bays in Y direction. Two shear walls of 250 mm thickness are placed symmetrically on both directions to avoid torsion and length of shear wall is 3.5 m. Figure 4.2.4 shows plan view of the five story building with 1% shear wall ratio in each direction.

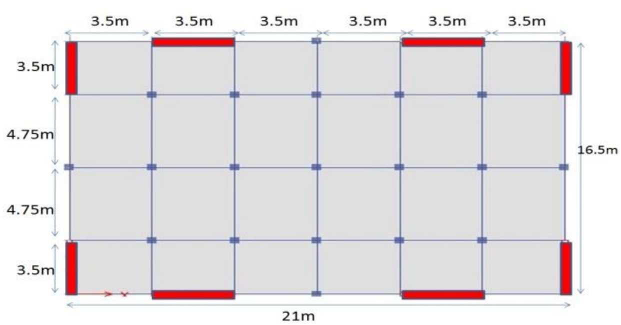


Figure 5.2.1: Plan of the building model with 1% shear wall ratio in each direction

Building model will be developed by using E-TABS software. Column dimensions are 400 mm x 400 mm for all stories, beam dimensions are 400 mm x 250 mm and thickness of slab is 125 mm. Height of each story is 3m, shear wall thickness is 250 mm and joints are fixed.

Three Dimensional Modeling of Five Story Building with 1% shear wall ratio

Building model will be developed by using E-TABS software. Assumed that building is located in seismic zone III and for earthquake loading, the provisions of the IS: 1893(Part1)2002 is considered. The plan dimension of the building is 21 m x 16.5 m two shear walls of 250 mm thickness are placed symmetrically on both directions and length of each shear wall is 3.5 m. The basic loading on all structures are kept same, other relevant data is same as case-1 which is tabulated in Table 4.1. Figure 4.2.6 shows five story building model with 1% shear wall ratio in each direction.

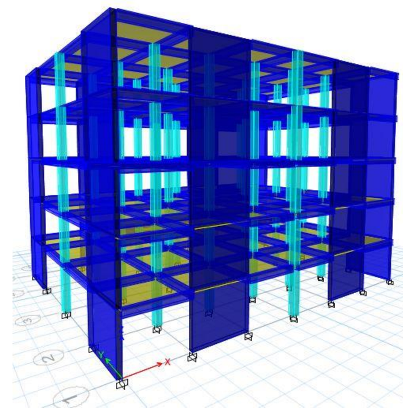


Figure 5.2.2 Five story building model with 1% shear wall ratio in each direction

5.3 Case-3: Five Story Building 1.5% Shear Wall Ration in Each Direction

The plan dimension of the building is 21 m x 16.5 m. The floor plans were divided into six bays in X direction and four bays in Y direction. Two shear walls of 250 mm thickness are placed symmetrically on both directions to avoid torsion and length of shear wall is 3.5 m. To achieve 1.5% shear wall ratio in both directions Figure 4.2.4 shows plan view of the five story building with 1.5% shear wall ratio in each direction.

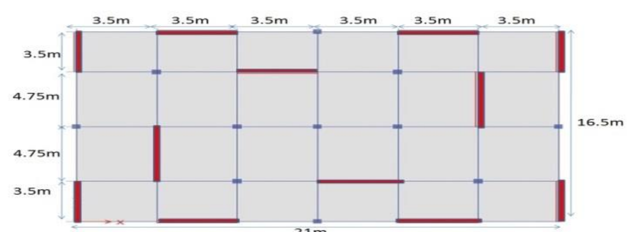


Figure 5.3.1: Plan of the building model with 1.5% shear wall ratio in each direction

5.4 Plan of the building model with 2% shear wall ratio in each direction

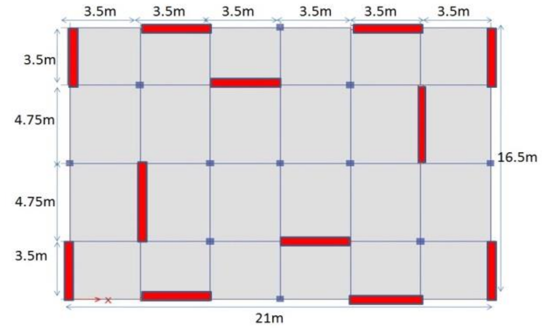
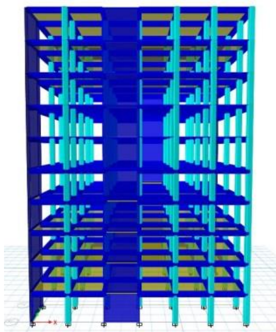


Figure 5.4.1: Plan of the building model with 2% shear wall ratio in each direction

5.5. Ten Story Building Models



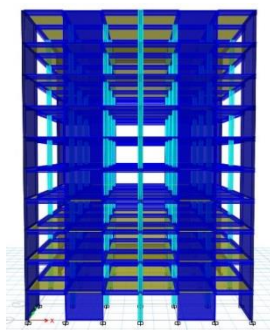
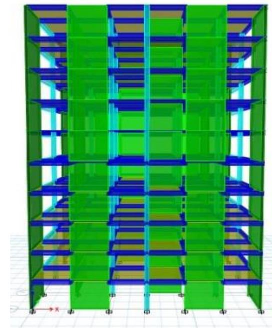


Figure 5.5.1 Structure with 0.5% shear wall area
Figure 5.5.2Structure with 1% shear wall area



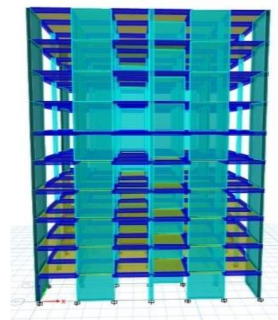
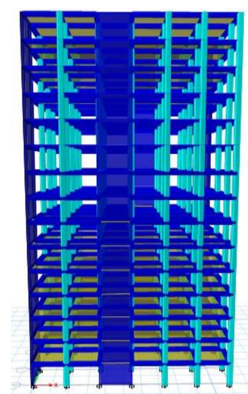


Figure 5.5.3 Structure with 1.5% shear wall area
Figure 5.5.3 Structure with 2% shear wall area

5.6. Fifteen Story Building Models



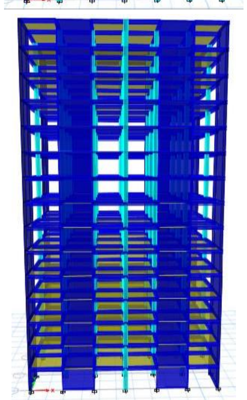
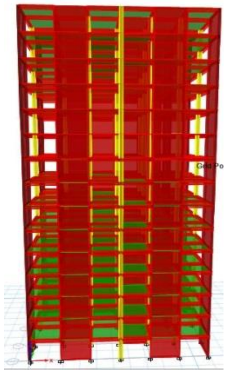


Figure 5.6.1 Structure with 0.5% shear wall area
Figure 5.6.2 Structure with 1% shear wall area



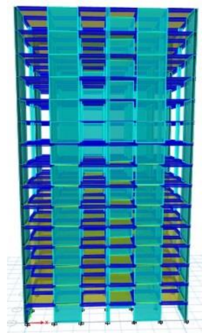


Figure 5.6.3 Structure with 1.5% shear wall area
Figure 5.6.4 Structure with 2% shear wall area

Summary

The modeling RCC structures are explained. Three dimensional modeling of 5, 10 and 15 story buildings models with shear wall ratios of about 0.5, 1.0, 1.5, and 2.0% are structures are shown.

VI. ANALYSIS AND RESULT

Dynamic Analysis Results

Dynamic linear analysis is discussed with seismic analysis of the structure and dynamic analysis can be used to find natural frequency, dynamic displacements, modal analysis and time history results.

6.1 Time period for 10 story building with shear wall shear ratios

In any structure the stresses are basically calculated from the net displacement of each and every node in various directions. Once we calculated the displacements The building will oscillate back-and-forth horizontally and after some time come back to the original position, these oscillations are periodic. The time taken (in seconds) for each complete cycle of oscillation (i.e. one complete back-and-forth motion) is the same and is called Fundamental Natural Period T of the building. Value of T depends on the building flexibility and mass; more the flexibility, the longer is the T, and more the mass, the longer is the T. Table 5.5 shows that time period values for 10 story building with shear wall ratios about 0.5%, 1%, 1.5% and 2%. Observed that time period values of building with 2% shear wall ratio is less as compared to building with 0.5% shear wall ratio.

Table: 6.1 Time Period

Mode Shape No	Shear wall ratio (%)			
	0.5	1	1.5	2
1	0.891	0.804	0.626	0.612
2	0.795	0.695	0.609	0.60
3	0.653	0.555	0.478	0.470
4	0.242	0.201	0.162	0.153
5	0.224	0.185	0.147	0.138
6	0.168	0.135	0.117	0.112
7	0.113	0.089	0.072	0.066
8	0.106	0.084	0.065	0.06
9	0.074	0.057	0.050	0.047
10	0.073	0.056	0.042	0.039
11	0.065	0.050	0.041	0.038
12	0.057	0.043	0.032	0.03

6.2 Time period for 15 story building with shear wall shear ratios

In any structure the stresses are basically calculated from the net displacement of each and every node in various directions. Once we calculated the displacements The building will oscillate back-and-forth horizontally and after some time come back to the original position, these oscillations are periodic. The time taken (in seconds) for each complete cycle of oscillation (i.e. one complete back-and-forth motion) is the same and is called Fundamental Natural Period T of the building. Value of T depends on the building flexibility and mass; more the flexibility, the longer is the T, and more the mass, the longer is the T. Table 5.7 shows that time period values for 10 story building with shear wall ratios about 0.5%, 1%, 1.5% and 2%. Observed that time period values of building with 2% shear wall ratio is less as compared to building with 0.5% shear wall ratio

Table: 6.2.1Time Period

Mode Shape No	Shear wall ratio (%)			
	0.5	1	1.5	2
1	1.479	1.366	1.088	1.06
2	1.296	1.156	1.045	1.038
3	1.087	0.945	0.843	0.838
4	0.425	0.370	0.290	0.282
5	0.385	0.329	0.282	0.265
6	0.305	0.252	0.223	0.214
7	0.206	0.168	0.135	0.128
8	0.193	0.157	0.124	0.114
9	0.142	0.112	0.098	0.092
10	0.124	0.098	0.078	0.072

Base Shear and Displacement Results for El Centro Earthquake

From analysis it is observed that base shear values are increasing with increase in shear wall ratio. Maximum base shear value is 1081.84 when shear wall ratio is 2%.

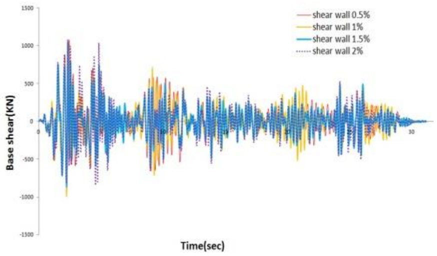


Figure 6.2.1: Base shear for El Centro (1940) ground motion

Earth Quake (EQ) in X–direction:

In the below Figure 5.8.2 shows that the Displacement is compared in x-direction for shear wall ratios 0.5%, 1%, 1.5% and 2%. For better comparability the displacement for all models along the y-direction of ground motion are plotted in as shown in Graph.

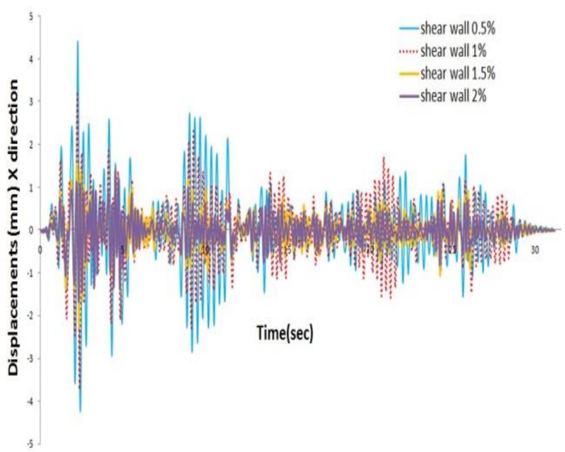


Figure 6.2.2 displacements in X-Direction

Table: 6.2.2 Displacement values (mm)

Shear wall ratio (%)	Maximum displacements(mm)
0.5	4.404
1	3.185
1.5	1.558
2	1.130

Quake (EQ) in Y–direction:

The below Figure 5.8.3 shows that the displacement is compared in y-direction for shear wall ratios 0.5%, 1%, 1.5% and 2%. For better comparability the displacement for all models along the x-direction of ground motion are plotted in as shown in Graph.

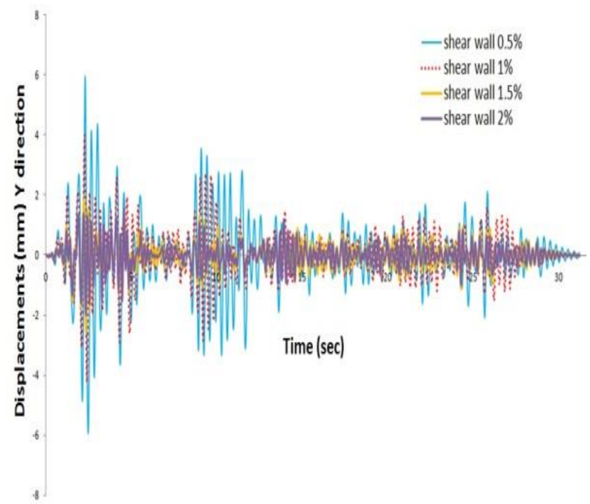


Figure 6.2.3: displacement in Y-direction

Table: 6.2.3Displacement values (mm)

Shear wall ratio (%)	Maximum displacements(mm)
0.5	5.960
1	3.991
1.5	1.699
2	1.340

6.3 Base Shear and Displacement Results for Kobe Earthquake

From analysis it is observed that base shear values are increasing with increase in shear wall ratio. Maximum base shear value is 347.688 kn when shear wall ratio is 2%.

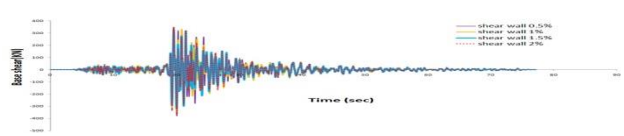


Figure 6..3.1: Base shear for Kobe (1995) ground motion

Earth Quake (EQ) in X–direction:

In the below Figure 5.8.5 shows that the Displacement is compared in x-direction for shear wall ratios 0.5%, 1%, 1.5% and 2%. For better comparability the displacement for all models along the x-direction of ground motion are plotted in as shown in Graph.

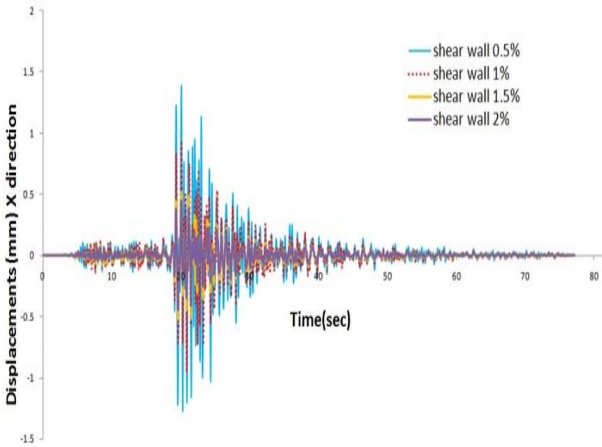


Figure 6..3.2 displacements in X-Direction

Table: 6.3.1 Displacement values (mm)

Shear wall ratio (%)	Maximum displacements(mm)
0.5	1.386
1	0.919
1.5	0.484
2	0.426

Earth Quake (EQ) in Y–direction:

The below Figure 5.8.6 shows that the displacement is compared in y-direction for shear wall ratios 0.5%, 1%, 1.5% and 2%. For better comparability the displacement for all models along the y-direction of ground motion are plotted in as shown in Graph.

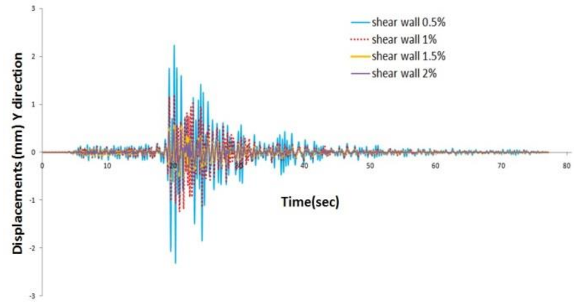


Figure 6.3.3: displacement in Y-direction

Table: 6.3.52Displacement values (mm)

Shear wall ratio (%)	Maximum displacements(mm)
0.5	2.197
1	1.167
1.5	0.538
2	0.430

6.4 Base Shear and Displacement Results for Bhuj Earthquake

From analysis it is observed that base shear values are increasing with increase in shear wall ratio. Maximum base shear value is 4472.05 kn when shear wall ratio is 2%.

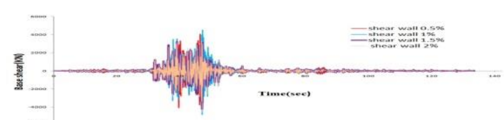


Figure 6.4.1: Base shear for Bhuj (2001) ground motion

Earth Quake (EQ) in X–direction:

In the below Figure 5.8.8 shows that the Displacement is compared in x-direction for shear wall ratios 0.5%, 1%, 1.5% and 2%. For better comparability the displacement for all models along the x-direction of ground motion are plotted in as shown in Graph.

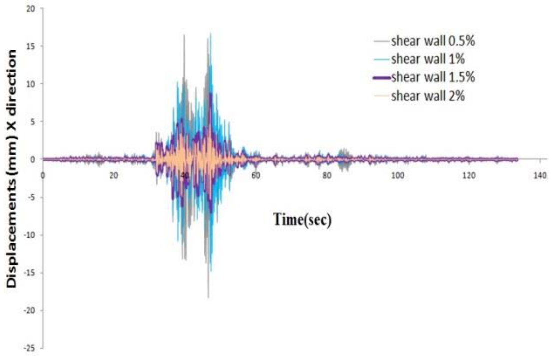


Figure 6.4.2 displacements in X-Direction

Table: 6.4.1 Displacement values (mm)

Shear wall ratio (%)	Maximum displacements(mm)
0.5	17.244
1	16.27
1.5	9.162
2	6.631

Earth Quake (EQ) in Y–direction:

The below Figure 5.8.9 shows that the displacement is compared in y-direction for shear wall ratios 0.5%, 1%, 1.5% and 2%. For better comparability the displacement for all models along the y-direction of ground motion are plotted in as shown in Graph.

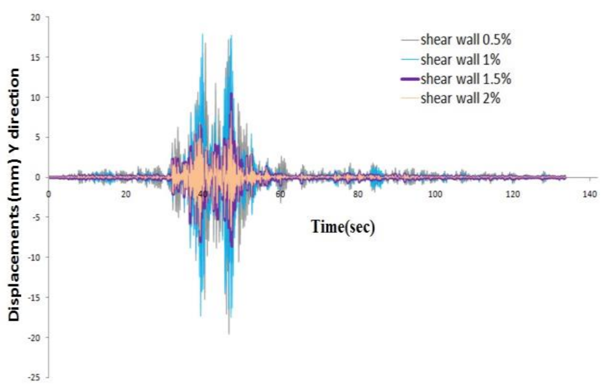


Figure 6.4.3 displacements in Y-Direction

Table: 6.4.2 Displacement values (mm)

Shear wall ratio (%)	Maximum displacements(mm)
0.5	17.425
1	16.916
1.5	9.991
2	7.953

6.5 Response Spectrum Analysis

- For response spectrum analysis same buildings were considered and assumed to be located in seismic zone III.
- The zone factor value is 0.16 and soil type is medium soil.
- Response spectrum analysis done in both the directions i.e. x and y.
- From Response spectrum analysis story drift results are taken for all the structures.

Story Drift Results for 5 story buildings

Story drifts of the 5 story building models with shear walls ratios in x-direction and y-direction. The graphs are shown below and disscused by comparing the structures with shear wall ratios about 5%, 1%, 1.5%, and 2%. From the bellow figures we can observe that the storey drift is decreasing in both x-dirction and y-direction with increasing of shear wall rato. After 1.5% shear wall ratio the reduction in story drift is very less as compared to 0.5 and 1% shear wall ratios.

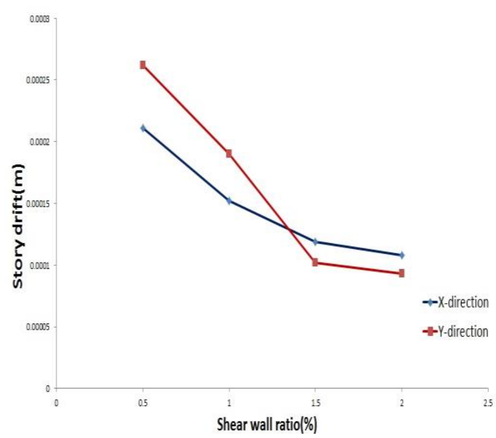


Figure 6.5.1 Story drift for 5 story building

Table: 6.5.1 Story drifts values (m)

Shear wall ratio (%)	X-direction	Y-direction
0.5	0.000211	0.000262
1	0.000152	0.000190
1.5	0.000119	0.000102
2	0.000108	0.000093

Story Drift Results for 10 story buildings

Story drifts of the 10 story building models with shear walls ratios in x-direction and y-direction. The graphs are shown below and disscused by comparing the structures with shear wall ratios about 5%, 1%, 1.5%, and 2%. From the bellow figures we can observe that the storey drift is decreasing in both x-dirction and y-direction with increasing of shear wall rato. After 1.5% shear wall ratio the reduction in story drift is very less as compared to 0.5 and 1% shear wall ratios.

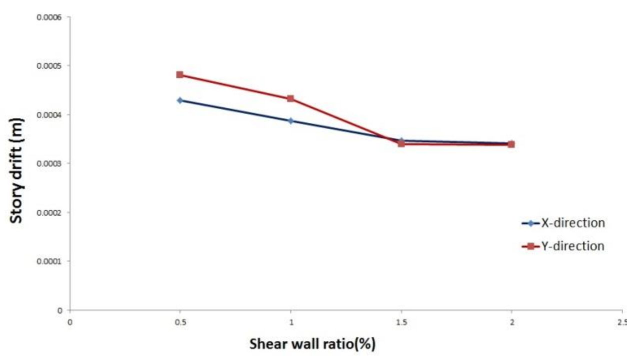


Figure 6.5.2: Story drift for 10 story building

Table: 6.5.2 Story drifts values (m)

Shear wall ratio (%)	X-direction	Y-direction
0.5	0.000429	0.000481
1	0.000387	0.000432
1.5	0.000347	0.000340
2	0.000341	0.000339

Story Drift Results for 15 story buildings

Story drifts of the 15 story building models with shear walls ratios in x-direction and y-direction. The graphs are shown below and disscused by comparing the structures with shear wall ratios about 5%, 1%, 1.5%, and 2%. From the bellow figures we can observe that the storey drift is decreasing in both x-dirction and y-direction with increasing of shear wall rato. After 1.5% shear wall ratio the reduction in story drift is very less as compared to 0.5 and 1% shear wall ratios.

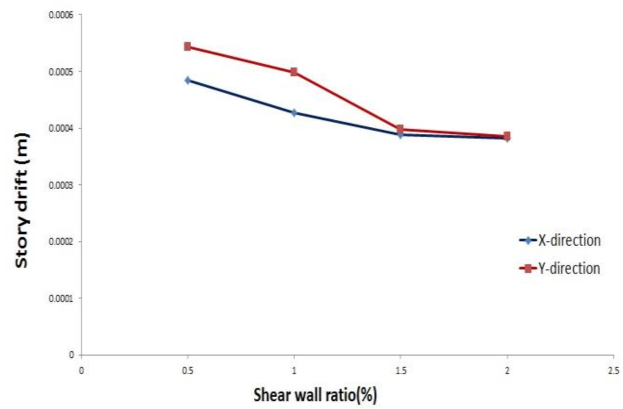


Figure 6.5.3 Story drift for 15 story building

Table: 6.5.3 Story drifts values (m)

Shear wall ratio (%)	X-direction	Y-direction
0.5	0.000484	0.000543
1	0.000427	0.000498
1.5	0.000388	0.000397
2	0.000382	0.000386

Summary

In this chapter modal analysis, time history analysis and response spectrum analysis are done. From analysis it is observed that the time period values and displacement values of buildings with 2% shear wall ratio is less compared to building with 0.5% shear wall ratio. The storey drift values are decreasing in both x-dirction and y-direction with increasing of shear wall rato. After 1.5% shear wall ratio the reduction in story drift is very less compared to 0.5 and 1% shear wall ratios.

VII. CONCLUSIONS

In this study, the effect of shear wall area to floor area ratio on the seismic behavior of reinforced concrete structures is presented. Parameter considered are time period, displacement, base shear and story drift are considered.

- In time history analysis it is observed that the building with 0.5% shear wall ratio has maximum displacements whereas minimum at buildings with 2% shear wall ratio.
- In Response spectrum analysis story drift is highly influenced by the increasing of shear wall ratio in the Buildings.
- It is observed from response Spectrum analysis the story drift is decreasing with increase in Shear wall ratio from 0.5% to 2%.
- The results indicate that at least 1.0% shear wall ratio should be provided in the design of RC buildings to control the drift.
- When the shear wall ratio increases beyond 1.5%, it is observed that the improvement of the seismic performance is not as significant.

VIII. FUTURE SCOPE

Further it would be desirable to study more cases before reaching definite conclusion about the behavior of RC frames buildings. Studies can be conducted on high rise buildings (Multistoried) by providing more thickness of shear walls, providing shear wall at various other locations and also by providing dual system, which consists of shear wall (or braced frame) and moment resisting frame. The study can also be done on Sloping grounds, various damping mechanisms and its applications on structures, and also by conducting the structures having base isolation system.

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